Effectiveness of a Global Oral Health Programme targeting 6-7 year old primary schoolchildren in NW England, UK

Anna Mary Cooper

School of Health Sciences

College of Health and Social Care

University of Salford, Salford, UK

Submitted in Partial Fulfilment of the Requirements of the degree of Doctor of Philosophy, 2015

Dedicated to and in memory of Professor Lindsey Dugdill a great mentor, supervisor, colleague and friend who leaves a lasting impression and a big hole. I will always be immensely grateful to and fortunate to have worked with, known and learnt from the prof. You are greatly missed.

Table of Contents

Table of Contents for Figures

Table of Contents for Tables

Acknowledgements

Firstly, I would like to thank my supervisory team Professor Lindsey Dugdill and Professor Cynthia Pine. Without their guidance, patience and support this work would not have been possible. I would like to thank them for the opportunities provided to gain experience, and improve my skills. I would especially like to thank Lindsey for the amount of time, support, guidance, opportunities, for always being available for whatever is needed from a chat - to teaching/mentoring - to keeping up with my thought process; her seemingly untiring confidence at times compensated for the lack of mine. I would like to thank Dr Margaret Coffey for stepping in to help at a difficult time for everyone owing to illness and loss of Lindsey and supporting me through some challenging times both with this and personally.

I would like to thank members of the WHO Collaborating Centre at the University of Salford. Especially Rosy Armstrong for carrying out all of the dental plaque exams, Louise Robinson for helping in the schools and Girvan Burnside for the support with statistics. Thanks to my family, especially to my mum for always finding time.

For their enthusiasm to support the work I would like to thank NHS Salford, particularly the Healthy Schools team – Assumpta O'Connell and members of the Health Improvement team. Also I would like to thank the Healthy School team in NHS Tameside – Lynn Callaghan.

I would also like to thank Unilever Oral Care for their support; especially Dr Monica Carlile for coordinating the links with Unilever and organisation of SOHP materials. Also for the use and support of the data loggers, Unilever Research & Development Jean-Paul Claessen, Sue Bates and particularly Adam Russell for the amount of time provided during the work with loggers without which much of the study would not have been possible.

Penultimately, I would like to extend a special thanks to all the schools who allowed us to work with them including the teachers and parents for their invaluable support and contribution to the work. Most importantly I would like to thank all the children who took part in the work with enthusiasm and excitement; without them the research would not have been as rewarding or possible.

Declaration

Within *study 2* (*Chapter 6 & 7*), all plaque data was collected by Rosemary Armstrong. Additionally Louise Robinson provided some support collecting data within *study 2*. Support with analysis of plaque data was provided by Dr Girvan Burnside. Finally within *study 3*, support with the configuration and set up of the data logging toothbrushes prior to use in the school was provided by Adam Russell.

All other data collection and analysis was conducted by the author of this thesis.

Key definitions:

Non milk extrinsic sugars – A group of sugars that should be limited in a person's diet due to their impact on the formation of dental caries; they contain sugars that are "*neither components of milk, nor contained within plant cell walls*" (Gibson, 1997, p367).

Dmft/dmfs – Used as a measure to describe the prevalence of dental caries for individuals and populations. This is expressed as mean caries prevalence calculating by scoring – decayed, missing, filled teeth or surfaces (Malmö University Oral Health Database, 2011).

Cariogenic – "*Foods/drinks containing fermentable carbohydrates that can cause a decrease in salivary pH to <5.5 and demineralisation when in contact with micro-organisms in the mouth*" (Naidoo & Myburgh, 2007, p316).

Intervention – "*Set of actions with a coherent objective to bring about change or produce identifiable outcomes*" (Rychetnik et al., 2002, p119).

Habit – "*Habits are learned dispositions to repeat past responses. They are triggered by features of the context that have covaried frequently with past performance, including performance locations, preceding actions in a sequence, and particular people*" (Wood & Neal, 2007, p843).

Routine – "*A routine is a recurring sequence of behaviours controlled as a unit or 'chunk'. Routine behaviour occurs on an everyday basis, typically in a regimented manner*" (Aunger, 2007, p2).

Complex interventions definition – *"the greater the difficulty in defining precisely what, exactly, are the 'active ingredients' of an intervention and how they relate to each other, the greater the likelihood that you are dealing with a complex intervention"* (Medical Research Council, 2000, p1). The updated MRC guidance in 2008 added *"…usually described as interventions that contain several interacting components. There are, however, several dimensions of complexity: it may be to do with the range of possible outcomes, or their variability in the target population, rather than with the number of elements in the intervention package itself"* (p7).

Abbreviations and acronyms used throughout thesis:

BASCD – The British Association for the Study of Community Dentistry

BCT - Behaviour change techniques

CRF - Common risk factors

DoH- Department of Health

D&W – Draw and write

DLT – Data Logging Toothbrushes

DMFT – Decayed, Missing, Filled Teeth in adult dentition

dmft – decayed, missing, filled teeth in primary dentition

DPH – Dental Public Health

ECC – Early childhood caries

FDI– FDI World Dental Federation

FG – Focus group

FSM – Free School meals

HS – Healthy schools

IMD – Indices of multiple deprivation

MRC – Medical Research Council

NHS – National Health Service

NICE – National Institute for Health and Clinical Excellence

NHSP – National Healthy Schools Programme

NC – National Curriculum

OH – Oral Health

PA – Physical Activity

PH – Public Health

PSHE – Personal Social health and economic education

RCT – Randomised control trial

SOHP – School Oral Health Programme

SES – Socio-economic status

WHO – The World Health Organisation

Abstract

Overall aim of thesis: To evaluate the effectiveness of a pre-designed school oral health programme (SOHP), aimed at the establishment of sustained twice-daily toothbrushing.

Methodology: A unique aspect of this thesis was the use of a child-centred mixed-method design, targeting 6–7 year olds. **Study one:** Piloted a new portfolio of research tools (n=97, in 3 schools), to test the suitability of intervention materials for use in UK schools, and to provide initial contextual understanding of children's knowledge around oral health. **Study two:** Evaluated a complex SOHP, using a one-month exploratory matched-cluster controlled trial (n=8 intervention and n=5 control clusters, n=256 children n=256), with a 6 month follow-up. **Study three:** Validated a children's self-report questionnaire (n=108, 5 schools) against an objective measure (data loggers) in a one-month test-retest study.

Results: Study one: there were a number of changes made to two of the three research tools (children's focus groups and draw & write); and some initial changes were made to the SOHP materials. **Study two:** the current SOHP produced no overall intervention effect relating to children's plaque outcomes and self-reported brushing rates. Post-intervention there was a significant association between sugar-snacking behaviour and group in favour of the intervention group, although this was not sustained at follow-up. Overall the intervention group's knowledge improved, along with sub-cohorts reporting positive changes in toothbrushing behaviour. **Study three:** The children's questionnaire showed good reliability across the 2-week test-retest period, but showed a statistically non-significant association between subjective and objective measures. Objective brushing behaviour highlighted the difference between weekday and weekend brushing rates, with children's average brushing time being 71.93 seconds.

Conclusion: 6–7 year olds are capable of being active participants and effectively expressing their current knowledge and behaviours regarding OH, hygiene and nutrition in research when provided with suitable research tools. Transferring a SOHP into the home is challenging but necessary to improve effectiveness. The use of data loggers can potentially aid evaluations by complementing self-report and providing objective feedback to children, parents and stakeholders.

Chapter 1 - Introduction

1.1 Chapter overview

This chapter outlines the rationale and overall aim of this PhD thesis: to evaluate a complex School Oral Health Programme (SOHP) developed by Unilever Oral Care ('*Brush Day & Night*'). A primary objective was to involve 6-7 year olds centrally throughout all stages of the research and to ensure the suitability of the research tools to evaluate their self-reported behavioural outcomes (morning and evening toothbrushing, and nighttime sugar-snacking). The research was conducted during 2009-2012 predominantly in Salford, an urban area of Greater Manchester, North West (NW) England, which is characterised by high levels of social and economic deprivation (Association of Public Health Observatories & Department of Health, 2014a).

1.2 The importance of child oral health and the need for intervention

> *"Dental caries has been called a scourge of modern civilization and is, without doubt, one of mankind's most prevalent chronic diseases"* (Sreebny, 1982, p1).

Although three decades old, this quote is still relevant today, with dental caries being the most prevalent global chronic disease in childhood and common in all societies (Gussy et al., 2006; Blas & Kurup, 2010). Worldwide:

> *"One in four 5 to 6 year old children experience tooth decay"* (Kwan & Petersen, 2003, p10).

Oral health[1] (OH) can have wider reaching implications for a child's general health and quality of life e.g. through pain (Slade, 2001); reduced attendance[2] at school (Fisher-Owens et al., 2007; Blumenshine et al., 2008), impaired nutritional intake (Fisher-Owens et al., 2008) and potentially an impact on self-esteem through appearance related factors (Mattheus, 2010). In 2009/10, 7% of all absences in English schools were due to dental appointments (check-ups and treatment) (Department for Education, 2011). The cost of whole population dental care and

[1] Oral health is defined by the WHO (2003, p6) as enabling "individuals to speak, eat and socialise without active disease, discomfort or embarrassment"

[2] E.g. In the US an estimated 51 million school hours are lost as a result of dental problems each year (this equates to approximately 0.6 days per child)

treatment by dentists in the 'old' European Union was estimated to be US$54 billion/annum, with:

> *"66% of these costs related to treating dental caries and its consequences and periodontal diseases"* (Eaton & Carlile, 2008, p287).

For many low income countries[3], even in the previous decade, the cost of treating dental caries exceeds the total health budget for children, making caries the fourth most expensive disease to treat within many of these countries (Yee & Sheiham, 2002; Sheiham, 2005).

A national survey (2005–2006) of 5-6 year olds across the UK reported that average dmft was 1.57, showing a small reduction from 1.62 since the 2003/4 survey (Pitts et al., 2007). The survey reported that "*39.4% of children in Great Britain had evidence of caries in dentine*" (Pitts et al., 2007, p60). In Salford dmft was recorded to be significantly higher at 2.42 (in 53% of children), which is also higher than the North West average dmft of 2.0 (see *Table 2-1* for further detail). Across Salford more than half of children have caries before they attend primary school (Pretty, Bridgman & Haley, 2007).

Due to continuing high rates of caries prevalence, improving and promoting OH has become a key public health (PH) target worldwide (World Health Organisation (WHO), FDI World Dental Federation); through National Dental Associations and local health service providers (e.g. in the UK NHS Oral Health Teams). Prevention of dental caries can take many forms and occur at different levels; at a population level (e.g. fluoride in water supply) or individual level (e.g. one-on-one support for brushing) that can target the relevant behavioural components (e.g. diet and behaviour) or the use of medical treatments (e.g. fluoride sealants and extractions) (Edelstein, 2006).

OH status is impacted and influenced by a multitude of factors that all interact to have a cumulative effect (Sheiham & Watt, 2000) with diet, particularly sugar intake, and toothbrushing habits having a direct effect on the prevalence of caries (Cinar, 2008). Due to the complexities of factors that influence a person's OH

[3] Defined by The World Bank from 2010 as those with GNI per capita of $1,005 or less - http://data.worldbank.org/about/country-classifications/country-and-lending-groups#IDA

there is a necessity to provide additional interventions that target behaviour and nutrition, alongside ensuring suitable access to fluoride (either through toothpaste, water or clinical application). Fluoride provision is part of the WHO recommended '*Basic Package of Oral Care*' (due to its proven role in the prevention of caries – Marinho, 2009) designed for community and national programmes, to deliver an OH package for all, aimed at reducing caries rates (Frencken, Holmgren & Van Palenstein Helderman, 2002).

One of the main etiologic factors for dental caries is dental plaque and the interaction between the bacteria within plaque and sugars (Levine & Stillman-Lowe, 2004). Plaque can be removed with twice-daily brushing to help reduce the likelihood of developing dental caries. However, twice-daily brushing is not the norm in some populations e.g. the European HBSC survey 2009/10, reported European averages for 11 year olds reporting brushing more than once-a-day was 60% of boys and 69% of girls (Currie et al., 2008; Zaborskis et al., 2010; Currie et al., 2012). A Cochrane review reported good levels of evidence that brushing twice-a-day with fluoridated toothpaste had a preventative effect on dental caries in both adults and children (Marinho et al., 2003). Accordingly, the SOHP evaluated throughout this thesis is specifically focused on encouraging children to brush twice-daily.

Reviews by Kay & Locker (1996 & 1998) and subsequently by Watt (2001) found little evidence of a measurable gain in OH as a result of dental health education targeting both children and adults. In reviewing dental health education and health promotion literature from 1982–1992 Brown (1994), reported for 12/57 studies that used a theoretical framework for some elements of the programme they "*not only achieved positive behavioural and health outcomes, but were also able to identify factors related to the observed changes*" (p96). It is still the case that despite many OH interventions being implemented globally, few produce a long-term behaviour change in their recipients (Stillman-Lowe, 2008, Cooper et al., 2013).

A person's behaviour is influenced by a huge variety of factors: knowledge, society/culture, peers, family, media, social constructs, socio-economic circumstances as well as their own desire and attitudes (Petersen, 2003; Patrick et al., 2006; Lencová et al., 2008). This complex human behaviour and influencing

factors also impact the effectiveness of dental education programmes targeting adults as well as children (Riedy et al., 2001; Yevlahova & Satur, 2009). For children there are many aspects they do not fully control, including those relating to their own health (e.g. bedtime routines) (Kalnins et al., 1992; Mayall, 1993).

Within health promotion, schools are an important setting for the delivery of programmes (St Leger, 2004). However, schools can have both facilitating factors as well as barriers (Hagquist & Starrin, 1997; Gill, Chestnutt & Channing, 2009). Facilitating factors can include availability of drinking water and healthy snacks at breaks, lunchtime brushing programmes and peer support programmes between younger and older children. In contrast, barriers can include a lack of integration of OH into the whole school health promotion activities and being asked to carry out too much in addition to the curriculum to be able to deal with OH effectively. As the home is the natural location for OH routines this poses an added complexity for SOHP and can lead to intervention effects not being sustained long term due to the lack of relevant contextual cues (Wind et al., 2005).

Habitual toothbrushing behaviours are increasingly difficult to impact by the time adolescence is reached (Sandström, Cressey & Stecksén-Blicks, 2011). Establishing good health-related habits early in life increases the chances they are sustained throughout life (Kuusela, Honkala & Rimpelä, 1996). Hawkins et al. (2000) noted that little evidence was available regarding two important aspects in OH education "*oral hygiene knowledge of young children and the effectiveness of dental health education programmes for this age group* [5-7 years old]" (p337). This situation has still not altered greatly since this paper, for example Marshman et al. (2007) reviewed 3266 papers on child dental health of which 7% involved children at some point in the research but only 0.3% *actively* involved children in the research. The majority of knowledge around child OH is gained from questionnaires completed by parents or guardians (by proxy) rather than directly from the children. At present there is no uniform way (e.g. through the use of common core-indicator sets) of evaluating reported behavioural impacts of dental health education programmes, with many authors using different survey methods/tools (Murray, Lopez & Wibulpolprasert, 2004; Harris et al., 2004; Dugdill & Pine, 2011), and only methods of clinical data collection being standardised (Bourgeois & Llodra, 2004).

1.2.1 Overall aims of thesis

Reducing childhood caries in 5 year olds by 80%, by 2012 was cited as a key target in the Salford OH strategy (Pretty et al., 2007). One of the methods for achieving this was to implement sustainable, evidence-based OH promotion programmes throughout Salford. Unilever Oral Care, whose programme is being evaluated, has a long history of designing and implementing SOHP on a global level (Unilever, 2013).

In order to understand the impact of a new complex SOHP developed by Unilever ('*Brush Day & Night*'), this research used child-oriented methods as the predominant focus, rather than traditional research approaches where parents or teachers report by proxy. The need to ensure children's views are heard and reported is also echoed by Marshman et al. (2007):

> *"Only by conducting research with children will our understanding of children's oral health and their views of management be expanded"* (p325).

Working directly with children through this thesis was considered to be paramount in improving understanding of how they experienced the programme and any impact the SOHP had on their OH behaviour. The research design allowed key factors relevant to the lives of children (as experienced and reported by them) to be taken into account in the programme evaluation. For example, barriers and facilitators that may not be perceived by parents, teachers or researchers due to children's unique views of the world and the time they spend away from different stakeholders (Hart, 1992; Kellett, 2005; Marshman et al., 2007; Fargas-Malet et al., 2010). Where possible, to ensure a complete understanding of the home and school, schoolchildren's data was complemented by that of parents and teachers, this was particularly important within the pilot to ensure the suitability of the SOHP. In conjunction with this, the research aimed to improve the evidence base of children's understanding around OH, hygiene and nutrition (outline of objectives mapped onto the methods in section *Table 1-2*). In addition to the literature review (*chapter 2-3)* and to further the evidence base around primary school based OH

intervention; a Cochrane review[4] was led by the author of this thesis as part of the aims of the PhD.

1.2.2 Theories underpinning the research

Through this research a staged approach to evaluating the intervention has been used (Sanson-Fisher et al., 1996; Medical Research Council (MRC), 2000 & 2008). Initially *study 1* was conducted with the aim of testing the validity and reliability of a new portfolio of research tools, and to determine any modifications required to the SOHP and the research tools prior to *study 2.* Testing the validity and reliability was carried out in respect of: face validity of the children's questionnaire and trustworthiness of the children's draw & write (D&W) and focus groups (FG) and how these tools worked as a package (feasibility). As part of this it was necessary to understand some contextual results around the children's current knowledge and reported behaviour, parents reporting of behaviour in the homes and teachers and Healthy Schools (HS) stakeholder views around OH/nutrition and the SOHP being evaluated (National Institute for Health and Clinical Excellence (NICE), 2007; MRC, 2008). This was important to ensure the intervention was 'pitched' at the appropriate level for 6-7 year old children in Salford. This was followed by an exploratory matched-cluster controlled trial (*study 2*) to evaluate the effectiveness of the SOHP in relation to clinical outcomes, self-report behavioural outcomes, knowledge and a process evaluation. The final study (*study 3*) used an objective measure of toothbrushing (data logging toothbrushes, DLT) to test validity and reliability of the last 24-hr recall within the children's questionnaire. This objective measure also allowed a profile of current, free-living toothbrushing behaviour in a sample (n=108) of 6–7 year olds to be constructed. All data from the study has been used to make recommendations to aid future adaptation of the SOHP through better understanding of current behaviours of those targeted by the intervention.

Prior to and following *study 1,* the 26-item behaviour change taxonomy (Abraham & Michie, 2008) was applied to the '*Brush Day & Night'* SOHP components evaluated in the thesis (*Figure 3-4*, which illustrate the aspects of the complete '*Brush Day & Night*' SOHP evaluated). This mapping process aimed to aid

[4] The overall objectives of this review were to determine the clinical effectiveness of SOHP (targeting 4-12 year olds) aimed at changing behaviour that related to both toothbrushing habits and frequency of consumption of cariogenic food and drink.

understanding of how the intervention was designed to target knowledge, skills and techniques for changing and sustaining changes in behaviour. In other areas of PH it is increasingly possible to determine the significant behaviour change techniques (BCT) for interventions to successfully impact on a person's behaviour and lead to behaviour change - much of this research however is with older children and adults (Peters et al., 2009; Golley et al., 2011). While understanding of interventions from young children's views within dental public health (DPH) is still limited, isolating the specific components of interventions and their BCT is more complex with only partial knowledge of intervention impact and experience, which makes it challenging to understand what is impacting behaviour. As younger children have many factors that affect them and an evolving place in society, establishing important BCTs should account for family, school and other settings that impact on their lives (Fisher-Owens et al., 2007). As advocated by NICE (2007) and intervention mapping literature for health promotion (Bartholomew & Mullen, 2011), this research engaged directly with those targeted by the intervention (children).

1.3 Research location

Greater Manchester is an urban region of NW England containing areas of high deprivation. Manchester City Council (2012) reported dental extractions as the most common reason for hospital admissions in children across Greater Manchester. In 2010/11, 696 operations were carried out for 5-9 year olds, with this rate increasing since 2005/06. Manchester City Council (2012) further reported that 8% of children in the Greater Manchester NHS area have experienced extractions and 50% of 5 years olds have experienced decay. Within Salford in 2009/10, for 0-4 year olds 73 dental extraction operations were carried out and for 5-8 year olds 171 operations; with an anticipated cost to the NHS of £191,263 (NHS Salford, 2010).

This research was predominantly conducted in Salford, with control schools for *study 2* located in a NHS matched benchmarking area (*section 6.4*), Tameside. As OH is impacted by socio-economic status (SES) (Petersen, 2005) it was essential to understand the differing levels of behaviour and knowledge of children across SES and how SES impacts on the SOHP outcomes. The SES of a school was

determined using a range of indicators in conjunction with discussion with the local Healthy School Coordinator who had a detailed understanding of each school. SES was measured for school locations rather than using the children's home location due to the focus of the delivery of the SOHP being in the school. Free school meal (FSM) data was used as one indicator of SES; FSMs are used frequently within educational research as a proxy SES measure (Hobbs & Vignoles, 2007). As with any proxy measure there is a need for caution as it is not a definite measure of an individual SES.

Salford Health Profile

In Salford, life expectancy is considerably lower than the UK averages for men (11.5 years less) and women (8.5 years less) (Association of Public Health Observatories (APHO) & Department of Health, 2014a). Salford is one of the 20% most deprived districts in England - IMD 2007 average score of 36.51 compared with 30.02 for Manchester or 27.60 for the NW (Local Futures, 2009). However, some areas of Salford fall into the least deprived IMD quintiles (Boothstown & Worsley) with health inequalities varying from East where health outcomes are poorer (closer to Manchester) to West where health outcomes are better (closer to Chester). The Salford Health Profile (APHO & Department of Health, 2014a) reported 12,700 (28.3%) children living below the poverty line. In the 2014 Salford Health Profile many indicators of children's health and wellbeing fall below the English average (e.g. alcohol-specific hospital stays, obese children).

Upon the creation of the Salford OH Strategy, a number of key OH problems in Salford were outlined (Pretty et al., 2007):

- "*By the age of 5 more than half of children will have experienced decay (approx. dmft 2.5)*."
- "*On average 19 children (up to the age of 16) have 8 or more teeth extracted in one General Anaesthetic operation a month. It is however not known how many teeth are extracted in dental practices under local anaesthetic so the overall rate of extraction is likely to be higher*."
- "*The percentage of 5 year olds with decayed teeth is not evenly distributed across all wards and is impacted by the SES of each ward*."

Tameside Profile (*Study 2* control area)

Tameside is an NHS matched benchmarking area for Salford (meaning it has similar characteristics and populations) and is predominantly an urban area. In 2004 Tameside was classed as the 56th most deprived borough nationally. Similarly to Salford, 10,300 (23.7%) children were living in poverty (APHO & Department of Health, 2014b) with life expectancy lower than the English average for men (by 10.9 years) and women (by 8.2 years). Twelve year old children within Tameside have a higher rate of dental decay (average dmft 1.1) than the English average (average dmft 0.7). The 2001/02 5 year old survey found 51% (mean dmft 2.56) were affected by decay, with no significant change in dmft levels since 1985 (Personal & Health Services Scrutiny Panel, 2005). In the 2007-8 dental survey 36.7% of 5 year olds in Tameside & Glossop had decay (average dmft 1.36). In 2010, 81 schools had achieved healthy schools status, a lower level than Salford.

Table 1-1 outlines Salford's and Tameside's '*usual care*' during the study period and how the new '*Brush Day & Night*' intervention added to this. Targeting year 2 (6-7 years old) children helped to provide an understanding of how OH can effectively be integrated into the national curriculum (NC) for younger children providing greater consistency of early intervention messages and aiding development of effective OH practices. Within Salford and Tameside there was no OH promotion taking place in year 2, meaning that the usual care programmes should not have impacted on the SOHP evaluation.

Table 1-1 OH interventions in Salford, Tameside and how the *'Brush Day & Night'* programmes adds and compliments '*usual care*'

Salford OH interventions (2009 – 2012)	Tameside OH interventions (2009 – 2012)	Added to/ complemented by '*Brush Day & Night*' intervention
NHS funded Toothbrushing at lunchtime - Provides toothbrushes/toothpaste to nursery, reception and year 1, ensuring children brush at least once-a-day under supervision.	**Toothbrushes and toothpaste provided for children to take home** (no brushing in school programme)	**Structured OH intervention and resources for year 2 children delivered by teachers** (6-7 year olds)
HS provision of a dental health resource pack for nursery classes.	**All Reception classes have access to a 'home-linked' resource pack** (delivered in class by teacher or School Nurse).	**Home intervention for children and parents to encourage and support twice-daily toothbrushing.** (including provision of toothbrushes and toothpaste)
Sure Start children's centers provide advice from health visitors and midwives around weaning and healthy eating.	**Foundation, KS1 and KS2 teaching material** (provided by the school library service) - literature designed to be embedded into NC and contains evidenced based information around fluoride toothpaste.	
Brushing for Life packs made available to all families through health visitors		

1.4 Overview of thesis

Chapters 2 and *3* present an overview of the literature in relation to: the prevalence and aetiology of dental caries; the impact of caries on children and the prevalence impact of SES; policy related to OH; primary school aged children's development and habit formation; the Healthy School Scheme and OH in the National Curriculum (NC). *Chapter 3* also presents a summary of the Cochrane review (Cooper et al., 2013) completed alongside this PhD; examples of other SOHPs; and an overview of the '*Brush Day & Night*' intervention.

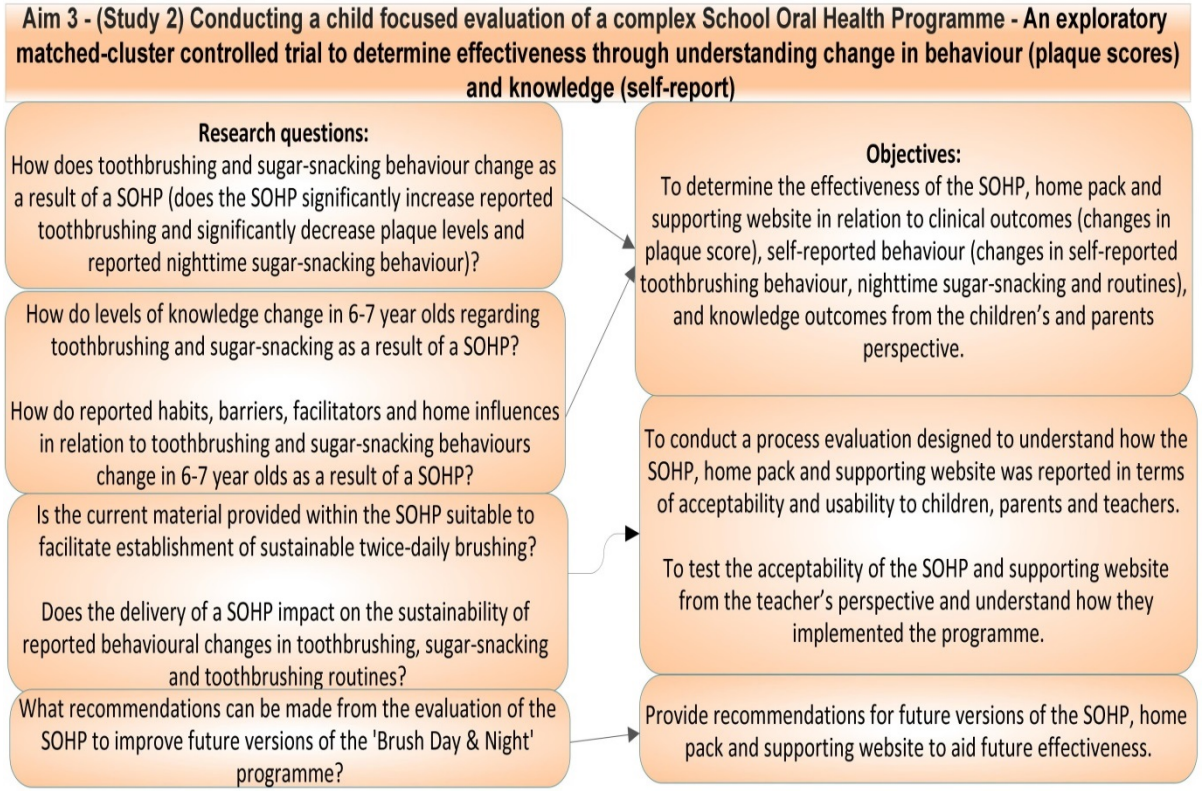
Chapter 4 presents an overview of the methodology of evaluating complex behavioural interventions, specifically in relation to NICE and MRC. Additionally literature around the use of mixed-methods research with children and the place of

children in research and OH research is discussed. Finally, the rationale for orienting the research in a child-focused manner is outlined.

Table 1-2 presents an overview of the three studies conducted for this thesis, which are contained within *chapters 5-8*. Although *study 3* was planned as part of the research (to ensure the robustness of validating the children's questionnaire) and ideally would have been conducted alongside *study 1*, this was not possible due to the lack of availability of the data logging toothbrushes.

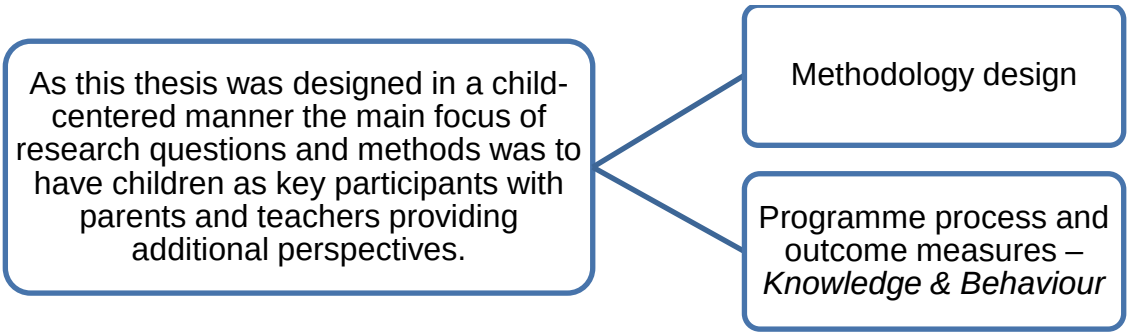
Table 1-2 Overview of research reported in thesis

Study	Thesis Aim, Research Questions, Objectives	Research tools
Study 1 (*chapter 5*) Study 1: Pilot exploration of 6/7 year olds' perceptions of oral health and nutrition	**Aim 2 – (Study 1) Improving the understanding of young children's knowledge and behaviour about oral health, toothbrushing and nutrition** **Research questions:** → **Objectives:** What is the face validity of the newly developed children's questionnaire as a new quantitative tool relating to toothbrushing and sugar-snacking for use with 6-7 year olds? → To test the face validity of the newly developed children's questionnaire. What is the trustworthiness of focus groups and Draw & Write relating to toothbrushing and sugar-snacking designed for use with 6-7 year olds? → To explore the trustworthiness of the children's focus groups and Draw & Write. What is the feasibility and acceptability of a new portfolio of research tools (children's questionnaire, focus groups and Draw & Write) within dental public health research with 6-7 year olds? → To evaluate the feasibility of using a portfolio of research tools with 6-7 year olds. Is the current SOHP material appropriate for use in English primary schools and what initial changes would be advised? What level of knowledge do 6-7 year olds already have regarding toothbrushing and sugar-snacking? → To explore the suitability of the SOHP for use within English primary schools. What are the current habits, barriers and facilitators in relation to toothbrushing and sugar-snacking as reported by children and parents? → To explore the current self-reported habits of 6-7 year olds and the barriers and facilitators from both children's and parents perspective.	**6-7 yr olds** (n=3 schools in NHS Salford area): Children's questionnaires (n=97); draw & write (n=50) and focus groups (n=35 children). **Parents**: face-to-face semi-structured interviews (n=10), **Teachers & Healthy** School stakeholders: focus group (n=1 with n=10 female participants)
Study 3 (*chapter 8*) Feasibility of using DLT to validate children's 24-hour toothbrushing self-report	**Aim 2 – (Study 3) Improving the understanding of young children's knowledge and behaviour about oral health, toothbrushing and nutrition** **Research questions:** → **Objectives:** What are the current toothbrushing habits of 6-7 year olds in low/middle SES schools in Salford? → To test the validity and reliability of the children's questionnaire using data logging toothbrushes. What are the current toothbrushing habits of 6-7 year olds as reported by parents? → To use data logging toothbrushes to establish current brushing habits of 6-7 year olds in low/middle SES schools	**6-7 yr olds**: n= 108 in n=5 schools in the NHS Salford area (low and middle SES) • Children's questionnaire • Data logging toothbrushes **Parents** (n=76): • shortened questionnaire

Study	Thesis Aim, Research Questions, Objectives	Research tools
Study 2 (*chapter 6 & 7*) Conducting a child focused evaluation of a complex school oral health programme – An exploratory matched-cluster controlled trial		**6-7 yr olds**: In total 13 classes from 13 schools participated (n=256 children with consent). (baseline n=174 intervention group and n=74 control group) • Plaque analysis (modified Silness & Löe plaque index, 1964) • Children's questionnaire • draw & write • focus groups • Evaluation & follow-up questionnaires and focus groups **Parents** (baseline n=43 intervention group and n=50 control group)**:** • Salford demographic questionnaire • Child routine inventory (Sytsma, Kelley & Wymer, 2001) • Adapted questions from Finnish family competence study (Mattila et al., 2005). • Evaluation and follow-up questionnaires and online feedback **Teachers:** Intervention group teachers (n=8) • Evaluation questionnaire and online feedback

When considering the overall aims of the thesis it is important to recognise that the outcomes are reported both in terms of process and outcome measures and also methodological outcomes in relation to the package of tools (*Figure 1-1*).

Figure 1-1 Design of research question to answer methodology and programme process and outcome measures



Within *study 2*, the main setting for the research and intervention was the school (year 2 classes), with the behaviour targeted occurring at an individual level (child); leading to the cluster being at the level of the school. Within the SOHP parents and the home setting were targeted to aid development and change in the children's toothbrushing behaviour in the natural setting.

Chapter 9 discusses the three main unique aspects that emerged through the research, in relation to how this research has advanced the current philosophy, the limitations of the research and implications for future research and SOHP. Finally this chapter provides an overall conclusion and summary to the thesis.

Overall the studies within this thesis are aimed at:

1. Improving the current literature around child-centred OH research methods (*chapters 2 & 3*)
2. Improving the understanding of young children's knowledge and behaviour about OH, toothbrushing and nutrition (*chapters 5 & 8*)
3. Conducting a child focused evaluation of a complex SOHP (*chapters 6 & 7*)

Chapter 2 - The prevalence and problem of childhood caries

2.1 Chapter overview

The literature in *chapters 2 & 3* answers the questions related to the first overall aim of the thesis. *Figure 2-1* (highlighted boxes, below) illustrates the objectives designed to answer the research questions linked to this aim.

This chapter presents a synopsis of the literature[5] in relation to childhood caries prevalence, trends and impact on society from a global to a local level. In addition relevant local and global policy with an oral health (OH) focus will be outlined.

[5] Details of search strategy and databases can be found in *Appendix 45.*

Figure 2-1 The research framework (Aim 1)

2.2 Prevalence of Childhood caries

2.2.1 Global rates in the UK

Despite caries being largely preventable it is still one of the most prevalent childhood diseases (Petersen et al., 2005; Gussy et al., 2006; De Silva-Sanigorski et al., 2011). The US Department of Health & Human Services (2000) reported that children experienced tooth decay, five times more frequently than asthma and seven times more frequently than hay fever. With Petersen et al. (2005) stating:

> *"Given the extent of the problem, oral diseases are a major public health problem in all regions of the world"* (p667).

Although dental caries is prevalent in developed and developing countries, the distribution and severity is greatly varied[6] e.g. 12 year old decayed, missing or filled permanent teeth (DMFT) levels in the Americas is 3.0 compared to many Africa countries where DMFT averages 1.7, with the European region averaging 2.6 (Petersen et al., 2005). Subsequent research has shown for people living in poorer socio-economic areas (e.g. Brazil, Taiwan, parts of USA) there has recently been an increase in the levels of caries, potentially due to changes in diets and increased consumption of bottled rather that fluoridated tap water (Bagramian, Garcia-Godoy & Volpe, 2009). However, Newbrun (2010) reported that a link between changes in levels of caries and bottled water is still not proven, and although drinking bottled water may lead to a decrease in fluoride intake, many people will still be exposed to fluoride (e.g. through toothpaste). Increased availability of sugars in developing countries has led to levels of dental caries rising but there can still be difficulties accessing fluorides and dental care, leading to an increase in the number of people with untreated caries and the wider impacts this can have on lives (Diehnelt & Kiyak, 2001; Moynihan, 2005; Petersen, 2008). Early research by Sreebny (1982) found, for 12 year olds (across 47 nations), the per-capita availability of sugar was positively correlated to dental caries, but this correlation was not found for 6 year olds (23 countries). Although it is not clear why they found no effect for 6 year olds, it was mentioned as potentially being due to less frequent sugar intake compared to older children, with diet often being more controlled by parents.

[6] World *table* for Oral health provided at part of The Oral Health Atlas: mapping a neglected global health issue (Beaglehole et al., 2009)

2.2.2 Childhood caries rates in the UK

Rates of childhood caries in the UK, specifically England, remain lower than many other countries; however the latest childhood survey indicated a plateauing of decay levels. By 5 years old, over a third of UK children have experienced tooth decay (Pitts et al., 2007). The conclusion of the 2003 child dental survey in the UK reported:

> *"…no statistically significant changes between the 1993 and 2003 surveys in the proportion of five and eight-year-olds with obvious decay experience ($d_3$mft) or teeth with decay into dentine (d_3) in the primary teeth. There were decreases in the proportion of children with filled primary teeth"* (Lader et al., 2005, p11).

The percentage and mean number of teeth with obvious[7] decay for 5 year olds (50%, mean decayed, missing or filled deciduous teeth (dmft) 1.8 in 1983 to 43%, mean dmft 1.6 in 2003) and 8 year olds (70%, mean dmft 2.3 in 1983 to 57%, mean dmft 1.8 in 2003) in England has been consistently lower than Wales (5 year olds with obvious decay 66%, mean dmft 2.6 in 1983 to 52%, mean dmft 1.9 in 2003), Scotland[8] and Northern Ireland (N.I.) (5 year olds with obvious decay 74%, mean dmft 3.7 in 1983 to 61%, mean dmft 2.6 in 2003) (Lader et al., 2005; Harker & Nuttall, 2004 & 2005 a & b).

The greater reduction in 8 year olds experiencing decay, compared to 5 year olds, may be as a result of increased awareness through the OH component of the national curriculum (NC) taught to 7–8 year olds. The 2003 child dental survey outcomes show government targets[9] for mean caries free primary teeth were not met, but targets for mean caries free permanent teeth in England and N.I. were surpassed (Office of National Statistics, 2004). As national dental surveys are presently only conducted every 10 years it is not possible to determine how the introduction of '*Choosing Better Oral Health: An oral health plan for England*' (DoH, 2005a) as well as local initiatives have impacted children's OH.

[7] Obvious dental caries – "*experience relates to teeth with dental cavities, missing teeth and filled teeth in the DMFT dental decay index*" (Lader et al., 2005, p3)
[8] An in-depth report for Scotland was not produced as part of the Child Dental Survey.
[9] As set out in '*An oral health strategy for England*' 1994 – 70% of 5 year olds to have no caries experiences; on average 5 year olds and 12 year olds should have no more than 1 dmft.

Table 2-1 summarises the results of local British Association for the Study of Community Dentistry (BASCD) dental surveys for 5 year olds in Salford. Within Salford, average dmft levels and the percentage of children with at least 1 carious lesion since 1995/96 has been consistently higher than England and North West (NW) averages. As part of the introduction of the new OH strategy for Salford there has been a focus on prevention and the need for early intervention (Pretty et al., 2007).

Table 2-1 Summary of 5 year old national BASCD dental health survey (adapted from data provided by NW Public Health Observatory)

Year of survey report	Salford	Lowest NW region	Highest NW region	NW	England	Policy and Salford Public Health (PH) intervention
	Mean dmft (% of children who have a dmft score of one or more)					
1995/96	2.85 (63%)	Warrington 1.36 (39%)	North Manchester 3.96 (75%)	2.50	1.60	
1997/98	2.32 (54%)	Southport & Formby 1.11 (32%)	Central Manchester 3.13 (67%)	2.15 (50%)	1.47 (39%)	
1999/00	2.32 (54%)	Crewe 0.94 (29%)	North Manchester 3.96 (69%)	2.18 (50%)	1.43 (38%)	
2001/02	2.45 (56%)	Crewe & Nantwich 0.66 (24%)	Rochdale 3.51 (66%)	2.13 (50%)	1.47 (39%)	Fluoridated milk scheme begins in Salford 2002
2003/04	2.50 (54%)	Crewe & Nantwich 0.56 (19%)	Preston 3.43 (72%)	Not reported	1.49 (39%)	
2005/06	2.42 (53%)	Congleton 0.66 (24%)	Blackburn with Darwen 3.18 (63%)	2.00 (47%)	1.47 (38%)	'*Choosing Better Oral Health: An oral health plan for England*' (DoH, 2005)
2007/08[10]	1.86 (42%)	Western Cheshire 0.73 (23%)	Blackburn with Darwen 2.41 (51%)	1.52 (38%)	1.11 (31%)	Fluoridated milk scheme ends. Roll out of lunchtime toothbrushing to replace milk scheme[11]
2012	1.96 (47%)	Cheshire East 0.58 (22%)	Oldham 2.10 (48%)	1.29 (35%)	0.94 (28%)	

[10] Dental survey changed to positive consent

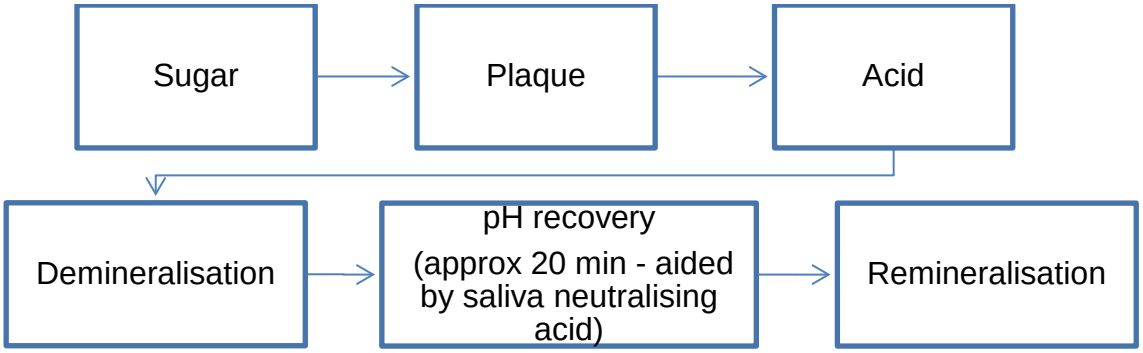
[11] Lunchtime toothbrushing offered across all areas of Salford to: all nursery and reception classes in primary schools, children's centre link nurseries and playgroups. All primary schools taking part or in the process of arranging (NHS, personal communication).

2.3 Dental Caries

2.3.1 Development of dental caries

The main bacterium linked to caries development is *Streptococcus mutans*, transmitted after birth to children by parents (Holtzman, 2009; Cashmore, Phelan & Blinkhorn, 2010). When sugars are digested they are absorbed by bacteria, aiding in plaque formation. As the sugars are metabolised, acid is produced which alters the pH of the mouth and leads to demineralization (*Figure 2-2*) (Winston & Bhaskar, 1998).

Figure 2-2 Schematic of caries development process (adapted from text by Levine & Stillman-Lowe, 2004, p3-7)



Frequent '*acid attacks*' can lead to demineralization rates being greater than remineralisation rates, causing the decay process. Saliva is a natural way for the mouth to neutralise acid but if the consumption of sugars or food (e.g. through snacking) is too frequent, pH recovery time (approx. 60 minutes –Burt et al., 1988; Zaura & Ten Cate, 2004) may not be met (Levine & Stillman-Lowe, 2004). The Department of Health (DoH) and BASCD (2009) recommended the consumption of sugary foods and drinks should be limited to no more than 4 times daily. Young children are particularly susceptible to cariogenic substances due to primary and mixed dentition, with newly erupted teeth having more porous enamel prior to enamel maturation finishing (Tahmassebi et al., 2006).

2.3.2 Socio-economic impact and influence

As with many areas of PH, dental caries rates have been shown to be related to deprivation (Locker, 2000; Steele & Lader, 2004, Pine et al., 2004; Watt, 2007; Baker, 2010). An independent UK government review into inequalities determined

that although there have been dramatic improvements in OH there are still wide differences between regions and districts (Lowdell, Bardsley & Morgan, 1999).

> *"In the United Kingdom, there is nearly a threefold difference in the dental health of 5-year-old children from the relatively prosperous region in the South West and the relatively deprived regions of the North West"* (Watt & Sheiham, 1999, p8).

Watt (2007) illustrates how methods of 'upstream' healthy public policy (e.g. policy initiatives, legislation and Health Promoting School (HPS)) and 'downstream' health education and clinical prevention (e.g. chair-side dental health, school dental health) can each have a role in tackling dental caries. However, as Roberts (2012) reported, in order to have a lasting impact on social inequalities it is necessary to act on and consider in the design of intervention "*the causes of the causes*" (p39) (e.g. low income impacting on nutritional intake due to poor diet – Darmon & Drewnowski, 2008). These can differ at a personal (e.g. family routines), community (e.g. beliefs locally around OH) and national level (e.g. Government targets that don't account for difference across socio-economic status (SES)). Interventions that are generic in design may increase the inequality gap by not being accessible to all (e.g. different ethnic groups); poor OH may be one of a number of complex underlying causes that need to be considered in intervention design. Peterson-Sweeney & Stevens (2010) reported US families from more disadvantaged backgrounds did not prioritise OH over more immediate issues (e.g. food/shelter, illness or joblessness). In contrast in English Sure Start programmes Daly et al. (2010) reported through focus groups (FG) with mothers, that all felt OH was a priority for their children.

Solutions for tackling childhood inequalities need to account for not only the local, regional or national SES but also parental demographics and OH knowledge (Williams, Whittle & Gatrell, 2002). Children of more deprived families within the NW of England had higher levels of decay and parents exhibited lower levels of dental knowledge, than those from less deprived families (Williams et al., 2002).

In 2010, '*Giving children a healthy start*' found children living in deprived areas were 19% more likely to have poor dental health. The Spearhead group (made up of the bottom 70 Local Authority (LA) and 62 Primary Care Trust (PCT)s

experienced worsening levels of dmft compared with the national average. Decay figures for the Spearhead areas increased between 1999/2000 and 2001/2002 from 1.46 to 1.75; with 2005/2006 levels remaining at a mean dmft of 1.7 (Audit Commission, 2010). The Audit Commission concluded the gap between rich and poor had not been greatly impacted despite roughly £10.9 billion being invested to improve the health of under-fives (p4), with these children also 8% more likely to be obese[12].

Globally patterns of dental decay within countries fluctuates depending on many factors (e.g. access to Non-Milk Extrinsic Sugar (NMES))[13], to fluoride and dental care) as well as "*geographical and social factors*" that influence decay, with caries continuing "*to affect the majority of children, some severely*" (Moynihan & Petersen, 2004, p205). In most developing countries there has been very low investment in oral care prevention and treatment, with a priority being given to emergency care and pain related treatment (Petersen, 2005). With greater investment and objectives towards prevention through school programmes and fluoridation schemes, there is a need to ensure that disparities/inequalities are not increased further (e.g. by the uptake of interventions by those who do not require them as greatly and the '*worried well*') (Garcia & Sohn, 2012).

2.3.3 Sugars, diet and dental caries

Cariogenic food impacts on the formation of dental caries through demineralisation but caries can also impact a person's diet through difficulty eating after extractions due to pain and inability to chew food (Watt, McGlone & Kay, 2003; Touger-Decker & Van Loveren, 2003). Since the turn of the 21st century, rates of caries have increased in line with the availability of dietary sugars (Winston & Bhaskar, 1998; Jones et al., 2005), and "*contemporary changes in beverage patterns have the potential to affect oral health*" (Marshall et al., 2003, pe190).

Drinking and eating foods containing NMES at night contributes to the incidence of dental caries, particularly if this is following nighttime brushing (Levine, 2001). Eckersley & Blinkhorn (2001) stated that 79% of parents reported their 3 year old

[12] The other difference found thorough the Audit commission "9 per cent more likely to be of a low birth weight; and 12 per cent more likely to have an accident" (2010, p4)
[13] Non-Milk Extrinsic sugars – on average in the UK these are consumed more than recommended 60g/day (Watt, Mcglone & Kay, 2003)

had a drink before bed or during the night, with 24% of those in deprived (36% non-deprived) wards having drinks containing NMES. They also reported a difference between SES groups regarding children's consumption of food at night (with the majority of these being sugary foods) with 45% of lower SES parents reporting snacking compared to 28% in high SES areas. The large numbers of children eating and drinking at night poses a problem for OH.

Despite the evidence, current OH interventions do not sufficiently highlight the health implications of eating and drinking sugary substances at night as actively as they target the importance of twice-daily toothbrushing. All included studies in a recent Cochrane review, completed as part of this work, found targeting nutrition was a secondary intervention component (with less emphasis than the toothbrushing component) (Cooper et al., 2013). Van Loveren & Duggal (2004) found among preventative dentistry experts in Europe that although there was agreement about the impact of sugar, there was a lack of agreement about how many sugar-snacking episodes between meals were 'safe', with the UK expert reporting a maximum of 10% of energy intake from NMES. Burt & Pai (2001) after conducting a review of studies concluded that due to the now common exposure to fluoride there is a weaker relationship between levels of sugar consumption and caries. As a result they suggest controlling sugar consumption is necessary, but may not be the most important part of the design of caries prevention programmes.

Few interventions within dentistry have managed to successfully alter a person's diet (Watt et al., 2003) meaning reliance has to be placed on guidelines being delivered accurately and lessons learnt from other areas of health promotion. Moynihan & Petersen, (2004) reported dietary interventions that target sugar intake specifically within OH were rare, due to the difficulties and complexities of prescribing a set diet for longer periods and the studies available being conducted a long time ago (e.g. '*The Turku study*' - Scheinin, Miikinen & Ylitalo, 1976). A factor to consider within SOHP is the whole school environment policy on healthy food; there is a need for part of OH interventions to ensure breaktime snacks are healthy (Freeman & Oliver, 2009) and influence school and packed lunches (Buttriss, 2002). With the introduction of National Health Schools Programme (NHSP) and the UK governments legal standard for school food (Statutory

Instruments, No. 2359, 2007) schools are required to have a healthy food policy accounting for the importance of nutrition in childhood and targets around obesity (Haroun et al., Report revised 2012).

2.3.4 Fluoride

Due to the known beneficial impact of fluoride on dental caries (inhibits demineralisation – Featherstone, 2000) the World Health Organisation (WHO) (1994) and FDI (1993), have both stated it is a basic right for everyone to have access to fluoride through natural or topical means. It has become a major contributor in tackling rates of dental caries both through natural sources (e.g. in some water) and through the addition of fluoridated products e.g. water (FDI, 2008), milk (Bánóczy, Petersen & Rugg-Gunn, 2009), salt (Marthaler & Petersen, 2005) and toothpaste (Marinho et al., 2003). A review by Ammari, Baqain & Ashley (2007) into effectiveness of preventative programmes in early childhood caries (ECC) determined, although there was no definitive evidence around specific interventions; in young children those that were fluoride based appeared to be effective in protecting teeth.

Fluoride is a natural occurring mineral, and lower levels of tooth decay have been found to occur in places where certain levels of fluoride are present in the water supply (Nuffield Council on Bioethics, 2007; Public Health England (PHE), 2014). Water fluoridation is seen by some as a key strategy for the prevention of dental caries, as it can have the ability to affect whole populations across a life course irrespective of any socio-economic gradient (Iheozor-Ejiofor et al., 2013).

In 2014, PHE reported 12.3% of Lower Super Output Areas (LSOA) had community water fluoridation schemes, with 0.2% LSOA being naturally fluoridated. The DoH estimated in 2009 that 10% of the population in England received fluoride through drinking tap-water, either due to its addition artificially or natural levels. In the US 51-75% of people benefit from fluoridated water (Pizzo et al., 2007; Beaglehole et al., 2009), with an average estimated cost of US$0.72 per person per year in 1999 (Centers for Disease Control & Prevention, 2001). Currently five UK water companies (there are over 20 water companies in the

UK)[14] are required by local authorities to fluoridate their water (Defra, 2011). Greater Manchester is not currently artificially fluoridated or likely to begin a fluoridation programme soon. Strategic Health Authorities prior to introducing a scheme are required by the '*Water Act 1991*' to carry out public consultations (currently occurring in Southampton) and compile detailed reports in line with government and DoH guidelines; since 1985 no new artificial water fluoridation scheme has been implemented in the UK (Bennett, 2012). Reasons against artificially fluoridated water include: expense for companies and local authority areas; opposition from groups opposed to mass medication; concerns of the impact on other areas of health; and also the challenge of ensuring fluoridated water is only provided to those within the specific local authority area as many water companies cross several local authorities. There is additionally a concern that children may develop fluorosis through the excessive consumption of fluoride (Newbrun, 2010). McGrady et al. (2012) explored rates of caries and dental fluorosis in comparison to SES in a fluoridated (Newcastle) and non-fluoridated area (Manchester). McGrady et al. (2012) reported those living in fluoridated areas had significantly less dental caries, but there was still an increase in the prevalence of mild fluorosis. They concluded that water fluoridation had positively impacted health inequity by reducing the social gradient between deprivation and dental caries rates.

More recently studies have found evidence that community water fluoridation programmes reduce rates of dental extractions. The PHE (2014) report on water fluoridation found that within England, for those areas that have fluoridated water, there are 45% fewer admission to hospitals of children aged 1-4 for dental extractions. Similarly, Elmer, Langford & Morris (2014) compared dental extraction data for areas in the NW (no community water fluoridation programme) to areas of the East Midlands where community water fluoridation programmes occur and found that after accounting for deprivation children aged 0-19 years olds were more likely to experience dental extractions in hospitals in the areas were community water fluoridation did not occur. Across many parts of the UK fluoride occurs naturally in drinking water, however for the majority the level is too low to

[14] In 2011 the five companies required by local authorities to fluoridate water supplies were: United Utilities, Northumbrian Water, Anglian Water, Seven Trent Water and South Staffordshire Water (Defra, 2011: available at www.dwi.defra.gov.uk/consumers/advice-leaflets/fluoride.pdf)

have a preventative effect on dental caries (for a preventative effect, water needs to contain 1ppm fluoride) (Chief Medical Officer Professor Sir Liam Donaldson & The Chief Dental Officer Pofessor Raman Bedi, 2003). Therefore prevention is still needed at an individual level (for example in terms of teaching children good habits around twice-daily toothbrushing with fluoridated toothpaste)

Part of the debate around the need for community water fluoridation links to the fact fluoride is found and used in an increasing number of ways e.g. fluoridated toothpaste, used within dental practices as varnish. In addition globally, access to a clean and controlled water supply also limits the ability for a global programme of fluoridation to help reduce caries. The implementation of toothbrushing programmes with fluoride toothpaste can be achieved with greater ease, less cost and resources, compared to water fluoridation. Within the FDI-Unilever '*Live.Learn.Laugh*' partnership programme, there are examples of toothbrushing programmes being implemented effectively in areas where water would not be able to be fluoridated, ensuring the children have access to a suitable intervention for the resources available to the country (Dugdill & Pine, 2011; Pine & Dugdill, 2011).

Fluoridated milk has also provided a cost effective vehicle for helping to prevent caries in schoolchildren (Bánóczy, Petersen & Rugg-Gunn, 2009). Although a Cochrane review (Yeung et al., 2005) of fluoridated milk found a lack of "*robust evidence*" (p7), the review concluded this was due to the quality of RCTs and that despite this there was evidence of the preventative benefits to schoolchildren. Additionally, laboratory tests have confirmed the remineralisation efficacy of fluoridated milk on '*artificial enamel caries*' (Itthagarun et al., 2011, p.817). Although the impact on caries is not as apparent as fluoridated toothpaste, fluoridated milk also has a protective and preventative effect on caries (Yeung et al., 2005; Itthagarun et al., 2011). Within Salford, as seen in *Table 2-1,* fluoridated milk schemes ran from 2002-2007.

Salt fluoridation, with an optimal concentration on 250mg/kg (Jones et al., 2005), has been found to have preventative effects similar to the levels of water fluoridation. Unlike many water fluoridated areas the addition of fluoride to salt products allows a choice to buy the product or not.

Fluoridated toothpaste has been proven in many studies and subsequent systematic reviews (e.g. Davies et al., 2003; Marinho et al., 2003; Marinho, 2009; Walsh et al., 2010) to be the most effective delivery method for fluoride for children and adults (Twetman et al., 2003; Marinho et al., 2003). However fluoride toothpaste, as outlined by Jones et al. (2005) relies on behaviour:

> *"…an important limitation is that the effectiveness of these toothpastes depends upon the behaviour of the individual and the family in purchasing and regularly using the products"* (p673).

Additionally it is dependent on the user adhering to certain conditions:

- Concentration of the fluoride toothpaste - the most effective containing over 1000ppm. Clarkson, Ellwood & Chandler (1993) found that adults who used fluoride toothpaste had a 25% reduced risk of caries development.
- Frequency of use of fluoride toothpaste – with the optimum being twice-a-day (DoH & BASCD, 2009; PHE 2014).
- Amount of toothpaste used – with the recommended amount being pea sized (DoH & BASCD, 2009; PHE 2014). Although, Ashley et al. (1999) found in Manchester adolescents the amount of toothpaste used (e.g. half or more than half of brush head covered) did not significantly impact mean DMFT levels.
- Rinsing behaviour (not just spitting) – Clinical trials (e.g. Chesters et al., 1992; O'mullane et al., 1997) reported that those who brushed their teeth regularly but rinsed with a lot of water had a high caries rate compared to those who did not rinse (Ashley et al., 1999; Davies, Davies & Ellwood, 2003). This is due to the fluoride from brushing being removed.

2.3.5 Determinants of OH

A person's life can be impacted in a multitude of ways due to dental disease, the DoH highlights how:

> *"Good oral health enables individuals to communicate effectively, to eat and enjoy a variety of foods, and is important in overall quality of life, self-esteem and social confidence"* (2005a, p15).

For younger children the impact of pain from dental caries may not be communicated verbally but be noticeable through altered eating and/or sleeping patterns (Feitosa, Colares & Pinkham, 2005), potentially impacting their development both physically (e.g. through impact on nutrition) and cognitively (e.g. through loss of time at nursery/school) (Gussy et al., 2006). Children who have experienced Early Childhood Caries (ECC) are more likely to develop dental problems later in life (Peterson-Sweeney & Stevens, 2010), with poor dental health being linked to other health problems in adults such as cardiovascular disease (Jansson et al., 2001).

Health-related behaviour is complex (Watt, 2005) and influenced by multiple factors. As a result of this OH advice alone, whether from a dentist or teachers through SOHP, is unlikely to result in a change in behaviour (Watt & Fuller, 1999). Impacts of culture and society on people's behaviour and dental needs are dynamic and occur via complex interactions, rather than in isolation (Fisher-Owens et al., 2007). Improving a person or population's knowledge about a topic, although important to begin the process of behaviour change, does not often lead to the targeted change in behaviour (Pleasant & Kuruvilla, 2008). For children, especially up to the age of 5, parents play a central role in monitoring and influencing dietary and toothbrushing habits; this subsequently impacts on the children's dental caries experience (Mattila et al., 2000).

Fisher-Owens et al. (2007) outline 5 categories with factors impacting child, family and communities in different ways:

- "*Genetics and Biology (e.g. child level – Biological and genetic endowment; family – health status parents)*,
- *Social environment (e.g. child level – diet; family – health behaviour factors and coping strategies; community – community OH environment)*,
- *Physical environment (e.g. child level – health behaviour practices; family – SES; community - fluoridation)*,
- *Health influencing behaviours (e.g. child level – diet; family – status of parents; community -culture)*,
- *Medical and dental care (e.g. child level – dental insurance; family – coping skills; community – health care system)*" (adapted pe510-e520).

By following a systematic intervention design (e.g. NICE, 2007; MRC 2000 & 2008 or intervention mapping - Bartholomew et al., 2011), it is possible to develop a greater understanding from the 'bottom-up'[15] about how those targeted experience the multiple influences. Although there is understanding of barriers and facilitators in OH common to many populations (e.g. access and habit formation), how communities and groups are skilled in improving OH will vary depending on knowledge, attitudes, beliefs and available resources (e.g. access to clean water and complex cultural behaviours such as adding sugar to milk). Additionally, if those targeted by the intervention have had an active part in the design, this helps to develop ownership and control, leading to a greater likelihood of behaviour change occurring (NICE, 2007).

Although core messages need to be included, it is important that an intervention is accessible to those they target. With children the language and materials need to be accessible, which is more likely to be achieved through actively working with the children so that clarity can be found with respect to conceptual and language comprehension regarding the intervention. Using a professional developed intervention (top-down), complexity around the interaction of factors may be either not accounted for or not accounted for in a way that allows the intervention to work within a specific community group (Popay & Williams, 1994). A challenge within OH is the number of interventions produced by companies for global use (*section 3.3*) which can have a limiting factor on the ability to localise interventions.

In adults there is a perception by some that toothbrushing is "*a tedious procedure which is performed primarily to provide cosmetic rather than health benefits*" (Davies et al., 2003, p139). Due to parents having a key role in teaching young children about OH and hygiene, this perception needs to be changed to ensure this attitude is not passed on to children. Aunger (2007) highlights the central role parents have in motivating their children to brush their teeth as this motivation is not instinctive. The DoH and BASCD (2009) recommend that children up to the age of 7 should be supervised when brushing their teeth as some may still struggle to brush all areas of their mouth effectively. However, it has been found

[15] Defined by Laverack & Labonte, (2000) as "*the outside agents act to support the community in the identification of issues which are important and relevant to their lives, and enable them to develop strategies to resolve these issues*." (p256)

many children, by age 6 years old, are being given increasing responsibility to take charge of their own toothbrushing behaviour (Sandström et al., 2011).

Dos Santos, Nadanovsky & De Oliveira, (2011) in reviewing the recommendation for oral hygiene practices given to children in 10 developed countries, reported information was provided by almost all organisations in relation to toothbrushing frequency, toothpaste and amount of toothpaste. However, recommendations around technique were not mentioned by 16/24 organisations and the length of time to brush was only provided by 2 organisations for 2 minutes and 1 organisation for 1 minute. This illustrates how certain messages are accepted across countries as important within OH promotion, but for other messages there is a lack of consistency and contrasting evidence.

Despite it being common practice to be taught that you should brush your teeth for 2 minutes, this timing is not contained within BASCD guidelines (2009), and is inconsistently recommended within the literature (Zero et al., 2010). However, the new PHE guidelines state "*thorough cleaning may take at least 2 minutes*" (p18) (2014) and the current NHS guidance within England (2011) recommends people should brush with fluoride toothpaste for two minutes, twice-daily. Further a study by Gallagher et al., (2009) found that plaque removal increased with brushing time and concluded clinicians should try to encourage patients to brush for a minimum of 2 minutes. This message is also often contained in SOHP, such as those by Unilever and Colgate, and has been used as the recommendation throughout this thesis. Ramsay (2000) reported that adults on average only brushed for 30–60 seconds, but will on nearly all occasions, double this time if asked to estimate their brushing behaviour. For children (5-15 years) it has been reported that after brushing for a minute, little additional plaque is removed (Hodges, Bianco & Cancro, 1981) potentially due to poor technique with the same areas being repeatedly brushed (Cancro & Fischman, 1995).

Cancro & Fischman, (1995) examined the impact of mechanical removal (toothbrushing) of plaque on people's OH and reported "*behavioural modification is a problem of considerable magnitude*" (p71). When interventions were put in place (e.g. lunchtime brushing programmes), these were reported as having a

positive impact on children's OH and the cost associated with OH problems. Further Ramsay, makes the important point:

> *"…toothbrushing behaviour is related to the flexibility of one's daily work schedule as well as other lifestyle factors such as times at which one wakes up and goes to sleep"* (2000, p309).

The fluctuating nature of people's routines needs to be accounted for when developing OH and hygiene interventions to help increase compliance rates and sustainability of any behaviour change (Bernheimer & Keogh, 1995). For children it is also necessary to consider the parent's daily schedule and lifestyle factors, as they are normally the main implementer of the child's personal hygiene routines (Aunger, 2007; Amin & Harrison, 2009).

A current challenge within OH research is the use of self-report for toothbrushing habits in most studies. Martins et al. (2011) studied mothers of 24-48 month olds and found poor agreement between parent self-reported behaviour and observed toothbrushing, consequently the authors advised caution when considering the results of such surveys. Frequently OH related factors for young children are reported by parents as proxy, which adds an additional layer of interpretation into the behaviour and the outcomes of studies (Jokovic, Locker & Guyatt, 2004). A UK survey of adults (1998) found that although 74% of people reported that they brushed twice-a-day, 69% of these still had visible plaque, and that this only increased by 10% for those who reported that they brushed their teeth once-a-day (Eaton & Carlile, 2008). The results of this survey and further research by Ganss et al. (2009) and Zero et al. (2010) highlight the problems with brushing technique and the amount of time people brush their teeth for, both of these are often targeted with less prominence in interventions.

Through the '*Health Behaviour in School aged Children*' survey in 2001/2002 Maes et al. (2006) stated for 11, 13 and 15 year olds across Europe (32 countries) there were higher average reported brushing rates (greater than once-a-day) in Northern Europe compared to Eastern and Southern countries, concluding:

> *"…within the European continent and in North America, gender, family affluence and parental occupation were significantly*

associated with toothbrushing frequency as reported by adolescents. The association between family characteristics, such as the absence of one of the parents and the supervisory role of the parents, and brushing behaviour of the children appeared to be rather weak and inconsistent" (p166).

2.4 The development of Childhood caries

2.4.1 Children and OH

Mouradian, (2001) in the context of children stated:

> *"Oral health includes the interrelationship with all aspects of the child's developmental processes, genetic potential and environmental circumstances"* (p822).

The fuller impact of having poor OH in childhood, although potentially not apparent straightaway to the child or family, can have lasting impacts into adulthood; through a greater tendency to have dental problems in adulthood and through impacts on education levels and social skills (Gussy et al., 2006).

Globally, for some children, twice-daily brushing is not the norm, due to lack of toothbrushes (Blair et al., 2004), or not carrying out the correct frequency of behaviour (Kwan & Petersen, 2003). A further barrier to reducing caries can be the affordability and use of fluoride toothpaste (Goldman et al., 2008). An example of the differing oral hygiene habits can be seen in the Netherlands where the average person used 300g of toothpaste a year compared to Burma where they used 35g (Beaglehole et al., 2009). Further, for the poorest 10% of people in Zambia it can take about 30 days of household expenditure to afford a year's supply of toothpaste (lowest - Japan at 0.09). In the UK[16] for the poorest 10% of the population it is still less than a day's household expenditure (0.31) (Beaglehole et al., 2009). Although the above data is for adults, use of toothpaste and income to buy toothpaste, will impact on young children through the need for caregivers to provide OH products, and the contributing factor of parental influence on a child's behaviour and the state of a child's OH (Okada et al., 2002).

[16] For a pea sized recommended amount of toothpaste (approx 0.25g) with twice-daily brushing you would expect to use 182.5g a year. For a full brush (approx 1g) with twice-daily brushing you would expect to use 730g (Denbesten & Ko, 1996; Goldman et al., 2008)

Worldwide, the number of children being admitted to hospital for dental extraction under general anaesthetic (GA) as a result of poor OH remains high. Within the UK from 1997–2006 there was a 66% increase in hospital admissions for children (up to 17 years old) having tooth extraction (Beaglehole et al., 2009; Moles & Ashley, 2009). A report into the social determinants of OH linked to the 2003 UK children's dental survey determined there was:

> *"…clearer evidence that treatment choices may be influenced, with extraction of permanent teeth much more likely in deprived groups"* (Steele & Lader, 2004, pviii).

It is likely that this finding is also influenced by a wider range of factors that impact on or are impacted by deprivation such as access and frequency of access to dental health services, frequency of toothbrushing and frequency of consumption of cariogenic foods. In 2009/10 in England, dental appointments (check-ups and treatment) accounted for 7% of all absences in schools, with this figure higher for those children with special education needs, but no gender difference was found (Department for Education, 2011). Missed school days through OH have a multi-level impact, on children (e.g. learning and health); parents (e.g. missed work, treatment costs) and in places schools (Pourat & Nicholson, 2009). During an SOHP missed school/school activities can lead to potential missed sessions within the SOHP, which may limit the ability to reach those who may need the intervention the greatest.

School performance has been found to be worse in children who have poor general health, with those who experience poor OH also having poorer school performance, although it is unclear if this is a standalone factor in a person's performance (Fisher-Owens et al., 2007; Blumenshine et al., 2008). For children receiving free school meals (FSM), school performance in 5 year olds is an indicator of dmft (Muirhead & Marcenes, 2004). In addition to reduced attendance at school, OH issues can impact concentration, cause distraction when in school and impair nutritional intake (Palmer, Burnett & Dean, 2010). Similarly Koivusilta et al. (2003) reported there was a strong predictive association between Finnish adolescents who had a high toothbrushing frequency and later education levels when they are between 27-33 years old. Although it is not possible to account for

all confounding factors that can impact on a person, there are many common antecedents that impact on OH and general health (e.g. nutritional intake).

Through interviewing mothers in Salford, Eckersley & Blinkhorn (2001) reported children in deprived areas were more likely to be symptomatic dental attendees, with parents in less deprived areas reporting higher rates of regular dental attendance. Children who attended the dentist symptomatically are likely to have increased negative experiences compared to those who are regular attendees, due to the likely increase in dental work. At present for children in Salford tooth extractions are the most common reason for admittance to hospitals for general anaesthetics (GA), with approximately 5–8 extractions being carried out every week (NHS Salford, 2010). For some children their first experience of the dentist and dental treatment can be for emergency treatment which can often be painful and unpleasant. This can have a negative effect on their future dental attendance through increased anxiety (Milsom et al., 2003) that can continue through to adulthood (Armfield, Stewart & Spencer, 2007). Through an interview study of parents of children in Canada who had experienced extractions under GA, Amin & Harrison (2009) reported many barriers such as inconsistent information, providing sugary foods despite understanding their harm, pressures of daily life and children's temperament impacting on parents' reported ability to aid their children in developing correct OH behaviours. Amin & Harrison, (2009) reported:

> *"Although all parents agreed that baby teeth are important for a child's eating, speaking, and appearance, only some parents, mostly those in the no-relapse group, acknowledged a relationship between healthy baby teeth and healthy adult teeth"* (p122).

The family context is an important part of understanding children's behaviour especially in younger children (Amin & Harrison, 2009) due to the strong influence it has on their routines (Aunger, 2007). Amin & Harrison, (2009) further reported for parents, that good child OH was seen as *"not having any pain or discomfort"* (p121), with many not viewing OH holistically but only in relation to the presence/absence of caries. This study highlights the complexity of issues that parents feel influence OH and the challenge for SOHPs to understand and overcome these. Such an approach would likely improve both the child and their

family's knowledge of the need to establish routine and the importance of caring for baby teeth as well as keeping adult teeth healthy. Including the whole family and other siblings also aids parents in embedding routines within a family's schedule, rather than having to focus only on the child targeted by a SOHP.

2.4.2 Habit formation

Developing the correct habit[17] of twice-daily toothbrushing at a young age is more likely to be sustained through to adulthood (Aunger, 2007; Sandström et al., 2011). With early intervention helping to establish stable behaviours into adulthood and ensuring they are more resistant to lapses in behaviour (Tolvanen, Lahti & Hausen, 2010). These habits are also more likely to become life-long if schools *and* homes provide encouragement and regular reinforcement (Kwan & Petersen, 2003). For health related behaviours Aunger (2007) reported:

> *"Most routine behaviours are not executed to achieve rewards; they are not motivated behaviours. Instead, they must be learned using cognitive control, so that normal practice can later be executed using low-level, cue-based automatic control"* (p11).

Within SOHP there is a need to help develop or strengthen the 'cue' for children regarding when toothbrushing should be integrated into their routine, while allowing these cues to be flexible within a family's life. Although there is an understanding of habits and their importance, with approximately 50% of daily activities being habitual, changing a person's habits, especially in relation to hygiene, are both under researched and frequently unsuccessful in the long term (Curtis, Danquah & Aunger, 2009).

To achieve any long-term change in a person's OH behaviour, changing knowledge and skill alone is insufficient (Watt & Fuller, 1999). Presently within OH it is not possible to determine the essential behaviour change techniques (BCT) that interventions need to contain to produce a change in behaviour. Within other PH areas key BCT that all interventions should incorporate to change behaviour are being identified, potentially improving the effectiveness of future intervention design (Peters et al., 2009).

[17] Defined by Verplanken & Aarts, (1999) as "*learned sequence of acts that have become automatic responses to specific cues, and are functional in obtaining certain goals or end-states*" (p104).

Danner, Aarts & De Vries (2008) emphasise how frequency of past events does not always lead to the formation of a habit if the context they are performed in (place, time, and situation) is not stable, which led to behaviours still relying on intention. This is further supported by Verplanken (2006) who reports that although repetition is necessary, habits should be considered as "*a lack of awareness, difficulty to control and mental efficacy*" (p639). As school is not the natural or prime location of toothbrushing behaviour in normal childhood hygiene routines, it raises the issue as to whether SOHP can enable the correct forming of cues if the SOHP does not transfer successfully to the home (Verplanken & Orbell, 2003; Wind et al., 2005). Developing the correct cues for the behaviour aids the behaviour becoming automatic, though "*incremental strengthening of the association between a situation (cue) and an action*" (Lally et al., 2010, p998).

Over the course of a three year study (mean age 7.6 years) to deliver a toothbrushing-in-school intervention, Wind et al. (2005) reported any change in behaviour struggled to be maintained once the cues and habit-inducing intervention was removed (school-based component). The intervention had no impact on the habit strength or cognitions relating to toothbrushing at follow-up. The formation of the correct environmental cues in the home is a challenge for all SOHP to overcome with few effectively connecting with the home. Wind et al. (2005) concluded that a potential failure of their intervention to maintain the changes in behaviour were the lack of the appropriate environmental cues.

Curtis et al. (2009) in their review highlight the number of factors that are required for a person to initiate planned behaviour. They outline the need for individuals to "*become convinced of plausible, high-value benefits...and then for the individual to make a conscious plan to carry it out*" (p669). For children this translates to them understanding the need to brush their teeth to maintain good OH, to have the tools, place (setting) and ability to brush. Through repetition and reinforcement, Curtis et al. (2009) suggest behaviour will eventually become habitual, with cues such as getting dressed or ready for bed triggering the hygiene routine incorporating toothbrushing. Although there appears to be a simple sequence of actions that are required, there are still a great deal of barriers to many children achieving this behaviour (e.g. belief that it is not as important for first teeth and the lack of immediacy in problems occurring). Lally et al. (2010) calculated through modelling

of habit formation in adults using tasks relating to healthy eating, drinking or exercise, that automaticity scores plateau around 66 days (range 18–254 days, p1002), but that complexity impacts on the development of automaticity. Interventions need to be sufficient in length through the main phase, and reinforcement to account for the time it takes habits to form (Lally et al., 2010).

2.5 OH and the relevant Policy Environment

The 2004 former Labour Government's White Paper '*Choosing Health*' focused on the need to provide children with a good start, due to people's behaviour being set in early life (p41). Within the '*Healthy Lives, Healthy People*' (2010) white paper, the focus was not only on putting local communities centrally into all PH matters but also the importance of early intervention and children's health and wellbeing. Section 4.53 focuses on the dental public health (DPH) workforce:

> *"It will concentrate particularly on improving children's oral health, because those who have healthy teeth in childhood have every chance of keeping good oral health throughout their lives. It will also make a vital contribution to implementation of a new contract for primary care dentistry, which the Government is to introduce to increase emphasis on prevention while meeting patients' treatment needs more effectively"* (p63).

Table 2-2 illustrates key policy and legislation in the UK and globally that have impacted on OH promotion with children and primary schools. Although policies including sections relating to OH have increased, they are still limited compared to other PH areas (e.g. obesity). There is still a need to raise the profile of OH within policy in the UK[18], as well as greater guidance on child focused issues and ways to include all relevant settings (e.g. school, home, dentist and community). Additionally, policies that are designed to target children are often not designed in consultation with them, which can impact their success (De Winter, 1996).

[18] The issues is also found in the US - following the US Department of Health and Human Services report (2000), Allukian (2000) reported 80% of US local health authorities had no dental programme, with 39% of these having no specialist dental director to coordinate programmes and prevention efforts. Following the report there has been change in the US to better integrate OH and general health and the introduction of a greater number of programmes (Beaglehole et al., 2009).

Table 2-2 Timeline of key policy and legislation in UK and globally relating to OH

WHO and global policy	UK education policy	UK Health/PH Policies
1978 - Alma-Ata declaration (International agreement) **1986** - Ottawa Charter for Health promotion (International agreement) **1989 -** UN convention on the rights of the child **1995** - Global School health initiative (WHO initiative) **1997** - Jakarta Declaration on Leading Health Promotion into the 21st Century (International agreement) **1998** – Health 21 (International agreement) **2000** – 8 Millennium development goals (UN Declaration) **2003** – WHO information series on school health - OH promotion: An essential element of a Health-Promoting school (Guidance document - Document 11)	**1967** - Plowden Report (promote child-centred education) **1987** - The National Curriculum 5 – 16 (Consolation document) **2002** - Education act (c.32) **2004 -** Children's Act, The National Service Framework for Children, Young people and Maternity services **2005** - Education act (c.18) **2009** - Your child, your schools, our future (White paper); Independent review of the Primary curriculum: Final report (Rose, 2009 - Gov commissioned report) **2010** - The Importance of Teaching (White paper) **2011** – Proposed new primary curriculum presently shelved (along with planned PSHE changes)	**1997 -** Independent Inquiry into Inequalities in Health (Acheson's report, DoH, 1998) **2004** - Choosing Health: Making healthy choices easier (White paper); Every Child Matters (Policy document) **2005** - Choosing Better Oral Health: An oral health plan for England (Guidance document) **2006** - Our Health, Our care, Our say: a new direction for community services (White paper, does not include dentistry, p18) **2009** - Delivering better oral health: an evidence based toolkit for prevention (2nd edition, Guidance document); NHS dental services in England (Independent review led by Professor Steele) **2010** - Marmot Review: Fair Society, Healthy Lives (Gov commissioned report) **2011** - Equity and excellence: Liberating the NHS (White paper); Healthy lives, health people (White paper) **2014** – Delivering better oral health: an evidence-based toolkit for prevention (3rd Edition, Guidance document); Local authorities improving oral health: commissioning better oral health for children and young people (Guidance document)

An important step in the development of child-orientated PH approaches was the creation of the Ottawa Charter (WHO, 1986). A key principle was strengthening

community action through empowering individuals and communities throughout all health intervention related processes. Since the publication of the Ottawa Charter and in relation to an improved understanding of the social determinants of dental caries, there has been a shift from a totally medical and individualistic approach to caries prevention to a greater emphasis on the PH aspects of prevention (Watt, 2007). Watt & Fuller (1999), in summing up the changing opportunities in dental health in relation to the Ottawa Charter, highlighted three essential but neglected parts:

> *"Healthy public policy, supportive environments, and public participation are essential elements of effective oral health promotion, but are often neglected"* (p6).

In comparison to other areas of PH (e.g. school nutrition and obesity - Caraher, Crawley & Lloyd, 2009) it has taken longer for legislation and policy to focus on OH and specifically child OH; with fewer policies and legislation created. This in turn may have influenced the type of development of OH interventions in comparison to other PH developments where governments are more active. Within dentistry, FDI World Dental Federation produces evidenced based policy documents relating to OH for OH professionals globally[19]. Many FDI policies were updated in 2008 in conjunction with their first World Oral Health Day (Conrod, 2008). However, these were only designed to inform national policies and provide key evidence and guidelines rather than mandatory policy/legislation.

Within the last 10 years more inter-professional collaboration is occurring in the design of school health programmes, generally there is still limited focus on collaboration to target OH problems and working closely with the children (Cooper et al., 2013). Within UK schools there has been growing emphasis on health and wellbeing through the NC and the NHSP (The National Healthy School Standard, 2004). It was not until the WHO "*Equality, social determinats and public health programmes*," 2010 report that OH had a separate chapter exploring social determinants and equity.

[19] Full list of policies available at http://www.fdiworldental.org/policy-statements with seven being relevant to areas of DPH specifically: Global Goals for OH (2003, joint with WHO & IADR); The basic responsibilities and rights of dentists (2007); The basic rights and responsibilities of dental patients (2007); Promoting dental health through fluoride (2000, revised 2008); Promoting dental health through fluoride toothpaste (2000, revised 2008); Promoting oral health through water fluoridation (2000, 2008, revised 2014); Preventing oral diseases (1998, revised 2008).

The key messages of OH and the need to tackle the levels of dental caries in the UK was outlined by the DoH (2005a) though '*Choosing Better Oral Health: An oral health plan for England'*[20]. By stating, "*oral health is central to healthy living and a key marker of the health of a community*" (p16) proposing a shift towards prevention rather than treatment. The DoH highlights the need to integrate OH into the PH agenda through better dentist delivered, chairside prevention and early interventions targeting children's toothbrushing behaviour.

With the publication of the second edition of '*Delivering better oral health: an evidence based toolkit for prevention*' for children aged 3-6, six key messages of advice were outlined around: twice-daily brushing, not rinsing, supervision of brushing up to age 7, the use of adult fluoridated toothpaste 1450ppm, and reduction in sugar both in terms of food, drinks and children's medicines (DoH & BASCD, 2009). The third edition of '*Delivering better oral health: an evidence-based toolkit for prevention*' (PHE, 2014) and the supplement '*local authorities improving oral health: commissioning better oral health for children and young people*'[21] build on the messages contained within the second edition but add information around good practice where evidence is not readily available but the statements 'makes sense'. For children from 7 years of age and older the only difference in messages is the recommended toothpaste strength of 1350-1500ppm and supervision is no longer recommended as being required. The translation of these messages into SOHP is not always fully developed; with the development of the transition from school to home still in an early stage. Most interventions aim to involve parents by providing information and encouraging them to support children through brushing calendars and routine reinforcement.

Through conceptualisation of interventions, with those they target using child-centred and community orientated methods, it is possible to improve the effectiveness of intervention design that target specific behaviour. However, it is also necessary to acknowledge and incorporate the evidence based recommendation. As with other PH areas, a difficulty faced by policy makers in OH is the challenge of inequality within populations (driven by social and economic differences), and to target appropriate interventions where they are needed whilst

[20] The policy focused on: Diet and Nutrition; Poor Oral Hygiene; Fluoride; Tobacco and Alcohol; Injury (p6)
[21] This is designed to provide both the background to OH, the life course approach and determinants as well as the roles and responsibilities of commissioning services to improve the state of OH for children and young people in England.

avoiding increasing inequality gaps (Watt, 2007; Marmot et al., 2010). In targeting OH interventions and promotion at primary schools, a danger outlined by the Marmot Review (2010), is the need to not only target those in disadvantaged areas but to ensure that health is tackled universally across all SES areas, to alter the health gradient in a universal manner for all. Further, the '*Children and Young people health outcome forum'* report recommends greater integration and action to help reduce regional inequalities in OH (PHE, 2014). A danger with providing supportive health interventions is that they are more often taken up by those sections of the population that do not need them (the worried well) which can lead to a widening of the inequality gap (Wilkinson & Pickett, 2010).

The UK faces a further challenge at present due to the new NHS bill (2010a), through local GPs having greater responsibility and decentralising of health promotion. Although '*Healthy Lives, Healthy People*' (2010b) advocates the need for early intervention to ensure the best behaviours for OH leading to a greater likelihood they will be continued into adult life. Currently, both the '*Public Health Outcomes Framework*' (2013-16) and the '*NHS outcomes framework'* (2014-15) have OH indicators for commissioners to commission services against. There is also a growing recognition that local areas rather than centralised government are in a better position to target issues dependent on the local health priorities and accounting for the diverse socio-economic patterns across the UK. Within Salford the OH patterns of children in the most deprived areas vary greatly from those in the least deprived areas. Researching across the SES is important to understand how SOHPs impact children in different areas and how the need for support varies between areas.

As part of the local Health and Wellbeing boards (set up in line with the new PH strategy), children and young people are being given their chance, through a centrally run national forum, to have a say on the health outcomes that matter to them and how changes to the NHS can work better for them. This is still in consultation stages so it is not possible to know if OH will be a strand of the discussions/outcomes or at what ages of children are being engaged. These outcomes will feed into the new '*Joint Strategic Needs Assessments & Joint Health and Well-being Strategies*' (DoH, 2012, p6) meaning there will also be locally relevant as well as national targets. The new NHS and PH changes are

designed to incorporate the whole population with the slogan "*no decision about me without me*" (DoH, 2012, p10). For children, especially those of the age targeted in this thesis, it is not clear how this well be achieved.

2.6 Chapter summary

Before greater impact will be seen on rates of dental caries, future policy, interventions and advocacy need to continue to acknowledge and build on the understanding that "*dental health does not stand in isolation from other aspects of general health*" (Williams et al., 2002, p654; The British Dental Association Oral Health Inequalities Policy, 2009).

The preventative nature of fluoride is well known through a large evidence base and it is accepted as an essential tool to help tackle the still high rates of childhood dental caries found globally. There is still a great deal that needs to be understood in terms of behaviour and how OH can best be taught in schools, while effectively transferring into the home. There is a need to develop more effective interventions (targeting both toothbrushing and sugar-snacking) that aid the production of contextual cues to help habit formation and not just improve the children's knowledge.

Changes in policy are required for OH to have a greater prominence, both for national and local targets and funding of more long term interventions. As with many areas it is not known how the changes to PH England and the NHS will impact OH in terms of targets, prominence and prevention strategies.

Children aged 6-7 years have a number of outside influences impacting the formation of the correct oral hygiene routines (Blinkhorn, 1978; Okada et al., 2002). Influences occur in some form in all societies and aid children in developing important behaviours. At age 6, children are experiencing changes in their dentition with the loss of primary teeth and eruption of adult teeth, making it a crucial time to ensure correct habits are developed (Levine & Stillman-Lowe, 2004). Finally, although it is important to target interventions early before toothbrushing habits are set around adolescence, it is as important to actively involve parents who have both an influence and important role in their children's OH.

Chapter 3 - The role of schools in oral health programmes and child health development

3.1 Chapter overview

This chapter outlines the literature around the importance of schools in health promotion, the National Healthy School Programme (NHSP) and briefly looks at the changing NHSP in the UK. In addition relevant evaluations of School Oral Health Programmes (SOHPs) are outlined. Finally, it outlines the *'Brush Day & Night'* SOHP evaluated throughout this research.

3.2 Primary schools

3.2.1 The school as a site for delivery of health interventions

Schools, due to the prominent position they hold in many societies (Alibali & Nathan, 2010), have been one of the focal sites for health promotion[22] (Hagquist & Starrin, 1997; St Leger, 1999). As part of the '*Mighty Mouth*' SOHP evaluation the authors concluded:

> *"The school as a setting for interventions has a formative role to play in the child's social, personal and health education. It can provide the environment, the approaches and the variety of learning experiences that will help children to understand themselves, to relate to others, and to establish and maintain healthy patterns of behaviour"* (Harrington et al., 2001, p35).

Although many interventions are implemented in schools there is a need to effectively transfer the behaviours taught and practised into the home (*section 2.4.2*) (Bernheimer & Keogh, 1995; Neal, Wood & Quinn, 2006).

'The Importance of Teaching' White Paper (Department for Education (DfE), 2010) outlined the need to free schools from bureaucracy and restated that good schools had a vital role in promoting health and wellbeing both at school and community level. The report recognised that good health has an impact on a child's educational achievement e.g. through attention, attendance and development of social skills. In conjunction with DfE white paper, the 2010 English Public Health

[22] Health promotion defined by WHO (1986) as "*The process of enabling people to increase control over, and to improve, their health*"

(PH) White Paper, called for a change in the workforce to concentrate on child oral health (OH) and for a change towards a prevention model rather than a treatment model, and a link into changes within primary care dentistry over the more traditional OH treatment model:

> *"Taking better care of our children's health and development could improve educational attainment and reduce the risks of mental illness, unhealthy lifestyles, road deaths and hospital admissions due to tooth decay"* (p5).

Schools are an influential force on children's lives and can help to encourage the formation of habits that can enhance their personal health and emotional wellbeing and encourage them to continue these outside of schools (WHO, 1996).

Settings: As with the multitude of factors that can influence a person's health, there are also a multitude of settings that impact on health and routines (King, 1998). For children, although interventions target their individual behaviour, (e.g. '*Brush Day & Night*' targeting brushing routines) the intervention is targeted at groups in schools (for improved knowledge) and homes (to aid behaviour change). Poland, Krupa & McCall write:

> *"Taking a settings approach to health promotion means addressing the contexts within which people live, work and play and making these the object of inquiry and intervention as well as the needs and capacities of people to be found in different settings"* (2009, p505).

To fully understand the effect of the multitude of settings that impact children, from physical location, to culture, peers and the formation of correct habits, a detailed planning phase to interventions is recommended (Medical Research Council (MRC), 2008). The NHSP is an example of successfully implementing health promotion across a number of settings from national, community to school levels. A further challenge occurs when health promotion topics occur in isolation, such as OH and obesity, where each aims to impact on an individual and wider areas of life but the impact of isolated interventions is often limited in influencing the whole school approach.

Understanding the setting and the individuals can aid the ability for interventions to empower those who deliver them to improve capacity to sustain them (Poland et al., 2009). If interventions are not able to integrate into current systems at school and home there is a greater likelihood of behaviour change not being sustained.

3.2.2 Healthy schools

3.2.2.1 Origins

The notion of the health promoting school (HPS) was proposed in the 1980's by the World Health Organisation (WHO) (Deschesnes, 2003). In 1995, the WHO launched the '*Global School Health Initiative*' with the primary aim of mobilising health promotion and educational activities (WHO, 2010). The WHO defined a healthy school as "*a school constantly strengthening its capacity as a healthy setting for living, learning and working*" (WHO, 1998, p2). The HPS system requires a change in the way health is taught in schools from classroom focused to a whole school approach (Deschesnes, 2003; Healthy Schools, 2007a) that eventually becomes integrated into the school and the community.

It was not until 2003 that the WHO published a specific guide to help schools promote OH as part of the HPS (Kwan & Petersen, 2003, *Table 2-2*). A review of evidence into the effectiveness of HPS found children's health (e.g. improved nutritional intake and physical activity) and their education (e.g. improved learning and academic attainment) can be impacted positively by well-designed and whole school approaches to promoting health[23] (Warwick, Mooney & Oliver, 2009). Within this review Warwick et al. (2009) found that in addition to a whole school approach and good design, it is necessary to give:

> *"…children and young people a voice is a central feature of successful practice. But the degree of consultation needed and the room there is for negotiation with children and young people is not clear"* (p32-33).

The impact of health programmes is variable, with Lister-Sharp et al. (1999) finding programmes around healthy eating, fitness, abuse and mental health being

[23] Although schools are able to reach large segments of the population, if only schools are used there are still likely to be hard to reach populations which are not engaged and this could potentially widen inequality gaps (Kerr & West, 2010). These may be hard to reach populations, such as frequently moving populations, as well as segments of children in some countries who are unable to attend schools (e.g. due to cost or social inequalities).

more likely to be effective than those that targeted OH or substance misuse. Additionally Lister-Sharp et al. (1999) reported although HPS showed a positive impact on both behaviour and health of the children but this was not a consistent outcome across all targeted areas. There were a multitude of factors that impacted these findings such as the need to include the whole school and increase involvement of the home. Additionally, the design of interventions needs to be examined to ensure they are designed to effectively target behaviour change as well as knowledge change. As found in many reviews while the OH programmes achieved knowledge change they infrequently changed behaviour (Lister-Sharp et al., 1999). With the areas where programmes were found to be effective a greater amount of multi-domain and delivery approaches were used, as well as greater emphasis on the design of interventions specifically to change behaviour not only knowledge. Due to the poor description of many interventions, it is frequently not possible to determine the impact the intervention design has on differing levels of effectiveness between different health behaviours (Lister-Sharp et al.,1999; Michie et al., 2009; Cooper et al., 2013).

A recent Cochrane review by Langford et al. (2014) assessed the effectiveness of the HPS framework in improving student's health and wellbeing. They found only one study meeting the reviews criteria linked specifically to OH (conducted in China with 6-7 year olds - Tai, 2009). Langford et al. (2014) reported overall the results demonstrate evidence of effectiveness for HPS interventions in reducing Body Mass Index, increasing physical activity/fitness, and increasing fruit and vegetable intake; and positive intervention effects for reducing tobacco and bullying instances. However, for other areas Langford et al. (2014) found no evidence of effectiveness or no meta-analysis could be conducted (the case for OH) due to the low number of studies. Within this review Langford et al. (2014) were not able to report the impact of HPS on children's academic outcomes or impact on attendance.

3.2.2.2 The NHSP in the UK (1999-April 2011)

The NHSP in England was established in 1999 to target common risk factors such as diet, exercise and smoking. It marked 10 years of running in the UK in 2010 as one of the most subscribed non-compulsory programmes (Healthy Schools,

2007b). The programme worked with four main core themes: Personal, Social, Health and Economic education (PSHE); healthy eating; physical activity (PA) and emotional health and wellbeing. Schools that achieved HS status were required:

- "*To support children and young people in developing healthy behaviours*,
- *To help reduce health inequalities*,
- *To help promote social inclusion*,
- *To help raise the achievement of children and young people*" (Department of Health, 2005b, p7).

The UK NHSP tied into Every Child Matters (ECM) and automatically ensured schools adhered to a number of the criteria. The ECM programme "*place national outcomes for children and young people firmly at the centre of all policies and approaches involving children's services*" (Healthy Schools, 2007b, p10). It also helped ensure links between all agencies and organisations, within the local area, to work together and ensure children were not only given more say but also equipped with all they needed to succeed.

Stokes, Pine & Harris (2009) reported that the NHSP did not have a specific OH component built into it, but the English OH strategy highlighted promoting OH as a priority needing to be promoted through common risk factors (CRF). Stokes et al. (2009) carried out telephone interviews with 22 local Healthy School (HS) coordinators in the North West (NW) of England, who all reported incorporating OH into healthy eating programmes; they agreed with the evidence that OH is linked to general health, but lacked consensus regarding the responsibility of promoting and monitoring pupils OH. Only one local coordinator was aware that any of their schools had a "*specific oral health policy*" (p6) and common barriers expressed by the local coordinators were "*freedom of choice, lack of expertise, mixed messages, profile of oral health*" (p7). Coordinators highlighted that schools needed to independently link OH and other aspects within the NHSP and the CRF's set out in the programme, which can lead to OH being less likely to become embedded and reinforced within the school and only being taught in relation to NC requirements (Stokes et al. 2009).

3.2.2.3 NHSP in Salford (1999- April 2011)

The national target was to have 70% of schools (in a given area) as part of the NHSP by the end of 2010. NHS Salford passed this target with 84% of primary schools being part of the programme in 2009 and all others working towards registration (NHS Salford, personal communication). In September 2010 the previous Labour government introduced a higher level programme (enhanced NHSP; trialled in some areas in 2009) for schools to commit to a greater extent to changing two areas of health and also introduce more community orientated activities. The high number of primary schools that are part of the NHSP and working towards the enhanced NHSP highlight the commitment within Salford to improve school life and surrounding communities.

All primary schools in Salford were required to have obesity as one of their enhanced model priorities. This included: having a healthy eating policy, ensuring all pupils take part in at least 2 hours of PA per week and improving the OH of pupils through schemes such as toothbrushing at lunchtimes for younger years (NHS Salford, 2010, personal communication). By requiring all schools to target these areas it was designed to improve coordination of programmes and sharing of ideas across all organisations involved in the welfare of children. Under the Local Area Agreement (LAA)[24] for obesity, one of the performance indicators identified as a target was reducing prevalence of dental decay in 5 year olds.

3.2.2.4 Potential impact of the loss of the UK healthy schools programme

The coalition government began to change the NHSP in 2011 and instead began to focus healthy schools on school-led programmes and controls within local areas[25]. The new aim was to reduce central control, where control may be better suited at a local or school level. The new programme takes into account the diversity within England and the many different health and wellbeing challenges faced. Achievement will be recognised only at a local level, potentially impacting on how this occurs in different areas. Although the government has reiterated its support for the NHSP - through the likely loss of funding there is a danger only 'good' schools will continue to pursue the health-related aspects of education and the less affluent schools may not have the funds to continue aspects of the

[24] Full list of LAA's available at http://www.partnersinsalford.org/salfordagreement.htm
[25] http://education.gov.uk/schools/pupilsupport/pastoralcare/a0075278/healthy-schools

programme; potentially increasing inequality gaps. For OH in domain 4 of the new PH outcomes framework is an indicator is "*tooth decay in children aged 5*" (DoH, 2012). Within the NHS outcomes framework the indicator relates to dental attendance of children and adults (DoH, 2011). As the NHSP is no longer regulated centrally there are only likely to be local targets rather than targets that previously contributed during Ofsted inspections, although this is an area that is unknown.

The new schools toolkit aims to provide a practical '*plan-do-review*' to help schools improve the health and wellbeing of children. Instead of monitoring through the old NHSP, every 2 years schools complete a whole school review allowing them to renew their own HS Status (DfE, 2012). At present there are many unknowns about how the new system will impact OH and children's health and wellbeing.

3.2.3 The English National Curriculum (NC)

Currently, within PSHE for key stage 1 (5-7 years old), children are expected to be taught about hygiene and simple choices to improve their health and wellbeing, but again teaching OH is at the teacher's discretion. In year 2 (6-7 years old) children complete a '*Life processes and living things*' module in science, which at the discretion of teachers OH can be embedded around eating. OH has been a topic of the 2005 English Key Stage (KS) 1 reading and spelling SAT exam, through the story '*Smile Please!*' This provides an age appropriate resource for teachers to use prior to year 3, to begin to teach children about OH and link into other NC areas. Presently OH is not covered as a key topic[26] until children reach year 3 (8-9 years old) as part of KS2 science through '*Teeth and Eating*'. This topic covers food, diet, animal diet and teeth (types, milk/adult, decay/disease, impact food and prevention).

Having the first core curriculum component when children are 8–9 years old potentially impacts on the development of good OH, as routines become harder to change as children reach adolescence and many children are given responsibility for their own OH at a younger age (*section 2.4.2* & *2.5*). For schools taking part in

[26] As with many areas in England the NC is being reviewed and is likely to be changed. As outlined in *section 2.5* the proposed changes in the white paper are currently delayed due to an on-going NC review. Changes and a new curriculum are now expected for September 2013.
(http://www.education.gov.uk/schools/teachingandlearning/curriculum/nationalcurriculum)

lunchtime brushing programmes (aimed at reception class in Salford) there is a two year period between OH being expected to be reinforced; reducing consistent messages.

Through research with 7–9 year olds in Scotland, Wetton & Collins (1996) developed a curriculum resource '*Healthy teeth in Healthy mouths'*. Unlike many curriculum resources this was designed with a 'bottom-up' methodology working with the children to ensure the resources were targeted at the correct level, building on an understanding of their knowledge. However, this resource is no longer in print, and it seems it is now infrequently used for teaching and evaluating OH knowledge. As part of the resource Wetton & Collins (1996) highlighted that 7-9 is an important age range in teaching children about OH and building on their increased ability to see health as less linear, their current knowledge, skills and increased responsibility for keeping themselves healthy. This resource used the same child orientated methodology as Williams et al. (1989a) '*A Picture of Health*' that formed the basis for health to be introduced into the NC. Although the NC has become increasingly congested, requirements around OH are important to target for younger children just before or as their adult teeth erupt (6–7 years old), making correct brushing crucial within increasingly independent brushing routines (Axelsson, 2006).

To improve the link between OH and health and wellbeing the Salford HS team produced a NC planning matrix, but it is not known how and if these are used by schools. For each school year this highlighted links to the PSHE curriculum:

- Early years to year 3 - children are encouraged to develop an understanding of hygiene routines and the need to keep clean.
- Year 2- recommends only a small amount of OH work, in comparison to other years.

Having a continuous mandatory programme about the importance of OH will likely aid development of good toothbrushing habits in children. Pre-designed evidence based SOHP (such as '*Brush Day & Night*') have the potential to provide a resource for teaching OH around gaps in NC materials and requirements.

3.2.4 Interventions to improve OH in primary school aged children

3.2.4.1 Cochrane review – 'Primary School-Based behavioural interventions for preventing caries'

As part of aim1 of this thesis (*Figure 2-1*), Cooper et al. were involved in conducting a Cochrane Review[27]. The objectives were:

- To assess the clinical effectiveness of school-based interventions aimed at changing behaviour relating to toothbrushing habits.
- To assess the frequency of consumption of cariogenic food and drink in children (4-12 year olds).

The results highlighted the unequal weighting was given to toothbrushing in comparison to cariogenic sugar-snacking behaviours within the evaluated interventions. Components targeting toothbrushing were predominantly active, frequently reinforced and taught as the main component. Nutrition components in contrast tended to be passive (e.g. letters, leaflets, minimal content in lessons) and not developed by experts (e.g. nutritionist) with little if any reinforcement. Although the school is an important site for the delivery of OH interventions, few of the included studies had links into the home. This review supported the outcomes of previous non Cochrane reviews that knowledge is frequently changed but behaviour is either only changed short term or not changed at all (Kay & Locker, 1996 & 1998, Sprod, Anderson & Treasure, 1996). Through the analysis of the behaviour change techniques (BCT) within the interventions and delivery of interventions, a contributing factor may have been the design of interventions. Many did not contain elements designed to target the change of behaviour and were only effectively designed to change knowledge. In future interventions, it is important that multidisciplinary teams are involved in the design to ensure equal weighting of components.

The issue of poor reporting and quality of reporting within RCTs of dentistry has also been found by Cioffi & Farella (2011). They highlight that in most cases, as occurred in the Cochrane review, only the manuscript is assessed for quality or reviewed systematically. As recommended in the Cochrane review, making a

[27] Cooper AM, O'Malley LA, Elison SN, Armstrong R, Burnside G, Adair P, Dugdill L, Pine, C. Primary school-based behavioural interventions for preventing caries (2013).

greater amount of materials available in conjunction with publications, can improve reporting and reviews to ultimately improve the learning from previous and subsequent studies to improve child OH.

3.2.4.2 Synopsis of other relevant literature

As schools have become a popular preference for OH promotion strategies and interventions, increasingly feedback from teachers that deliver or help to deliver the messages is being obtained along with consultation with them in the designs of programmes. It is well reported that school based dental education and promotional programmes improved knowledge frequently only in the short term (Brown, 1994) but few produced a sustained behaviour change relating to toothbrushing or sugar-snacking (Sprod, Anderson & Treasure, 1996; Lister-Sharp et al., 1999; Stillman-Lowe, 2008; Davies & Bridgman, 2011; Cooper et al., 2013). Kay & Locker wrote:

> *"Despite hundreds of studies involving thousands of individuals, remarkably little is known about how best to promote oral health"* (1998, p139).

This is partly due to the nature of the school programmes and partly due to poor exit strategies when the intervention has come to end - with no continued reinforcement from teachers (or at times parents) and few providing long term follow-ups to help with sustaining any intervention effect (Allensworth & Kolbe, 1987).

Intervention design needs to target and allow the inclusion of the whole school rather than only individual classes (e.g. through break time initiatives as well as age relevant education programmes). Programmes should actively involve children, parents, teachers and others connected to the school community. Evaluation design needs to incorporate the whole school approach to allow analysis of settings, account for potential contamination between and within schools through a cluster design and engage with all involved as part of the evaluation. Evaluations conducted between classes within a school would potentially limit the ability to isolate the impact of the OH interventions, through children discussing the intervention and messages/resources being shared across the school. Assuncao et al. (2008) stated:

> *"Health professionals must look for active participation, not only of teachers but also of students, because participation involves choice to control oral health conditions, and only when people are able to choose and accept that responsibility we can see results of our educational efforts"* (p41).

Dental screening is carried out as part of many school programmes, e.g. measuring the dmft and/or the plaque levels of the children. However, Threlfall et al. (2006) surveyed clinical directors and found only 29.5% of them saw school dental screening as a "*vehicle to promote prevention of dental disease*" (p238). Tickle et al. (2006) asked stakeholders (in the NW England) who should take charge to follow-up dental issues; many teachers felt they already had too much to do and along with dental nurses felt parents needed to take responsibility. This study illustrates the tension that can arise in schools, parents and dental professional.

Teachers are a key component to the success of many programmes. They need to feel supported and that the SOHP is not just a disruption to their normal curriculum teaching, but can be integrated and is an important component of lessons (St Leger, 2000). Children are used to learning, following instruction and receiving support and encouragement from teachers. This will impact on their engagement with the programme through the teacher's ability to convey the importance of the message. Assuncao et al. (2008) in their review of a 7-year OH control trial with children in Portugal highlighted:

> *"…if teachers do not develop leadership in this process, there is little likelihood that the activities will lead to changes in student's practice, behaviour or action"* (p41).

Additionally, children targeted need to feel they have a choice about controlling and changing their OH and hygiene habits. If people feel they have ownership of their own behaviour and actions they are more likely to make changes than if they feel they are being dictated to (Schwarzer, 2001; David, Newen & Vogeley, 2008[28]). Teachers also play an important role in the transfer of messages to the home, (e.g. through homework or brushing calendars). The influence of the

[28] 'Sense of Agency' - Defined as ''*the sense that I am the one who is causing or generating an action*" (David, Newen & Vogeley, 2008, p524)

connection and engagement between the school and the home will continue to impact on the effectiveness of many more future interventions unless it is improved (Wind et al., 2005; Davies & Bridgman, 2011).

3.3 Examples of current SOHP

Passalacqua et al. (2012) summarised OH promotion strategies in the UK and identified three main strategies; '*National Healthy School'*, '*Sure Start*' and '*Brushing for life',* they also note there are a number of local initiatives. Passalacqua et al. (2012) concluded that as there was no national strategy which covers all children/parents and can account for the diversity in the UK (now only the case in England) many parents are left alone to teach good oral hygiene practices to their children and provide the correct information around sugar intake. The authors also reported they felt there needed to be a wider application of the WHO guidance around OH in the UK.

The summaries on *p80-84* outline examples of SOHP within a similar age range and area to the one being evaluated as part of this research. There are many common themes and messages delivered by the programmes (e.g. twice-daily brushing, visit the dentist) but as with most complex interventions it is difficult to ascertain which components of the intervention are the active component in impacting any behaviour change in the children. Although some larger companies provide support in the delivery, for many of the programmes the emphasis is on the teachers to use supporting guides and packs to help deliver the programme.

In addition to the complex programmes targeting knowledge and behaviour there are also a number of brushing only interventions. The '*Brushing for Life*' (Downer, 2006) programme targets mothers within health authorities with the highest levels of decay at 8, 18 and 36-month checks to provide both tools and education for brushing their child's teeth. Through their critique of the programme Downer (2006) concluded that although there were potential benefits, without further evaluation and long term data it was not possible to truly understand the programme's benefits.

From the interventions below, the studies evaluated as part of the Cochrane review (Cooper et al., 2013) and the evaluation of the *'Brush Day & Night'*

intervention, a number of key areas arose. Many of these interventions have unequal weight for the ‘active’ component in schools and ‘passive’ components in the home. Worthington et al. (2001) placed more emphasis in the home through homework to be completed with caregivers but still found any behaviour change was not sustained at follow-up. The interventions reviewed as part of the Cochrane review and those below had no overlap, although there were similar characteristics, evaluations of the interventions below were not conducted via RCTs.

Additionally the focus of these programmes was on toothbrushing and related behaviours with less emphasis and expertise used in the design of nutritional elements. Although inter-disciplinary teams are now helping to design OH interventions, the addition of a nutritional expert to help with the impact of diet on caries is still in its infancy. Unlike areas with greater evidence bases, such as obesity (Golley et al., 2011), it is not possible to determine common BCTs used within SOHP. Frequently interventions are poorly described in SOHP literature and primarily focus on providing information on behaviour change links and dental outcomes. Few SOHP interventions currently target specific goal setting, or consider the behavioural goals that can help children to understand and develop the cues for the behaviour in a practical setting. At present there is still a great deal of scope to work using a bottom-up approach to SOHPs and collaborate with other areas of PH rather than in isolation.

Examples of other brushing programmes

- **with no evidence of an effectiveness review being conducted:**

Brushing Buddies (The Nurdles) by Aquafresh, GSK

- No indication when started, UK targeting 3-6 years (online parent website form 0–6+years).
- Focus: Help children learn how to brush properly.
- Key Materials: Teachers pack (including cartoons), letter for parents, child activities and support material in school and at home (brushing calendars).
- Location and facilitators: School with interactive website and worksheets for the home. Duration designed to be adaptable for schools.

- Critique: Developed with input from all targeted including children. Uses cartoon characters as focus to guide children/encourage correct behaviour. A lot of resources and lesson plans provided but requires tailoring by teachers.
- Key similarity and differences '*Brush Day & Night*': Uses cartoons and child orientated images throughout. Website to disseminate the intervention and support the link to the home. Teacher delivered with main focus on school.

Bright Smiles, Bright Futures (Dr. Rabbit) by Colgate

- Introduced in 1991, 80 countries, 30 languages, estimated to reach 50 million children and families a year. Targeting pre-school and 6-8 year olds.
- *Focus:* Toothbrushing and frequency.
- *Key Materials:* Teachers, children's parents and OH educators (dentist) packs.
- *Location and facilitators:* Schools delivered by teachers.
- *Critique:* Clear guideline in the materials of where the intervention can be integrated into NCs.
- *Key similarity and differences 'Brush Day & Night':* Website to disseminate materials. Teacher delivered with main focus on school. Provides detailed information on links to other areas of UK NC/accompanying activities.

Open Wide and Trek Inside[29]

- Introduced in 2002, USA (altered for each state as required). Targeting 6-8 year olds.
- *Focus:* Science of oral environment. Addition to US NC or to provide specific focus on OH.
- *Key materials:* Teachers, home and dental professionals materials.
- *Location and facilitators:* School delivered by teacher (175p. guide), includes take home activities to link to the home.
- *Critique:* Website containing supporting materials. Detailed manual to help teachers, provide additional information links curriculum, background.

[29] http://science-education.nih.gov/supplements/nih2/oral-health/default.htm

- *Key similarities and difference 'Brush Day & Night':* Teacher delivered with main focus on school. Appears to have a greater emphasis on linking the work in the school to the behaviour in the home.

Smile Starts OH curriculum[30] (American Dental Association)

- Introduced in 2005(a-e), US. Targeting 4-7 year olds ('Shinning Smiles!') and 7-9 year olds ('A lifetime of Healthy Smiles').
- *Focus:* Flexible lesson plan to integrate into NC, provide hands on OH and hygiene lessons.
- *Key materials:* Teachers work book – including lesson plans, worksheets, activate ideas and class demonstration. Website for delivery of intervention.
- *Location and facilitators:* School delivered by the teachers.

- **with evidence of an evaluation of programme effectiveness:**

Mighty Mouth (Irish Dental Foundation, 2001)

- Introduced in 2004, Ireland, 5-6 year olds (OH for those children who are perceived to be at the greatest risk of developing dental caries).
- *Focus:* Toothbrushing and impact of food on OH.
- *Key materials:* Teachers guide, information leaflets parents, lesson plans. Children's brushing calendars.
- *Locations and facilitators:* Run over 8 weeks facilitated by teacher through the provision of an intervention guide.
- *Critique:* Designed from evidence base and also in response to parental identification of what they felt was needed. Although evaluation suggests additional support for parents and teachers, and accounting for their feedback, it does not raise the need to make any alteration from a child's perspective.
- *Review Findings:* Positive changes reported in behaviour. Increase in knowledge compared to controls. Low levels of supervision of brushing despite children being under 7. Requires teachers to be provided with support prior to running the intervention.

[30] Also includes programmes for older children - Teeth to Treasure! (9–12 years old) and Watch Your Mouth! (12–14 years old)

- Key similarities and differences '*Brush Day & Night*': Teacher delivered with main focus on school.

Winning Smiles (Dental Health Foundation Ireland, 2006)

- Introduced in 2005, Ireland (For evaluation – Belfast and Dublin). Targeting 7-8 year olds.
- *Focus:* Increase fluoride toothpaste use; improve child related quality of life. Improve knowledge, attitudes and access.
- *Key materials:* Resources for dental health promoter, teachers and children. Limited resources for parents.
- *Location and facilitators:* Key stage 1 & 2 intervention designed to fulfil NC requirement. 3 planned visits by community dental staff to deliver intervention over 6 weeks. Homework/worksheets for teachers in between visits. Final visits for awards.
- *Critique:* Development included dental health foundation, children, parents and teachers prior to the creation of full revised intervention. Worked closely with the children to understand toothbrushing rules, using worksheets (write) and drawing (Freeman et al., 2010).
- *Review findings:* Positive impact of intervention on OH of children (e.g. increase use fluoride toothpaste). Decline in OH satisfaction and increase OH awareness. 7-8 year olds self-report brushing behaviour did not correlate with clinical data.
- *Key similarity and differences 'Brush Day & Night':* Intervention delivered by dental health professionals, with only reinforcement by teachers in between. Targeted behaviour as well as knowledge.

Teaching programme based on NC (Chapman, Copestake & Duncan, 2006)

- Conducted in 2006, Manchester and London. Targeting 7-8 year olds.
- *Focus:* Integration into NC and 'Teeth & Eating' unit. 3 sessions – function, problem, taking care.
- *Key Materials:* Worksheets, lesson materials.
- *Location and facilitators:* School – delivered by student dentist and class teacher.

- *Critique:* No control group. Only aimed to increase knowledge, was a simple pilot of initial design that would need to be developed for wider use.
- *Review findings:* Significant increase in knowledge post-intervention.
- *Key similarity and differences 'Brush Day & Night':* Similar breakdown of messages within the three lessons.

3.3.1 Public-Private Partnerships

Private companies (such as Unilever, Colgate and GSK) have an important role in helping tackle communicable and non-communicable diseases in support of public sector organisations (Reich, 2000). Within OH the reach of the school programmes (and provision of toothbrushes and toothpaste) is far greater than would be possible without the resources and infrastructure of private sector companies. As with any collaboration between two differing sectors there are both facilitators and barriers (Reich, 2000). In many cases these consists of sharing of skills and resources to improve an intervention and also ensure effective evaluation (Widdus, 2001). A challenge of partnerships currently is to ensure that the design, evaluation and implementation of SOHP follows country guidelines and is effectively designed to be relevant to all countries intended or be allowed to be tailored.

3.4 The '*Brush Day & Night*' programme

This section outlines the development of the *'Brush Day & Night'* SOHP (*Appendix 1-12*) evaluated in this thesis. Overall the intervention is designed to motivate and empower parents to help their children; and to educate children using fun methods to encourage them to form the habit of twice-daily brushing.

3.4.1 Origins

Unilever Oral Care has a long history of implementing SOHP; estimated to reach over 44 million children worldwide (Unilever, 2007; Pine & Dugdill, 2011). In 2009, Unilever launched an aligned global campaign called '*Brush Day & Night*' (*Figure 3-1*).

Figure 3-1 Intervention and campaign logo ©Unilever

This included a SOHP based upon a previously created hierarchy of engagement for behaviour change programmes (Pine, 2007). *'Brush Day & Night'* is designed to help transform what can be a daily battle for some parents in the bathroom into an enjoyable one for children, and an easier routine for parents to implement. This forms the core to the intervention, and a behaviour that ultimately can be carried out anywhere in the world if the correct tools (toothbrush and toothpaste) are available. Message delivery is supported through explanations of why the intervention focused on their mouths; what can happen (decay, germs); prevention and brushing technique. With reinforcement provided through brushing calendars, with rewards of larger stickers each month and caregivers allowing time on the supporting website games for optimal behaviour occurring. The core message is set firmly within the proven evidence base (*Chapter 2*) that twice-daily brushing can reduce dental decay.

Parental packs aimed at promoting enjoyment and sharing between the parent and the child are supplied with the intervention aiming to empower mothers to feel confident they can deal with brushing incidents (child not wanting to, not brushing correctly) to encourage their child to form the correct habit.

The key aim of the SOHP is to ensure children brush their teeth in the morning and in the evening. By inference then, this intervention is targeting behaviour change at those children who currently do not brush at all, or only brush once-a-day to increase their brushing to twice-a-day. The intervention also aims to encourage children to brush for a sustained two minute period at any one brushing event.

3.4.2 The complete programme

The SOHP exists as one part of a complex intervention that has evolved since its launch and contains various interlinking components, including a Television saga, education through print media and dental professionals, digital engagement and PR, as well as related in store activities and promotions.

'Brush Day & Night' targets 6-7 year olds and their parents - secondary target audiences being teachers and dentists - to help deliver the key messages, improve their awareness of the importance of good oral hygiene and provide support and reinforcement. The triad of support for children is designed to help sustain the programme between prescribed OH lessons and once the teaching component of the intervention is complete. Behaviourally, children aged 6 are naturally becoming more independent and forming the basis of routines and habits themselves.

Incorporating, unlike many interventions, an exit strategy (teacher driven programme) in the design is an effort to increase sustainability within communities and potentially improve the longevity of any behaviour change. Additionally having teachers as the main deliverer of the intervention, as well as resources being available to download and print through the supporting website (www.brushdayandnight.com), is also aimed at increasing the ability to reuse the programme and reduce the need for outside support.

Two key characters are depicted on all of the material, linking the components, are a father 'Pablo' and his son 'Oliver'. They are shown brushing their teeth together, with Pablo using various methods (e.g. germ monsters - *Figure 3-2*) to encourage Oliver to brush twice-daily and mimic his habits.

Figure 3-2 '*Pablo*' & '*Oliver*' advert example ©Unilever

The '*Brush Day & Night*' intervention is designed to be implemented in any country regardless of economic status or school system. With this in mind it can be partially tailored to local needs, both through dental recommendations that may differ in individual countries around OH (e.g. toothpaste strength, visits to dentist); to local characters on the materials to increase children's familiarity.

An example of local adaptation is '*Ayahdi & Dika*' (*Figure 3-3*) in Indonesia where the television adverts were also tailored to increase resonance with local audiences, together with a change to the locally relevant Unilever brand Pepsodent, instead of Signal.

Figure 3-3 Localised advertising and TV screen shot (Indonesia) ©Unilever

The school: Currently, lessons are designed to be delivered at least once a term by teachers, with support, reinforcement and reminder activities occurring both in the home and school for the remainder of the year. In some countries where multiple schools within a region are running the intervention, activities are suggested to take place across schools to provide ways of reinforcing the behaviour through competition (e.g. inter-school brushing challenges and teacher awards). Additionally, it is suggested, where possible, that parents are provided with a seminar at the start of the programme to highlight the aims, messages and their role in supporting their children. Additionally, within this research six '*Teeth Chief*' cartoons were being trialed to determine their ability to support the SOHP and help children with developing the correct brushing routines.

Supporting SOHP website: To support all aspects of the intervention and to be an additional source of information and materials, an intervention website has been produced (www.brushdayandnight.com). For teachers and dental professionals the website contains examples of academic literature and packs that can be downloaded. For children the website provides games that can be used as reward for bushing and also brushing contracts that can be made with parents.

For practical reasons and due to the focus of the research, certain parts of the complete intervention were not evaluated or used. *Note: Example materials available at* www.brushdayandnight.com:

> **Dental pack:** The materials were designed to be supported by local dental federations (dentists, dental nurses and hygienist) to ensure the same core

messages are being provided to children when they visit clinics or dentists visit schools. Dentists are able to provide children and parents with materials containing the same logo, characters and messages aiding familiarity with the materials.

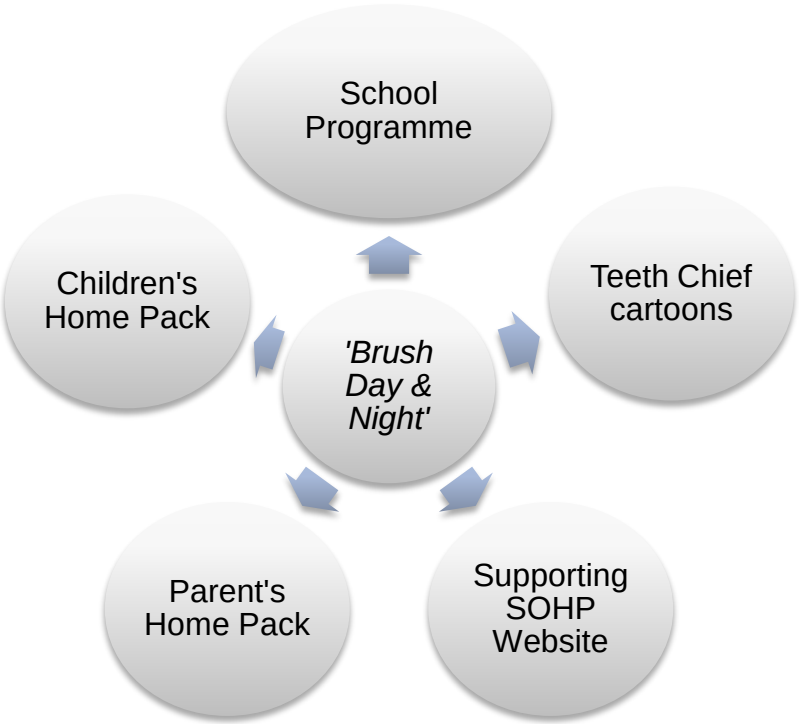
Media: TV adverts (Pablo & Oliver) and marketing (in store point of sale materials) have been developed to widen the reach of the message.

Relevance to the UK: '*Brush Day & Night'* is not implemented in UK and therefore materials have not been previously adapted for the local situation. Although the intervention tested was the global level design, there are many messages contained within the intervention that mirror '*Delivering Better Oral Health*' (DoH & BASCD, 2009; PHE 2014). All prescribed key messages targeting children 3–6 years old are included. Additionally, much of the healthy eating advice is included in the intervention, but details such as consumption of sugar (a maximum of 4 times a day) are not covered. Incorporating each county's policy is likely to be an issue in the design of a global SOHP, impacting the need for interventions to remain generic in the messages they target (both around brushing and nutrition).

3.4.3 Components being evaluated in thesis

The evaluation aimed to determine if the evaluated elements (*Figure 3-4*) of the '*Brush Day & Night*' programme were able to produce a change in children's toothbrushing and sugar-snacking behaviour and sustain any change over time.

Figure 3-4 Illustration of components being evaluated within *study 2*



In order to comply with local rules about outside companies going into schools all '*Signal*' and '*FDI*' logos were removed from distributed materials. The supporting SOHP website was not unbranded since it was not practical to replicate the global template without logos for this research project.

Sections 3.4.3.1-3.4.3.3 outline the main materials used through this thesis and summarise the impact of *study 1*, prior to their use in *study 2*.

3.4.3.1 The teacher's pack

The pack was designed to be easy for teachers to follow and provide them with supporting information to incorporate into the lessons and many countries NC's. Each lesson builds on the previous one to increase the children's knowledge and awareness about the importance of oral hygiene.

Table 3-1 Teachers pack and snapshot of materials ©Unilever

Material	Aim of material	Snapshot of material	Changes to materials as a result of *study 1* (*Chapter 5*) and *study 2* (*Chapter 6 & 7*)
Introduction sheet	Explain the packs, their role and the overall intervention		Creation of Lesson plans (*Figure 5-14–5.16*)
Lesson 1 (fact sheet)	The mouth, the teeth and their roles and kids activity sheet 1		
Lesson 2 (fact sheet)	The main teeth problems: germs and cavities and kids activity sheet 2		

Material	Aim of material	Snapshot of material	Changes to materials as a result of *study 1* (*Chapter 5*) and *study 2* (*Chapter 6 & 7*)
Lesson 3 (fact sheet)	The main solution *Brush Day & Night* with a fluoridated toothpaste and kids activity sheet 3		
7 teaching slides	To aid the delivery of the intervention to children in the classroom		After *study 1* teachers FG increased from 7 to 10 *(Figure* 5-13).
3 activity sheets shown	Designed to support the intervention and determine the level of children's knowledge and understanding of the key messages in the intervention.		Recommended changes following *study 2* – Suggested addition worksheet provided and graphics on worksheet enlarged

Material	Aim of material	Snapshot of material	Changes to materials as a result of *study 1* (*Chapter 5*) and *study 2* (*Chapter 6 & 7*)
2 posters	Containing the key messages and providing daily reminders for the children about the importance of brushing and when they should brush		
Teeth Chiefs cartoons	Being trialed in this evaluation the addition of 6 cartoons focused around 4 children who gain powers when they brush their teeth correctly to help them defeat the plaque'os who are trying to take over the town. The cartoons also carry the key message of brush twice-daily and brush for two minutes through the use of songs		Recommended after *study 2* to have story information and activities for each cartoon to allow teaching/activities around the messages
Provision of props	At the discretion of the local organisation, (e.g. mouth models, large toothbrushes etc.).		Provided by the University of Salford and Unilever Oral Care for the purpose of this research.

3.4.3.2 The children's pack

- One year brushing calendar and stickers - designed to bridge between home and school, providing a reward mechanism for children controlled by parents.

Figure 3-5 Front cover and 1 month example calendar sheets

- At the discretion of the local organisation, age appropriate toothbrush and toothpaste (sufficient amounts supplied for all classes involved in the three studies by Unilever Oral Care UK).
- SOHP Website – designed to encourage children to interact with the website e.g. to play educational games and upload videos of brushing.

3.4.3.3 The parent pack

To produce the desired behaviour changes or improvements in brushing it is essential to engage with the home environment and the child's parents (*Chapter 2 & 3*). The pack contains information for children 0–12 years old to account for siblings and is designed to improve the knowledge of parents around OH, and make brushing more fun for the children (*Table 3-2*). The parents' pack relies partially on parent's self-motivation to engage with the material and the website. Engagement with the intervention is designed to be driven through support of the child and encouraging their child to brush twice-daily.

Table 3-2 Parent pack contents and snapshot

Material	Aim of material	Snapshot of material	Changes to materials as a result of ***study 1*** **(*Chapter 5*) and *study 2* (*Chapter 6 & 7*)**
Introductory letter to the intervention	To introduce the intervention and explain the contents parent and child packs.		Changes to language to ensure relevant to UK e.g. '*mom*' to '*mum*'
Tips to brush	Leaflet to highlight the importance of brushing day & night and ways to make it fun for children		
Age guides	Information around children's OH and tips to help with brushing situations at different ages.		Recommended changes following *study 2* – change 'kid' to 'child' (from evaluation comment by parent). This was not picked up during *study 1* (*Appendix 9-11*)
Localised OH report *(Optional)*	Containing key messages and information about OH to highlight the importance of OH locally		Created as a result of *study 2* to help make parents aware of the key messages and the state of OH in Salford. (*Appendix 18)*
SOHP Website	Provide additional information and places to reward children's behaviour	e.g. optional extra resources such as a brushing contract that can be made with children (http://www.brushdayandnight.com/Upload/en-gb/getbrushing/the_brushing_contract.pdf)	Recommended changes following *study 2* – increase prominence due to lack access and awareness.

3.4.4 '*Brush Day & Night*' Behaviour change techniques

Abraham & Michie's, (2008) taxonomy of 26 BCTs aims to introduce common terminology and definitions across interventions. Michie (2008) advocated three main reasons for the need for theory based interventions:

- "*Likely to be more effective if they target causal determinants of behaviour and behaviour change*" (p662).
- It is not possible to test and develop theory unless the interventions have been theoretically informed in design.
- Through the basis of theory it is possible to "*facilitate an understanding of what works*" (p662) and why it works, thus improving the ability to transfer theory across context, behaviour and populations.

An independent chartered health psychologist reviewed the components of the '*Brush Day & Night'* SOHP evaluated in this thesis (*Table 3-3*) prior to any studies to aid understanding of the present BCT. Although the taxonomy is not exhaustive it allows an understanding of the techniques and theories that underpin the components of the *'Brush Day & Night'* intervention.

Table 3-3 Details of the 9 BCT found in the intervention (prior to this research) plus complete list and definitions of the 26 BCT (Taken from Abraham & Michie, 2008)

Technique (theoretical framework)	Definition	Found in intervention
1. Provide information about behaviour health link. (IMB[31])	"*General info about behavioural risk, e.g. susceptibility to poor health outcomes or mortality risk in relation to the behaviour*."	**Teachers' Materials and Pablo & Oliver videos**
2. Provide information on Consequences. (TRA[32], TPB[33], SCogT[34], IMB)	"*Information about the benefits and costs of action or inaction, focusing on what will happen if the person does or does not perform the behaviour."*	**Teachers' Materials, Teacher sheet 1 and Pablo & Oliver videos**
3. Provide information about others' approval.	"*Info about what others think about the person's behaviour and whether others will approve or disapprove of*	

[31] IMB = Information-motivation-behavioural skills model
[32] TRA = Theory of reasoned action
[33] TPB = Theory of Planned behaviour
[34] SCogT = Social-Cognitive theory

Technique (theoretical framework)	Definition	Found in intervention
(TRA, TPB, IMB)	*any proposed behaviour change*."	
4. Prompt intention formation. (TRA, TPB, SCogT, IMB)	"*Encouraging the person to decide to act or set a general goal*."	**Teeth Chief Cartoons (No. 4)**
5. Prompt barrier identification. (SCogT)	"*Identify barriers to performing the behaviour and plan ways of overcoming them*."	**Lessons**
6. Provide general encouragement. (SCogT)	"*Praising or rewarding the person for effort or performance without this being contingent on specified behaviours or standards of performance*."	
7. Set graded tasks. (SCogT)	"*Set easy tasks, and increase difficulty until target behaviour is performed*."	
8. Provide instruction. (SCogT)	"*Telling the person how to perform a behaviour and/or preparatory behaviours*."	
9. Model or demonstrate the behaviour. (SCogT)	"*An expert shows the person how to correctly perform a behaviour*."	
10. Prompt specific goal setting. (CT[35])	"*Involves detailed planning of what the person will do, including a definition of the behaviour specifying frequency, intensity, or duration and specification of at least one context, that is, where, when, how, or with whom*."	**Teacher Lesson plan (Note: *added after study 1*) and Teeth Chief Cartoons**
11. Prompt review of behavioural goals. (CT)	"*Review and/or reconsideration of previously set goals or intentions*."	
12. Prompt self-monitoring of behaviour. (CT)	"*The person is asked to keep a record of specified behaviour(s)*."	**Children's Brushing Calendar**
13. Provide feedback on performance. (CT)	"*Providing data about recorded behaviour or evaluating performance in relation to a set standard or others' performance*."	
14. Provide contingent rewards. (OC[36])	"*Praise, encouragement, or material rewards that are explicitly linked to the achievement of specified behaviours*."	
15. Teach to use prompts or cues.	"*Teach the person to identify environmental cues that can be used*	***Brush Day & Night – prompt for time***

[35] CT = Control Theory
[36] OC = Operant Conditioning

Technique (theoretical framework)	Definition	Found in intervention
(OC)	*to remind them to perform behaviour, including times of day*."	***of day***
16. Agree on behavioural contract. (OC)	*"Agreement of a contract specifying behaviour to be performed so that there is a written record of the person's resolution witnessed by another."*	
17. Prompt practice. (OC)	*"Prompt the person to rehearse and repeat the behaviour or preparatory behaviours."*	
18. Use follow-up prompts.	*"Contacting the person again after the main part of the intervention is complete."*	
19. Provide opportunities for social comparison. (SCompT)	*"Facilitate observation of non-expert others' performance."*	
20. Plan social support or social change. (social support theories)	*"Prompting consideration of how others could change their behaviour to offer the person help or social support, including 'buddy' systems and/or providing social support."*	
21. Prompt identification as a role model.	*"Indicating how the person may be an example to others and influence their behaviour or provide an opportunity for the person to set a good example."*	**Teeth Chief Cartoons (No. 6)**
22. Prompt self-talk	*"Encourage use of self-instruction and self-encouragement to support action."*	**Teeth Chief Cartoons**
23. Relapse prevention. (relapse prevention therapy)	*"Following initial change, help identify situations likely to result in readopting risk behaviours or failure to maintain new behaviours and help the person plan to avoid or manage these situations."*	
24. Stress management (stress theories)	*"May involve a variety of specific techniques that do not target the behaviour but seek to reduce anxiety and stress."*	
25. Motivational interviewing	*"Prompting the person to provide self-motivating statements and evaluations of their own behaviour to minimize resistance to change."*	
26. Time management	*"Helping the person make time for the behaviour."*	

As can be seen in *Table 3-3* the intervention was identified as containing 9 different techniques that are not congruent with one theory and that are designed to promote change in the desired behaviour drawing on a number of different theories in their origins. Following *study 1* (*chapter 5*) the above behaviour change chart was used to re-map the BCTs following the outcomes of the pilot (*Table 5-11, p200*). It is important to note that although the taxonomy aids understanding of the techniques included, it does not reflect the complexity of the interaction of the techniques and how they impact the participants. It also does not tell us which techniques lead to effective change but helps to understand how interventions are functioning (Michie, Atkins & West, 2014).

3.5 Chapter summary

Linking into the NC more consistently highlights the importance of OH as a continuous topic (similar to '*Child Smil*e' in Scotland that goes across the life course) rather than having only sporadic messages being given to schools, children and families.

Our understanding of the active and essential components of SOHPs is still in its infancy. Although many previous SOHP have changed knowledge, few have managed to sustain behaviour change. Through this chapter it can be seen that there are many similar elements to SOHPs, with the transition to the home and nutritional components being given less weight in interventions.

Within England the NHSP, along with many other services targeting PH, is in a transitional phase from central to local control. It is unclear how the changes will impact on Salford that previously had 100% of schools taking part or preparing to take part. As with other areas of PH where the use of multi-disciplinary teams and bottom-up approaches are the norm, OH is only just starting to design interventions using this approach.

The SOHP being evaluated through this thesis is a complex intervention, delivered and driven primarily by the teachers, with parents providing support in the home. Although the intervention tested was the global design, through *study 1* (*Chapter 5*) it was possible to adapt aspects of the intervention for local relevance in schools within the NW of England.

Chapter 4 - Review of methods: evaluating complex behavioural interventions and the place of children in research

4.1 Chapter overview

This chapter initially presents an exploration of literature related to complex behavioural interventions, and research with children. This is followed by an overview of mixed-method literature. The second part of this chapter presents an outline of the researcher's epistemological stance and the rationale for orienting the research in a child focused manner. This chapter then discusses the use of mixed-methods within this thesis. It is, followed by an overview of the literature relating to the core aspects of the portfolio of research tools (Children's questionnaire, draw & write (D&W) and focus groups (FG)) used within the studies. Finally, a summary is presented of the key points from the initial chapters and the impact on the thesis and research questions.

4.2 Complex behavioural Interventions in relation to oral health research

Rychetnik et al. (2002) highlight how "*public health interventions tend to be complex, programmatic and context dependent*" (p119). Complex behavioural interventions comprise a number of different components (Medical Research Council (MRC), 2008) which may "*act both independently and inter-dependently*" (MRC, 2000, p2) with the aim of producing the desired behaviour change.

Although there may be common target behaviours that an intervention is aiming to influence, it is often not possible to determine the component(s) of the intervention that influenced any changes in behaviour, and these component(s) may also vary across the population (MRC, 2000). Many health and wellbeing interventions may stand alone, but also operate within a health care or other setting (either directly or indirectly) which can add further layers of complexity in determining which part of an intervention is having the desired effect (Bonetti & Clarkson, 2010). For example, by delivering a school oral health programme (SOHP) targeting toothbrushing, a person's awareness of oral health (OH) is raised. This could lead to increased dental visits that may not be communicated to the researcher but may impact positively on the study outcomes.

In OH research there has been an increase in the use of complex interventions (Bonetti & Clarkson, 2010). An evaluated example is a community-based OH programme in Glasgow (Blair et al., 2006) that targeted pre-schoolchildren. This research used a multidisciplinary OH intervention (involving stakeholders and community members), with the key aim of aiding communities to identify ways to reduce the risk of developing caries themselves. Although due to the design of the study, Blair et al. (2004) reported initially it was difficult to attribute causation to observed clinical outcomes, they strongly suggest that

> *"the significant changes in dental health indices of pre 5-year olds in the programme areas were associated with the advent of community level interventions, although the relationship and relative importance of various components remains unclear"* (p296).

This difficulty is common within complex interventions, which can lead to challenges in identifying which component or components impact on changes in behaviour and subsequent reduction in dmft levels. Through the development of a taxonomy of behaviour change techniques (BCT), Michie et al. (2008) reported:

> *"…there is currently no comprehensive list of techniques; it would be extremely difficult for someone new to the field of behaviour change to extract these techniques from the literature and to find the detail that would be necessary to use them in a complex intervention"* (p665).

This is true not only for researchers in the area of behaviour change but also practitioners who deliver many of the interventions (e.g. in schools or communities), many without any specific training in intervention/service design. The National Institute of Clinical Excellence (NICE) guidelines and the BCT taxonomy (Abraham & Michie, 2008) aim to improve the effectiveness and sustainability of behaviour change programmes, help improve reporting of interventions (content and delivery) and standardise language. Another issue highlighted by the NICE (2007) guidelines is lack of uniformity in development processes:

> *"At present, there is no strategic approach to behaviour change across government, the NHS or other sectors, and many different models, methods and theories are being used in an uncoordinated way"* (p6).

4.2.1 NICE Guidelines: Behaviour change at population, community and individual levels

The NICE guidelines (PH6) aim to "*support attitude and behaviour change at population and community level*" (2007, p3). Through the completion of 6 systematic reviews of evidence (e.g. effectiveness (Jepson et al., 2006), cultural context and models (Taylor et al., 2006)), the NICE guidelines for health behaviour change were developed to identify key principles that should be followed when developing a successful behaviour change intervention. The guiding principles of PH6 go from planning, to delivery and evaluation (NICE, 2007); highlighting the multitude of factors that influence a person's behaviour:

> *"…the evidence shows that different patterns of behaviour are deeply embedded in people's social and material circumstances, and their cultural context"* (2007, p6).

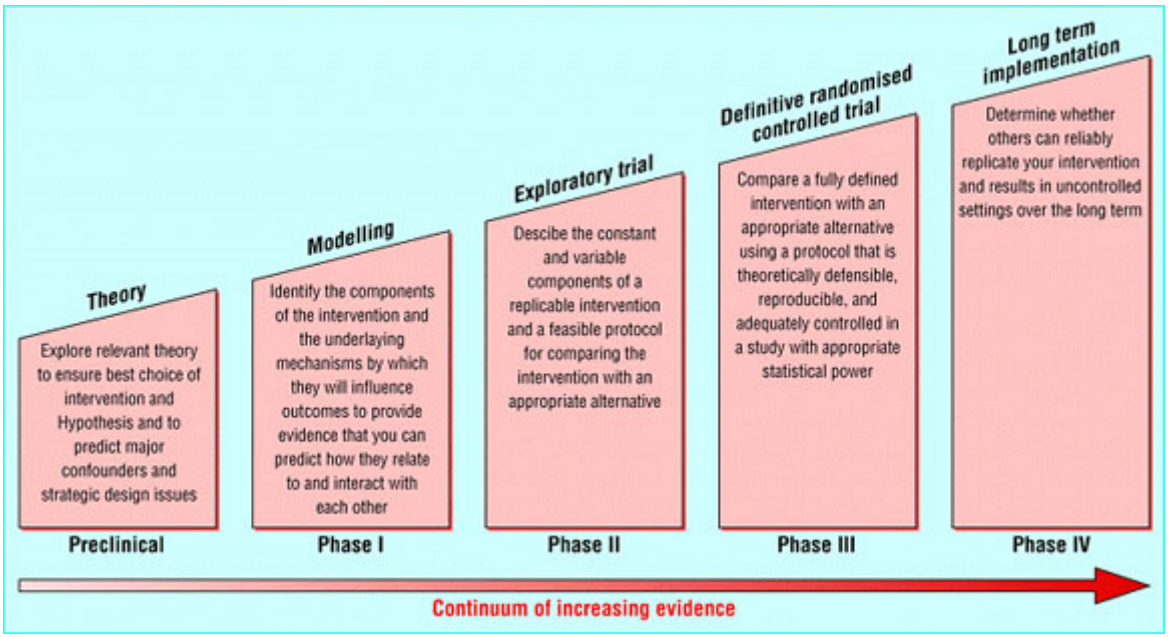
The multiple range of factors that impact a person's health, and a limited understanding about the effective components of intervention design, may explain why few health behaviour change interventions are successful at sustaining behaviour change (Linnan & Steckler, 2002; Michie, 2008). Upon completion of many interventions there is little active maintenance long-term to aid the continued production and sustaining of new behaviours, with the expectation that people will be able to self-sustain new behaviours without the intervention's support (Jones et al., 2011). More active designs of interventions are needed long term, including maintenance and reinforcement phases which are important (if not vital) to intervention design for sustained behaviour change. Some interventions already account for the need for greater on-going support for participants e.g. computer tailored health messages – 'WISEWOMAN' (Jacobs et al., 2004) or being able to re-enter a programme and continue to attend some sessions – 'GOALS' programme (Watson et al., 2011).

As part of the recommendations regarding the design of interventions, NICE guidance (2007) highlights the need to have a good understanding of the target population to allow programmes to build on the skills and resources already available. This aids the feeling of control that participants have in an intervention and positively influences sustainability once external support has ended. During the design phase of interventions it is important to consider a number of factors from socio-economic status (SES) and cultural contexts, to account for participants' perceived barriers to change. Collaboration between stakeholders and all relevant participants' aids the understanding of the setting in which any new interventions are designed (Bartholomew et al., 2011).

4.2.2 MRC Framework for the evaluation of complex interventions

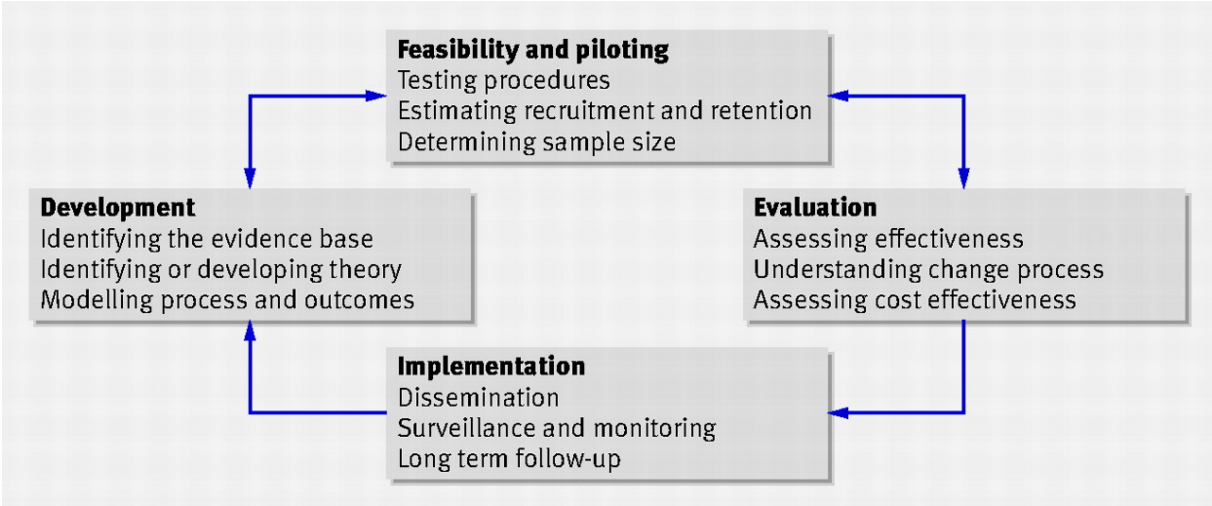
Similarly to NICE (2007), the MRC framework proposes a staged process to designing, testing and evaluating complex interventions prior to undertaking RCTs and long term implementation of intervention programmes. From the original framework in 2000 to the new guidelines developed in 2008, the framework moved from a linear model (*Figure 4-1*) to a process cycle (*Figure 4-2*) that can allow movement in different directions depending on individual interventions and the outcome of each phase.

Figure 4-1 Taken from Campbell et al. (2000). MRC framework for evaluating complex interventions. BMJ 321: 694 – 696



The new MRC framework (*Figure 4-2*) aims to ensure the systematic development and evaluation of an intervention to improve best practice.

Figure 4-2 Taken from Craig et al. (2008). Developing and evaluating complex interventions: the new Medical Research Council guidance. BMJ 337: a1655.



Although not all interventions may be designed, evaluated or implemented in this manner it is essential they are all designed using a clear evidence base and theory appropriate to the individual intervention (Craig et al., 2008). Having a staged design, built in feedback and time for adaptation where necessary will aid understanding of the components that can interact and be implemented in different

ways to understand how, why and what is helping the target group to make a change in the desired behaviour (Springett, 2001).

Mackenzie et al. (2010) highlighted areas of caution to be considered with respect to the MRC framework, e.g. for some health promotion interventions the randomised control trial (RCT) model of evaluation may not be appropriate due to the complexity of the setting and intervention being delivered. Increasingly within Public Health (PH), concerns have been raised about the efficacy of the RCT model for measuring complex behavioural interventions where multiple factors are interacting (Victora, Habicht & Bryce, 2004; Dugdill, Graham & McNair, 2005; Kemm, 2006; Cartwright, 2007; Christ, 2014). It is also necessary to consider that interventions designed through an evidence based framework may not be used in the same way in a community (translational efficacy of an intervention). The methods, intervention and evidence provided from an RCT are not always easily translated into practice, with the need to recognise the contribution non-RCTs can make, frequently in a reduced amount of time/money while maintaining research quality (Watson et al., 2012).

4.2.3 CONSORT and TREND statements

Further to the guidance above, statements have been developed with the specific aim of improving reporting and standardising the language used within research reporting. The CONSORT [37] statement was first developed in 1996, and subsequently updated in 2001, with the aim (through a 25-item checklist) of improving RCT reporting by requiring authors to include certain information in publications to improve both transparency and the ability to replicate trial intervention and analysis (Armstrong et al., 2008). In 2004 an extension to the CONSORT statement was published for cluster-randomised trials (Campbell et al., 2004) with the addition of points specific to cluster-randomisation that authors should ensure they report (e.g. the rational for the design). Currently over 50% of the core medical journals[38] endorse the CONSORT statement (CONSORT, 2011). However, a review of paediatric dentistry RCT's reported the impact of the introduction of CONSORT to be low, with a lack of paediatric dentistry journals that

[37] The Consolidated Standards of Reporting Trials (http://www.consort-statement.org/)
[38] For dentistry examples of journals that endorse CONSORT: American journal of dentistry, BMC Oral Health, British Dental Journal, Community Dentistry and Oral Epidemiology, Journal of Dental Research, Caries Research

required authors to use the CONSORT statement in the reporting of RCTs (Al-Namankany et al., 2009).

A separate statement (TREND, 2004) was developed aimed at non-RCT study designs. The TREND[39] statement (Des Jarlais et al., 2004) contains 22 items that have been revised from the CONSORT statement to account for the difference in non-RCTs (Kirkwood, 2004). Far fewer journals endorse the TREND statement for articles reporting non-RCTs and, until the end of 2011 no dental journals were listed as requiring the TREND guidelines to be followed, with only Evidence-based Dentistry publishing an editorial in 2004 about the statement (Treasure, 2004).

Since its introduction the TREND statement has received less support than the CONSORT statement and is still an evolving set of items (Armstrong et al., 2008; TREND, 2011). Dzewaltowski et al. (2004) recognised that the TREND statement would positively impact on literature but there is still a need for revision to account for external validity (e.g. settings level factors) and the aim of PH interventions to make a difference at population levels.

There are also a number of other guidelines (e.g. Taxonomy of Behaviour change - Abraham & Michie, 2008 and STROBE[40] for reporting observational studies - Von Elm et al., 2007) that have been designed for specific purposes to improve reporting and reviews of research to help advance our understanding of complex behaviours and intervention. At present, unlike many clinical methods, there are no common ways of reporting both the behavioural *components* and the behavioural *outcomes* of many complex interventions, leaving many interventions not formally described (Michie et al., 2009). In reviewing a number of systematic review of "*nearly 1,000 behaviour change outcome studies found that interventions were described in detail in only 5% to 30% of experimental studies*" (Michie et al., 2009, p1) making it hard to transfer key parts of intervention components to other settings.

4.2.4 Behaviour change reports

Understanding the complexities of behaviour change and the development of methods to identify the active components (i.e. components causing the changes

[39] Transparent Reporting of Evaluation with Non-randomized Design (http://www.cdc.gov/trendstatement/)
[40] Strengthening the reporting of observational studies in epidemiology (http://www.strobe-statement.org/)

in targeted behaviour) of interventions requires development (Michie et al., 2009; Dombrowskia et al., 2012). A further problem as highlighted by Michie (2008) is:

> *"...only 0.5% of medical research funding in the UK focuses on behaviour change interventions"* (p65).

The Select Committee report on behaviour change (House of Lords Science & Technology Sub-Committee I, 2011) aimed to outline the UK government's evidence, understanding and initiatives to "*bring about changes in people's behaviour*" (p5). This report concluded that more can be done to improve evaluation of interventions in all areas:

> *"There is a lack of applied research at a population level to support specific interventions to change the behaviour of large groups of people including a lack of evidence on cost-effectiveness and long-term impact"* (p18).

The above report states that any government initiative to change behaviour needs to be evidence based, clearly explained to the target audience and have a planned evaluation from the outset. Within PH a difficulty arises with changes of government and any subsequent changes in agendas that have an impact on the ability to carry out consistent longitudinal interventions and develop a greater understanding of interventions across the life course (Coote, 2004). As part of the Kings Fund report into '*Prevention rather than cure: making the case for choosing health'* Coote, (2004) highlighted a:

> *"...need to refocus attitudes, policies and behaviour across a wide range of stakeholders to produce a whole system that gives priority to securing health and reducing inequality"* (px).

4.3 Research with children

Although it is still recognised that adults play an essential role in ensuring children's health needs are met (Mouradian et al., 2007), there is also a move away from the view that due to the knowledge/experience of adults they know '*what is best*' for children (Morgan et al., 2002, p5). In many areas of health promotion and PH, there are growing numbers of research studies that are conducted directly with children instead of obtaining the views of the parents as a

proxy measure (Balen, 2006). It is increasingly recognised that children are able to be "*active agents and key informants*" (Darbyshire, MacDougall & Schiller, 2005, p419) on topics relating to their own health and wellbeing. The creation of child orientated legislation (e.g. UN *Convention on the Rights of the Child, 1989*) has contributed to the shift from research *on* children to carrying out research *with* children (Balen et al., 2000). It has helped to ensure that the importance of listening and allowing children the space to be heard has been given increasing weight and importance (Kirby, 2004). Within the UN convention, 4 articles relate to children's rights to be participants (12, 13, 14, 15), with all advocating the right to express their views, thoughts and the freedom to do this to ensure the participation of children, and to be genuine and taken seriously by adults (De Winter, Baerveldt & Kooistra, 1999).

The Ottawa Charter (1986) outlined five core health promotion actions, with a key aspect being the definition of health promotion "*enabling people to increase control over, and to improve, their health*" (WHO, 1986, p1). A limitation of the charter is that it did not include the need for evidence and effectiveness (Evans et al., 2007).

In the UK, the creation of the Children's Act 2004 and The National Service Framework for Children, Young people and Maternity services (2004) increased the focus on giving children and young people a platform to express their views but also have more say in their own health treatments. These acts recognised the importance of children, protecting them but also providing suitable material, methods and places for children in all aspects of life. In research with children, it is necessary to account for the guidance around child friendly processes and to ensure the same value is given to their responses as to those of adults. Research by Marshman & Hall, (2008) around OH research with children found there is "*no evidence that the risk of bias (including acquiescence and social desirability bias) is greater in data from children than adults*" (p237).

When working with children Wetton (as cited in Stewart & McWhirter, 2007) advocated the need to ensure you are "*starting where people are*" (p490) in the design of curriculum resources. If the research and programmes are designed to benefit children within many areas of health promotion (e.g. diabetes - Noyes et al., 2010) there is the recognition they should play an active part in all stages. This

helps to ensure the programme is targeted at the right level, something which may be unclear without their involvement (Williams, Wetton & Moon, 1989 a&b; Porcellato et al., 1999).

Punch, (2002) reflects that how researchers perceive research with children can be classified as one of two extremes "*just the same or entirely different from adults*" (p322) with this impacting on methodologies, approach and engagement with children. In conducting research with children, it is necessary to be flexible, creative and adaptable throughout the research process (Darbyshire et al., 2005). In relation to intervention design:

> *"...when children take part in program planning, the programs become more appealing to children because of the feedback from their perspective"* (Wyatt, Krauskopf & Davidson, 2008, p71).

This was also supported by De Winter et al. (1999) who reported that children's participation, and helping them to articulate their opinions, appears to also have a preventative factor in psychosocial problems and the promotion of health and wellbeing, through aiding the development of social responsibility.

In working with and targeting children it is important not to rely on proxy reporting (parents reporting on their child's behaviour), as the perception of children and adults can vary e.g. parents only have a perception of their child at school so their reporting may not be based on a complete understanding (Jokovic et al., 2004; Martins et al., 2011). Martins et al. (2011) reported low agreement between observed toothbrushing in children to that reported by their mothers. Proxy reporting has also been found to have varying levels of reliability depending on a child's age. For OH, using the parent perceptions questionnaire in conjunction with the child perception questionnaire, Jokovic et al. (2004) found agreement decreased from 10–14 years with parents frequently reporting '*don't know*' to responses, but note that "*it has to be recognised that parental and child questionnaires are measuring different realities*" (p1306). Additionally the increased variations may be due to children gaining greater autonomy, meaning parents may have less of an influence or understanding of aspects of their children's lives (Jokovic et al., 2004). Although proxy reporting has limitations that can change as children age, using parental reports in conjunction with children's

helps provide improved understanding of targeted behaviour within families, and the differing levels of understanding around the targeted behaviour (Sherifali & Pinelli, 2007).

Through society and cultural hierarchies there are issues of power imbalances between children and adults that need to be reduced as part of the research process. Much of children's lives are controlled, directed and constrained by adults (Punch, 2002). This also increases the need for children to understand the importance of being truthful, expressing their views and not being concerned about providing the correct answer. Finally as Ann Oakley, writes:

> *"The best way to defend the development of children's studies for children is to enrol them fully in the research process"* (1994, p26).

4.3.1 OH research with children

A systematic review of children's research in a dental context found the shift to research *with* children has not occurred significantly with only 0.3% (out of 3266 papers) of papers including active involvement of children in the research activity (Marshman et al., 2007). Marshman et al. (2007) reported 184 papers were conducted *on* children, compared to one where children were involved and 27 where children completed research measures created solely by adults. In 41 dental public health (DPH) studies, parents or clinicians were used as proxies with most of these involving children younger than 6 years old. Although there have been a limited number of studies conducted with children as active participants, Marshman & Hall, (2008) highlight interviews, focus groups, drawing, vignettes and time-lines (predominantly with older children) have been used to explore topics relating to OH and nutrition. Marshman & Hall, (2008) also emphasise the importance of ensuring the research question and method are suited to actively involving children, as not all research is designed or requires child-centred methods.

In order to address the level of evidence around children's knowledge of oral hygiene Hawkins et al. (2000) developed a set of measures: and open ended 'tell-me' questions in an interview from a list of potential responses; closed 'show-me' questions using pictures and visual aids with 5–7 year olds. A change in knowledge was indicated by the children, but they struggled with the concept of

germs. Hawkins et al. (2000) concluded that despite the challenges it was possible to use modified methods to research with children of this age around OH.

As outlined in *chapter 3* the evaluation of '*Winning Smile'* used a child-focused approach with 8–9 year old children (e.g. drawing). Through this method Freeman, Whelton & Gibson, (2010) were able to understand how the children viewed toothbrushing as a set of rules and the power imbalances they reported around the behaviour. Although the authors highlighted the need for more research in this area, this study reports a view of brushing that is uniquely reported by the children. As well as child-centred methodologies helping to improve understanding of the rules around brushing, research in Cardiff aimed to understand the motivation for brushing. Gill et al. (2011) used semi-structured interviews with 6-7 year olds and 10–11 year olds and reported that children did not fully understand the importance or need for toothbrushing. Brushing was found to generally be promoted by parents but this was influenced by reported daily barriers in the home. Through their discussion they highlight the issue of research being conducted predominantly with older children but little still being known around many issues with younger children.

Rodd et al. (2011) developed a questionnaire to understand feelings regarding dental treatment with the help of 7-16 year olds. Through the initial open ended questionnaire analysis, a 10-item questionnaire was developed to be answered using a visual analogue scale from negative to positive. As with many areas of child dental health Rodd et al. (2011) developed the questionnaire due to the lack of appropriate/accessible validated instruments in the area of interest (feelings of the children prior to and following treatment and view of the hospital environment/staff). Although it is not clear from this research how the large age range affected the input of the children into the design of the questionnaire, it shows how it is possible to involve young children to develop a useful questionnaire.

Through the few studies that have been conducted it can be seen that there are many complexities that children express which need to be accounted for in interventions.

4.3.2 Conducting research in schools with primary aged children

Conducting research in schools has both benefits as well as pitfalls (Valentine, 1999). Working with schools allows access to large populations that are used to being in an environment to learn and carry out research on many topic areas. Schools also provide units that can be easily randomised in cluster studies to reduce contamination issues (Keogh-Brown et al., 2007). It is important when researching with children in a more participatory way that they understand that despite parental consent, they have a choice not to take part (Valentine, 1999). There is also a need to explain that research is different to tests and their opinions and views are important and there are no correct answers (Balen et al., 2000). Studies taking place in schools have a potential to impact on wider aspects of the schools, families of children attending the school and school staff (Claudio & Stingone, 2008).

Across all countries where *'Brush Day & Night'* was designed to be implemented, schools and educational institutions have a role in delivering health information to children. St Leger (2004) highlighted the shift in the 20th century towards schools having greater responsibility and being expected to address a range of health topics from OH to mental health in both developed and developing countries. One aspect that is beginning to be addressed within this programme is the problem of many 'tool kits' arriving in schools without teachers being given any guidance or training on their delivery (translation into practice) (St Leger, 2004). In line with the National Healthy Schools Programme (NHSP)(*Chapter 3*), new interventions need to be able to be integrated into both the requirements for this scheme as well as the National Curriculum (NC); while also empowering the children to take control of their health as appropriate (Kwan & Petersen, 2003).

4.3.3 Children's ability to self-report on their behaviour

One of the topics of debate in all areas of research with children is their ability to report their behaviour. Riley, (2004) highlighted the issue that despite evidence being available that children as young as 6 years can report on their health meaningfully, "*scepticism will remain*" (p374) regarding young children's reporting and ability to be active participants in research. Scepticism will only be reduced by the continued increase in child orientated methodologies that are validated, and

the acceptance that children's reports will differ from adults but are equally valid (La Greca, 1990).

There has been great variation found between the developmental age (not just the chronological age of the child) and their perceived ability to produce valid responses to research methods (La Greca, 1990). Research into children's ability to report on their own asthma (at the age of 7) showed that although children required longer to answer, they were able to provide dependable and valuable responses (Olson et al., 2007).

Chapparo & Hooper, (2005) working with 6–7 year olds used mixed-methods (observation, small-group interviews containing a game, drawing, and analysis of video of the children's day) to investigate self-care (looking after self, staying healthy). They reported children had "*well developed understanding of a broad, sociocultural definition of self-care*" (p75). This exemplifies that children of 6-7 years old are able to report their views, are beginning to develop their own opinions and the use of multiple methods can improve not only the results but the children's engagement. Prior to age 6, children tend to have a 'black and white' view of the world and concepts within it (Greig, & Taylor, 1999). After this age they begin to develop understanding of different opinions.

4.4 Mixed-methods research

Mixed-method research has become a popular paradigm due to its ability to potentially provide "*the most informative, complete, balanced and useful research results*" (Johnson, Onwuegbuzie & Turner, 2007, p129). Within health service research there has been a rise from 17% in 1990s to 30% of studies in 2000s reporting the use of mixed-methods (O'Cathain, Murphy & Nicholl, 2007). Through the use of mixed-methods an attempt is made to consider the multiple perspectives and positions of those taking part and conducting the research (Johnson, Onwuegbuzie & Turner, 2007) as well as allowing triangulation of data sets.

Duhl & Hancock (1988) recognised the importance of using both quantitative and qualitative approaches to understand health and recognised that research needs

to be accessible. Although their research was within Healthy Cities their views are easily transferred to many aspects of PH research:

> *"Unless data are turned into stories that can be understood by all, they are not effective in any process of change, either political or administrative"* (1988, p7 as cited in Baum, 1995, p466).

Whilst single outcomes give an accurate understanding of intervention impact at population level, mixed-methods allow insight into individuals' and cohorts' experiences of an intervention and provide a greater understanding of process in relation to the intervention delivery (Sechrest & Figueredo, 1993; Christ, 2014).

Mason (2006) stated that a person does not exist in a single dimension, rather multiple-dimensions of both lived and social experiences. Research in OH and other areas of PH aims to understand the why, how, what and for whom an intervention works or if behaviour can change using a specific method/intervention (NICE 2007; Michie & Abraham 2004). Although quantitative methods are necessary and important for understanding health outcomes within large populations (e.g. dmft levels or obesity rates), they do not always promote understanding of the complexities of groups of people and communities behind the figures, or enable researchers to answer all questions (Mason, 2006). Many qualitative methods allow researchers to move from general statistical outcomes, to allowing the specific exploration of finer details within lives that can impact on our response to an intervention (Newton & Scambler, 2010).

Interventions (such as the one evaluated within *study 2)* may not produce a significant change for a population as a whole, but within this there may be sub-cohorts where both positive and negative changes have occurred (e.g. changes in rates of reported brushing). For instance, by investigating only clinical outcomes (e.g. plaque) of an entire intervention group it would not be possible to gain an understanding of characteristics of sub-cohorts to determine how the intervention impacted those who changed their behaviour differently to the rest of the study population (e.g. from parents and children perspectives).

Within the traditional medical model of dentistry, the format of journals and the nature of research have led to fewer studies using qualitative methods either alone

or in a mixed-method design compared to other areas of health (Bower & Scambler, 2007). Newton & Scambler, (2010) suggest that if problems around the use of qualitative methods in OH can be "*overcome, the potential benefits for our understanding of oral health are enormous*" (p67).

One of the major issues within mixed-method research is the challenge of linking paradigms, research design and ensuring suitability for the questions that are being asked (Creswell & Plano Clark, 2010). Sale, Lohfeld, & Brazil (2002) state that the use of mixed-methods requires the crossing of two paradigms – the positivism of the quantitative paradigm and more interpretivism and constructivism nature of the qualitative paradigm. Morgan (1998) recognises the appeal of mixed-methods in health research to help account for the complexities of people's lives but also recognises the need to ensure the research design supports the need for mixed-methods, and acknowledges the tensions within the different paradigms it crosses.

In addition to the different paradigms that need to be considered there are some inherent conflicts between quantitative and qualitative research methods (*Table 4-1*). Within qualitative research, there is a greater relationship between the researcher and the participants through the manner of data collection, with the aim more focused around the process, providing meaning to the data and less emphasis on generalising the results. Additionally in some arenas qualitative results can be given less weight than quantitative outcomes. Within quantitative research there is greater detachment between researchers and participants. Further, quantitative studies are frequently larger and more rigid with the use of validated tools and clinical measures that can be easily transferred in a variety of settings (Johnson & Onwuegbuzie, 2004). Conflicts also exist between the quantitative and qualitative paradigms in terms of terminology, such as in relation to the definition of validity. Within quantitative research, this means how accurate the inferences are, but within qualitative research this is more often taken as meaning how valid the results are within the persons' reality (Bryman, 2012).

Table 4-1 Examples of strengths and weaknesses of qualitative and quantitative research (adapted from Johnson & Onwuegbuzie, 2004)

Qualitative research		Quantitative research	
Strengths	**Weaknesses**	**Strengths**	**Weaknesses**
Provide opportunity to describe in detail phenomena situated and embedded within local contexts	Is more difficult to test theories and hypothesis	Ability to generalise findings when based on a random sample and a sufficient sample size	As focus is on theory and hypothesis testing and not generation phenomena may be missed
Allows a researcher to study dynamic processes	Data collection and analysis can be more time consuming	Data collection and analysis can be relatively quick and is often more prescribed	Research categories for data analysis may not reflect the wider community feelings
Useful for helping to describe more complex phenomena	Knowledge produced is not always generalisable to different populations and settings	Provides numerical data and often considered to be more precise results	Knowledge produced may be to general
Can help to explain how participants explain and interpret 'constructs' (e.g. self-esteem)	Results/analysis can be influenced by the researchers biases and beliefs	Can allow for confounding influences on variables to be eliminated and cause-and-effect relationships to be researched	May not always provide contextual detail which can impact results

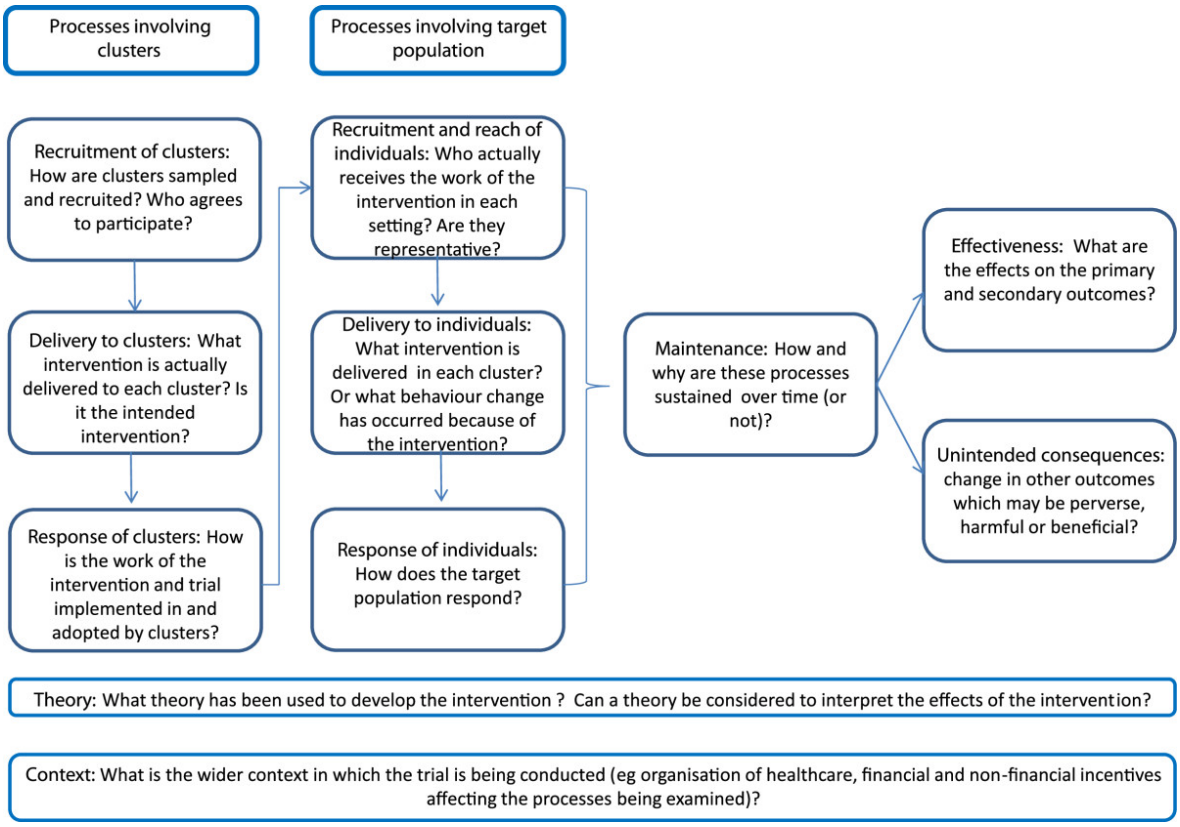
When designing studies it is important to recognise how different methods enable understanding of different research questions or different phenomena. A tenet of mixed-methods is being able to gain confirmation through the combining of outcomes. Onwuegbuzie & Leech (2004) recognise the ability for qualitative results to provide greater validation/explanation to quantitative results, which may help explain outliers or patterns in the results to break down some of the complexities that may not be able to be explained through quantitative data alone. Greene, Benjamin & Goodyear (2001) outline four ways mixed-methods can improve understanding of an area of research and help remove any uncertainty: "*enhanced validity and credibility of inferences; greater comprehensiveness of findings; more insightful understanding; increased value consciousness and diversity*" (p30).

4.4.1 Process evaluation within complex intervention research using mixed-methods

In 2009, Lewin et al., reported that for complex (or relatively complex) interventions in the '*Cochrane Effective Practice & Organisation Care register*' less than one third of these had a qualitative component to the RCT with many of these being carried out before trials to inform them. Lewin et al. (2009) stated that "*most of the qualitative studies identified were carried out before the trial so opportunities to understand better the effects of interventions and how they are experienced by recipients are not being fully utilised*" (p6). Within their discussion Lewin et al. (2009) note their surprise at this, given the nature of the studies and awareness of the impact of qualitative researches on aiding evaluation interventions.

Grant et al. (2013) advocate the need for clear and well-designed process evaluations "*to understand the effects (or not) of interventions*" (p2). To help ensure the quality of process evaluation in cluster-randomised trials Grant et al. (2013) developed and suggested a framework for how they think process evaluations should be designed (*Figure 4-3*); while also recognising the need to tailor a process evaluation to the particular study/intervention/outcomes as there is "*no single best way to conduct a process evaluation*" (p8).

Figure 4-3 Taken from Grant et al. (2013) "*Framework model for designing process evaluations of cluster-randomised controlled trials*" (p4)



Within *study 2* the use of mixed-methods should provide greater detail about how the children experience the intervention, whilst also being able to determine the effectiveness of interventions. In addition, the process evaluation conducted as part of *study 2* will allow the results to be considered in relation to the model outlined by Grant et al. (2013).

4.4.2 Rigour within and between methods in mixed-methods research

There is much debate about the need for different measures to determine the rigour of methods, outcomes within qualitative and quantitative methods, and how to ensure the outcomes are valid (Bryman, 2012). Creswell & Clark (2011) write that within quantitative research validity takes two levels in relation to quality of the scores and the conclusions drawn from the results (i.e. are the scores meaningful indicators of what was being measured). In contrast for qualitative validity Creswell & Clark (2011) relate this concept to whether the findings are accurate, trustworthy and credible. Unlike the more accepted ways within quantitative research to determine validity, within qualitative research there are a number of methods e.g.

member-checking of findings by participants, triangulation with other methods (used in this thesis) and multiple researchers conducting the same analysis (Creswell & Clark, 2011). Within a mixed-method design the use of triangulation can also explore the accuracy of information across different sources.

For qualitative research a number of authors suggest it is necessary to establish the trustworthiness of methods (Krefting, 1991; Shenton, 2004). Trustworthiness can be explored through four aspects of the research: credibility (similar to internal validity); transferability (similar to external validity); dependability (similar to reliability) and confirmability (similar to objectivity) (Bryman, 2012). In relation to health research Yardley (2000) sets out four slightly different but related criteria for ensuring the quality of qualitative research: '*sensitivity to context'; 'commitment and rigour'; 'transparency and coherence'* and *'impact and importance'* (p219). Throughout this thesis the questions and statements within the children's research tools were designed to complement each other (*Table 5-2*); as such qualitative methods were chosen to illuminate the outcomes of questionnaires (Barbour & Kitzinger, 1999).

Triangulation was used within this thesis to help improve the rigour of the outcomes. Originally triangulation was designed as an analysis method that was able to provide confirmation of outcomes; it has since developed into a method that provides a greater completeness to studies (Adami & Kiger, 2005). It is important to ensure the method of data analysis is used to "*add breadth and depth to our analysis; but not for the purpose of pursuing the objective truth*" (Fielding & Fielding, 1986, p33). As with all methods of data analysis, triangulation also poses difficulties. Thurmond (2001, p256) highlighted five main limitations: time taken to collect and analyse a wider range of data[41], quantity of data[42], investigator bias[43], theoretical framework conflicts[44] and weakness in understanding triangulation strategies[45].

[41] Analysing data independently and across methods increases the complexity of analysis (Thurmond, 2001).
[42] The ability and suitability of triangulation can be impacted by data collected using different methods that may be incomplete and of varying quality depending on the complexity of the method to the research group (Thurmond, 2001).
[43] Preferences to one particular type of data or analysis and reducing potential bias through inter-rater reliability analysis (Thurmond, 2001).
[44] Ensuring data and analysis methods are not incorrectly fitted into qualitative or quantitative molds (Thurmond, 2001).
[45] The need for clarity as to why and what is being compared to ensure false result are not produced through incorrect interpretations of triangulation (Thurmond, 2001).

In contrast to the different ways of determining the rigour of qualitative research, the validity of quantitative methods can be determined through statistical methods (e.g. following a test-retest study as with the children's questionnaire within *study 3*) or through ensuring the face validity of the tool (e.g. in relation to the children's questionnaire within *study 1*). Face validity can be determined through talking to the participants as they complete the questionnaire but also for example through following steps as outlined by Peat (2001) around piloting questionnaires.

4.5 Epistemological stance within this thesis

In order to understand the epistemological position of the thesis initially the ontological approach will be briefly outlined. The ontological approach refers to the nature of reality that influences this thesis and the researcher. Within this thesis the nature of research has been influenced by a relativist perspective. Guba & Lincoln (1989) explain this perspective as meaning "*phenomena are defined depending on the kind and amount of prior knowledge and level of sophistication that the constructor brings to the task*" (p86). Within this thesis this is seen as linking to the drive to allow children to have a voice and through sampling across SES to understand initially if SES (and the subsequent different realities) impact the use of the tools and contextual outcomes. This approach is also reflected in the use of comparisons between the outcomes of different research methods used with the children (triangulation).

This research was funded by a corporate sponsor. As part of this the studies and research questions were negotiated with the sponsor and the University. The methodology used within this thesis was influenced by the dearth of evidence that relates to how children experience a SOHP designed to target them. As outlined earlier in *chapter 3*, SOHP evaluations frequently employ the use of clinical measures (e.g. dmft or plaque), teacher's evaluations and parent's feedback, but substantive data from 6-7 year olds are not often included.

This research is based within a mixed-method paradigm; as such, defining a fixed epistemological stance within this paradigm has some tensions (Teddlie & Tashakkori, 2009). Many researchers using mixed-methods argue that rather than having a single epistemological stance there is a need to take a pragmatic approach, which equates to methodological decisions driven by the research

questions to be answered (Teddlie & Tashakkori, 2009; Christ, 2014). Further to this Bryman (2007) states that within mixed-methods research there has been a marginalising or lack of dwelling on epistemological and ontological stances, which had led to the emergence of pragmatism within research. Johnson & Onwuegbuzie (2004) propose that a pragmatic stance to research can help take into account some of the tensions between research methods and help highlight how a researcher approaches their research. Inherently quantitative and qualitative research methods are set within different epistemological positions, predominantly objectivist and constructivist respectively. In addition there are many other tensions that arise within mixed-methods, as discussed in *section 4.4* and illustrated in *Table 4-1*.

In spite of the challenges of defining a singular epistemological stance, mixed-method research can take both an objective and constructionist approach; but there will also likely still be an underlying pragmatic approach which aims to account for the belief that there are multiple forms to reality (Johnson & Onwuegbuzie, 2004; Creswell, & Plano Clark, 2010; Clark, 2014). Throughout the different phases of research there is likely to be shifting between aspects of the epistemological approaches. For instance, this may vary if a qualitative or quantitative method is being used or analysed and also within discussions. Objectivism is based in a more realism paradigm and the belief around *"the existence of reliable knowledge about the world, knowledge that we, as humans, strive to gain*" (Jonassen, 1991, p57). Therefore objectivism centres on the belief that we are learning about the real world (reality) which then impacts our thinking/understanding. Whereas in a constructivist epistemological stance there is more of a belief around a person constructing their 'reality' based on experience, culture, interpretation etc, which allows them to then construct their knowledge (Jonassen, 1991). As such, the epistemological stance taken in this thesis is one of pragmatism, which is linked to the belief around the need for a mixed-method design.

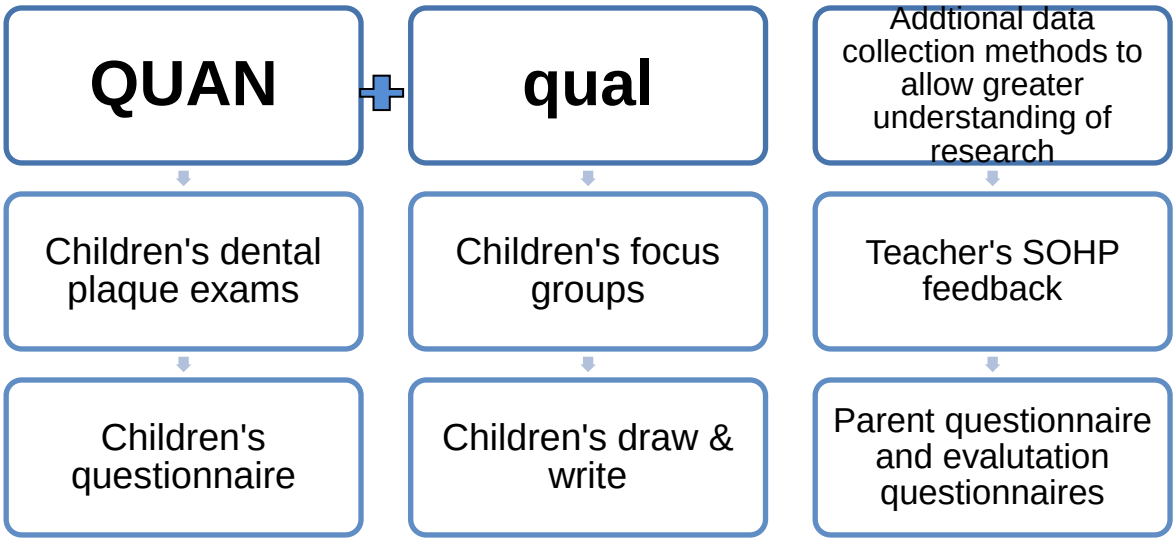
4.6 Mixed-methods within this thesis and new application of methods in dental public health

Throughout this research a mixed-method, '*QUAN* (primary data collection method) + *qual'* (secondary outcomes) design (Creswell & Plano Clark, 2010) was employed in order to improve understanding of the separate components of the '*Brush Day & Night*' intervention. A concurrent data collection design (indicated by the '+') was used; meaning methods of data collection and analysis occurred at the same time rather than collecting one type of data followed by the next after analysis (sequential). The aim of the design was to allow triangulation of different layers of data to answer key questions at specific time points in the intervention (baseline, post-intervention, follow-up) allowing a greater understanding of any process of behaviour change and the impact of the intervention over time (see *Figure 2-1* for overview of the research questions).

The core quantitative design (children's questionnaire) with the additional qualitative components (FG & D&W) was chosen to allow a greater insight into the impact of a complex SOHP and 6-7 year olds current oral hygiene habits. Through triangulation of multiple methods it was also possible to explore individual children's reporting to gain a more complete picture of their knowledge and behaviour (Thurmond, 2001; Hemming, 2008; O'Cathain et al., 2010). The comparison of outcomes across different methods also aids the rigour of the studies. *Figure 4-4* illustrates the design used in *study 2*, and the primary (QUAN[46]) and secondary (qual) data collection methods.

[46] Johnson et al (2007) define this design as "*Quantitative dominant mixed-methods research is the type of mixed-method research in which one relies on a quantitative, post-positivist view of research process, while concurrently recognizing that the addition of qualitative data and approaches are likely to benefit most research projects*" (p124)

Figure 4-4 Illustration of mixed-method data collection for *study 2*



When working with children on the topic of physical activity (PA) and obesity Derbyshire et al. (2005a) outlined the value of using mixed-methodology:

> *"…increased children's opportunity to choose and have at least partial control about how to contribute and what to say, and helped engage and interest them while demonstrating that we recognized them as active agents in the creation of their worlds"* (p424).

Some children find it easier to express themselves through one research method (e.g. in FG discussions) in comparison with another (e.g. self-report questionnaire) (Balen et al., 2000; Balen, 2006). Particularly within dentistry, some children may be fearful of a dental exam within a study or the recording of a FG but may wish to take part in other elements of research. Although this can impact on the completeness of a data set within a study, it values children as being able to make an informed decision about their contribution and ensure they are comfortable with the research process. Through the combination of qualitative and quantitative methods it is possible to overcome the weakness of a particular method and also aid the strength of the conclusion through the triangulation of findings (Johnson & Onwuegbuzie, 2004).

As 6-7 year olds are still a minority research group within OH, new research tools were developed for this thesis (see *sections 4.6.3.3-4.6.3.1* for introduction to the research tools). As with any new tool that is not validated, *study 1* (*Chapter 5*) and

study 3 (*Chapter 8*) allowed the tools to be assessed for suitability of use with 6-7 year olds and the ability of the tools to collect the relevant information.

The design of the method is targeted at ensuring an opportunity was given to all children in the studies to express their views and contribute to the research if they wish (Balen et al., 2000). In addition, for *study 2*, having questions in the parent questionnaire that elicited the same outcome as the simpler children's questionnaire (i.e. a question regarding children's toothbrushing behaviour) allowed agreement between parents and children to be determined (Thurmond, 2001). As adults' reported behaviour is often known to be exaggerated (Eaton & Carlile, 2008), this may also be the case for children's self-reporting of their toothbrushing behaviour.

The use of the combination of mixed-methods throughout the three studies is original within research with 6-7 year olds in DPH and was used to improve understanding of intervention effectiveness and influence on the school, home and children. Many of the methods have been used effectively in other areas of health promotion (e.g. smoking, obesity and cancer) with children and have been found to be both valid and reliable tools, it is therefore anticipated that the methodology will be able to be transferred effectively into DPH (Williams et al., 1989; Porcellato et al., 1999; Balen et al., 2000). The discussion also considers the impact of using new and novel methods on the outcome (*Chapter 9*).

4.6.1 Orientating the research in a child focused manor

Children have a unique view on the world that is only in part shared with adults (Harden et al., 2000). They spend time at different places (school, home, activities, and medical facilities) which provide adults at each location with a different 'snap-shot' of the child. Ultimately this can lead to difficulties in adults from different settings being able to accurately report by proxy on a child's behaviour (Riley, 2004; Olson et al., 2007). Wyatt et al. (2008) in advocating the use of FGs with children in the design and evaluation of interventions, highlight:

> *"...children can offer insight into their current knowledge about a particular topic and features that can enhance their learning*

process - areas that no other method can explore as effectively" (p72).

Through the pilot research in *chapter 5* the initial adult designed (top-down[47]) FGs and D&W were redeveloped using information gained from working directly with the children and how they perceived each question (bottom-up). This included changes in language, phrasing and more visual prompts. Throughout the evaluation in *chapter 6 & 7* the focus of the research was to understand from the children's perspective the effectiveness of the intervention and how the intervention related to them as a tool to help them change their brushing behaviour.

4.6.2 Ethical consideration in conducting his research with primary aged children

Due to this research being conducted with children under 16, written consent was gained initially from each school and also the child's parent or guardian[48]. Throughout the research, school policies, with respect to working with children, were integrated into the study (e.g. enhanced CRB checks for researchers and allowing classroom staff to observe aspects of data collection if they requested).

In addition to the ethical guidelines set out by the University of Salford, the '*Guidelines for Research with Children & Young People*' produced by the National Children's Bureau (2003)[49] and MRC Ethics Guidelines for Medical Research involving Children (MRC, 2007) were accounted for to ensure all additional considerations for research with children were followed.

Verbal assent was gained from children (whose parents had provided written informed consent), once the research had been explained to them and they had been allowed to ask questions. If a child did not want to take part they were not asked to explain why. A small number of children did not want to be audio-visually recorded during FGs, but were still allowed to take part in the other aspects of the study if they wished. Throughout the research it was important that the children

[47] Defined as "*From top down and from govt. out to private sector (although importance attached to causal theory also calls for accurate understanding of target group's incentive structure), Focus on extent of attainment of formal objectives (carefully analyzed). May look at other politically significant criteria and unintended consequences, but these are optional"* (Sabatier, 1986, p33)

[48] Ethical approval for the project was provided by the University of Salford (REPN09/122, REP10/047 & REP11/069).

[49] Updated guidelines produced in 2011. Shaw, Brady, & Davey (2011) Guidelines for research with Children and Young People. Published by NCB Research Centre, London.

were reminded that the research was not a test but they needed to be honest and, if there was a question they did not want to answer, they did not have to provide a reason and could leave it blank or not take part in that section. They were also reminded that they were able to change their mind at any point and withdraw from the research at any stage. Assent from the children was an on-going process; at each visit as well as before each task.

Each child who took part in the research was provided with a unique code to ensure their anonymity was maintained throughout and during the analysis of the research. Individual schools were also not identified to ensure anonymity of the children who have taken part in the study.

4.6.3 Background to the main children's research tools

The following sections (*4.6.3.1–4.6.3.3*) provide a background to the main research tools used within this study

- Children's questionnaire
- Children's D&W
- Children's FGs

It also provided examples of previous studies that have used the methods with children. Details of the design, implementation and analysis of these methods within the 3 studies can be found within *chapters 5-8* (where appropriate).

4.6.3.1 Introduction to the children's questionnaire on OH-related behaviours/support/attitudes and nighttime sugar-snacking behaviour

Rebok et al. (2001) carried out cognitive interviews with children aged 5–11 years to determine their response to pictorial questions around their health. Rebok et al. (2001) concluded although 6–7 year olds "*had difficulty with some health-related terms and tended to use extreme responses*" (p59) they still felt they were able to report their health experiences and understand what tasks required. Baxter (2009) and Baxter et al. (2009 a, b&c) found that for 9-10 year olds, a 24-hour period provided the greatest level of accuracy for recall of both school-breakfast and lunch. Edmunds & Ziebland (2002) also found that for 7-9 year olds using a '*day in*

the life questionnaire' around fruit and vegetables a 24-hour period was suitable for recall.

Within OH an OH-related quality of life (OHRQoL) questionnaire development study has been conducted with 5-year olds, which found that children of this age were "*capable of providing their own perception of oral impacts and highlighted important challenges in the process*" (Tsakow et al., 2012, p5). Tsakow et al. (2012) also noted that in order to help the children, questions and statement needed to be simple and kept short. Studies by Tsakos et al. (2012) and Page et al. (2013) with 5-8 year olds using a OHRQoL questionnaire demonstrate the ability of younger children to answer short questionnaires around OH. However, their questionnaires were trying to understand much more complex behaviours and cognitions than the questionnaire used in this thesis, suggesting that there should be no difficulties using a questionnaire of this type with this age group.

Within this research, no suitable tool was found, so a bespoke children's questionnaire was developed (*Figure 5-1*, and details of design in *section 5.4.2.1.1*) based on a smoking questionnaire that was used with the same aged children by Porcellato (1998) and questions developed in line with the OH literature and expert guidance. The aim was to provide a validated tool (through *study 3* for reliability and validity and *study 1* for face validity) that can be used within future research.

4.6.3.2 Introduction to D&W

Developed by Wetton in 1972 (Prosser, 1998), D&W was originally described as '*following a short story in mime, children were asked to draw something relating to the story, then to write describing their feelings around the story*' (p273). The original research highlighted how D&W enabled children's views to be understood and how the evidence collected from children could be used to improve intervention design (Wetton & McWhirter, 1995).

Through the primary school health education curriculum project, D&W was used on a large scale (4-11 year olds) by Williams, Wetton & Moon (1989 a&b) who showed that children understood more about healthy lifestyles than was anticipated. D&W has been previously used to explore concepts of health in

children within other areas (e.g. health in schools – MacGregor, Currie & Wetton, 1998; cancer and health related behaviour - Pion et al., 1997; Knighting et al., 2011 and preoperative needs – Smith & Callery, 2005). Through numerous different protocols for D&W in research, a process model for the technique has been developed consisting of 10 stages from initial "*consultation regarding key questions to which answers were needed*" through pilot research and further studies to finally "*curriculum development*" (Prosser, 1998, p281). This model is designed to ensure valid and reliable results and can be used to aid curriculum and intervention development (ensuring the answers of the children are given weight in the results).

The use of D&W within DPH has been limited with predominantly only drawings being used to assess aspects of dentistry in clinics and in relation to hospitals, rather than as an exploratory tool to further understanding. In 1966, Baldwin explored the use of human figure drawings in relation to "*psychological and behavioural responses of children to the stress of dental extractions*" (p1637). Using drawings only, Shapiro (1967), Eichenbaum & Dunn (1971) and Sheskin, Klein & Lowental (1982) have also explored the impact of repeated dental stress and oral surgery experience on children. The psychological impact of dentistry on children was further explored by Taylor, Roth & Mayberry (1976) who found children frequently drew standard dental equipment, with few drawing negative images of dentistry. A more recent study by Aminabadi et al. (2011) using a Child Drawing: Hospital scoring sheet to code children's drawing of dental distress in a paediatric setting, reported the method to be reliable. They recommended the use of drawing with children of all ages (4-11 year olds) as an effective way of understanding their emotional state. These studies aimed to use drawing as a means of psychological assessment or to create a tool that can be used for psychological assessment purposes in dental treatment situations.

The D&W in this research was not intended to assess the psychological impact of OH issues or as a measure of change in relation to OH, but was uniquely used to advance the knowledge around children's responses with respect to nutrition, support, routines and maintaining good OH. As the method has been used widely with 6-7 year olds within other areas of health research it was felt an appropriate

method to translate to this topic (Williams et al., 1989 a&b). Additionally, to the author's knowledge this research is the first within DPH to use D&W with children of this age, within a community setting to gain a greater understanding of children's knowledge, beliefs and attitudes towards OH and nighttime sugar-snacking. As such the statements were designed both specifically for this research and also to provide greater understanding for the wider dental public health community.

4.6.3.3 Introduction of Children's FGs on OH and sugar-snacking/nutrition

With children aged 6–7 years old the use of one-to-one interviews is a potentially unsuitable method. This is due to factors such as: power imbalances between child and researcher, children being unfamiliar/uncomfortable with the research process and not knowing the researcher (Kirby, 2004). FGs help to ensure children do not find the research situation daunting by being alone and reduce the impact of power imbalances between adults and children (Horowitz et al., 2003; Darbyshire, Schiller & MacDougall, 2005). FG questions should focus on specific topics but allow discussion, with children having peers present to ensure they feel that it is a safe environment (Mauthner, 1997). Although FGs are more frequently used with older children Wyatt et al. (2008) reported using FG for designing and planning interventions and that "*by 6 years of age, children are capable of reporting their thoughts in brief dialogues*" (p75) with a need to account for any limitations in communication abilities in the design. For interviews, Gibson (2012) reports for 7 year olds there is now general agreement that they poses the skills to provide useful and accurate information, when researchers use developmentally appropriate methods.

FGs are commonly used within DPH research, but less so with primary school aged children. FG questions (*section 5.4.2.1.3*) were informed by the literature, expert advice and the research aims/objectives.

4.7 Research overview for thesis

The studies conducted in this thesis (*Figure 4-5*) target children in schools through a SOHP aimed at increasing toothbrushing to twice-daily brushing (morning and nighttime) and reducing sugar-snacking at night after toothbrushing. Establishing the desired health behaviours for the targeted age groups greatly increases the

probability that the habit will be formed and be robust i.e. integrated into daily patterns (Slater & Bremner, 2003). The author of this thesis adopted a systematic approach to the research, the development of research tools, the research components and reporting of the studies (informed by the TREND guidelines, developed to improve reporting for evaluations that did not use a RCT design). Through this it is hoped that outcomes of the research will provide a greater insight into how children directly report their experience of a SOHP and allow new methods within DPH with children to be replicated in future research studies.

Figure 4-5 Research design and sample sizes for each element in thesis

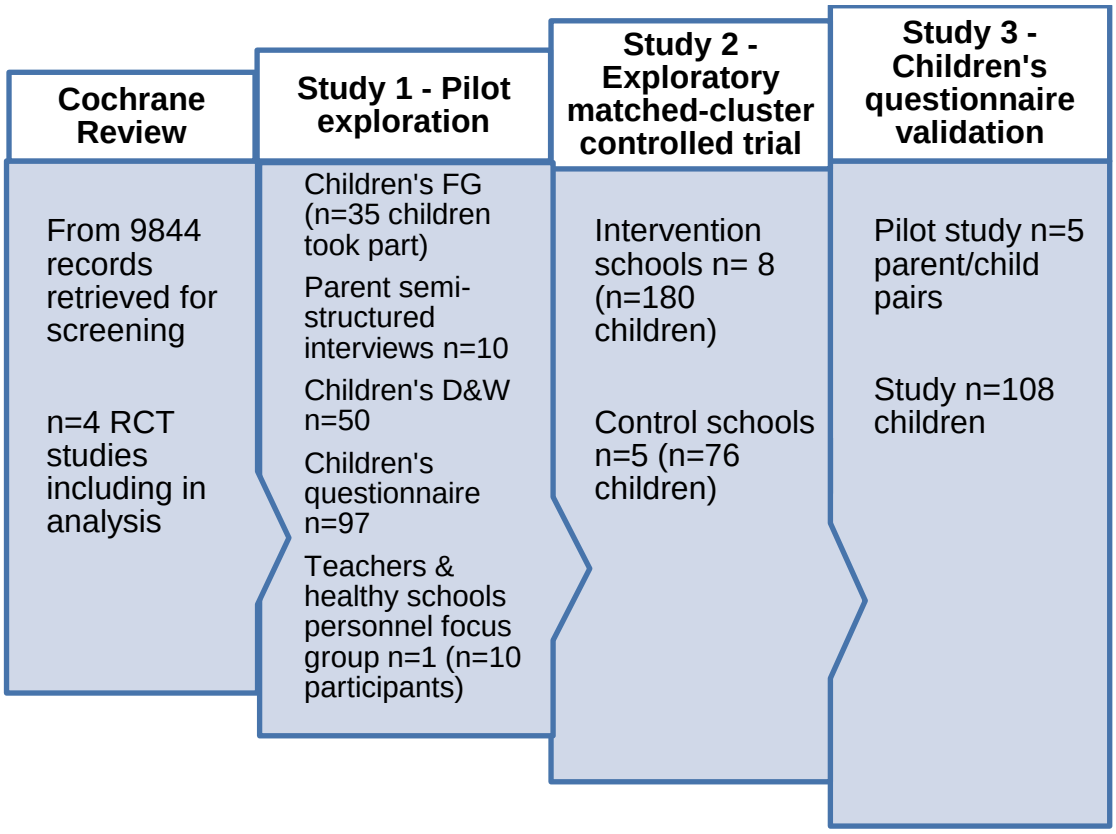


Figure 1-1 (p. 38) and *Figure 2-1* (p. 40) outline the research framework in relation to the 3 studies within this thesis (*chapter 5 – study 1, chapters 6 & 7 - study 2* and *chapter 8 - study 3*); the 3 overall aims of the thesis, the research questions and objectives are outlined.

4.8 Chapter summary – key issues emerging from the literature and impact on thesis design

- **Professional working** - Shift within DPH towards collaboration with other professions and the development and design of interventions.

- **Literature** - Stillman-Lowe (2008) reported a shift within DPH toward collaboration with psychologists and education institutes to aid the development of OH education programmes [50]. Despite the introduction of NICE and MRC guidelines, the development of interventions is frequently top-down.
- **Impact on thesis –** Within this thesis it was important to work with teachers and Healthy School personnel to make initial changes for the SOHP to be relevant to the English NC. Evaluation methods that were designed from the top-down were able to be adapted to account for bottom-up influences through *study 1*.

- **Method** - The need to involve children in research and the importance of working with children at each stage of development and evaluation.
  - **Literature –** Children are an important target for OH promotion, predominantly in the school due to the reach this provides and the creation of NHSP. Across many areas of health and wellbeing research there is a growing recognition of the need to include children's perceptions both for practical reasons (through them being the target of interventions) and ethically (due to the increasing legislations and recommendations) (Popay & Williams, 1996; Chapparo & Hooper, 2005; Yusuf et al., 2006; NICE, 2007). DPH, although experiencing a change, has been slower than many PH areas to engage with children as equally valid and separate voices around health as their parents and teachers (Marshman et al., 2007).
  - **Impact on thesis –** Through the use appropriate methodology with new, novel, clinical and mixed-methodologies children were seen in this thesis as the central component of the methods and evaluation. Additional evaluation to support this was provided by teachers and parents.

[50] Note: Within England the clinical impact of this will not be able to be determined fully till the next national 5- and 12-year olds surveys results, due within the next couple of years.

- **Method -** Quality of reporting of studies.
    - **Literature -** Despite CONSORT and TREND statements there are still areas that need to be improved to standardise both the development and reporting of behaviour change interventions. As found in Cooper et al. (2013) it is not always possible to understand the details of the intervention both in terms of contents and delivery.
      Impact on thesis – Within the reporting of this thesis the intervention was mapped on to the 26 BCT (Abraham & Michie, 2008).
- **Method** – Mixed-method paradigm.
    - **Literature –** Within DPH evaluating behavioural aspects is limited by the lack of common core indicator sets to standardize measurement tools, reducing the heterogeneity between methods and increasing the use of validated tools within studies, and improving the ability to review multiple studies (Harris et al., 2004; Dugdill & Pine, 2011). Further, due to the complexity of many interventions, it can be difficult to interpret findings without accounting for the contextual factors of the programme (Armstrong et al., 2008).
    - **Impact on thesis -** As with an increasing number of research programmes that involve complex interventions and research with children, this thesis uses a mixed-method approach. Through the use of triangulating methods and DLT it is aimed to overcome some of the issues of self-report.
- **Intervention** – Presently many interventions only have short-term impacts on any behaviour change. There is a need to establish good OH routines prior to adolescence when behaviours become harder to change.
    - **Literature** - Interventions targeted at improving oral hygiene habits have been found to have only minimal and frequently short lived effects. Reviews include: Kay & Locker, (1996 & 1998), Watt et al. (2001a), and Cooper et al. (2013). OH behaviours become increasingly difficult to change by adolescence and attitudes towards brushing have greater resistance to being influenced (Sprod et al.,

1996). By the age of 7 children usually have well developed fine motor skills to be able to grasp a toothbrush and carry out the required brushing movement effectively (Robinson, 2008).

- **Impact on thesis** – Through working closely with children it was hoped to understand how interventions can be more effectively designed to produce behaviour change. Additionally through the completion of the Cochrane review, a greater understanding is possible of the common BCTs used within previous RCTs designed to evaluate SOHP. The '*Brush Day & Night*' SOHP targets children 6-7 years old as they are gaining greater independence in their brushing routine.

Chapter 5 - Study 1: Pilot exploration of 6/7 year olds' perceptions of oral health and nutrition

5.1 Chapter overview

Study 1 was a cross-sectional, mixed-methods pilot study (n=97) designed to:

- describe the design of and pilot the feasibility and acceptability of the new portfolio of research tools (children's questionnaire, draw & write (D&W), and focus group (FG)) designed for this research,
- pilot the individual research tools in terms of their face validity (questionnaire) and trustworthiness (D&W and FG),
- test the appropriateness of the '*Brush Day & Night*' programme from teachers' and Healthy School (HS) personnel's perspectives, in order to understand any local adaptation required (supported through children's contextual results), and to ensure the '*Brush Day & Night*' programme was relevant for English schools prior to *study 2* (*Chapters 6 & 7*).
- to provide initial contextual information around toothbrushing and sugar-snacking relating to the current level of knowledge 6-7 year olds have, and how current habits, barriers and facilitators are reported by children and parents.

This chapter outlines the rationale and research questions for *study 1*. Following this, the sampling strategy, design, implementation, method of data preparation and summation of the portfolio of research tools and intervention materials are outlined. Next the results are presented in relation to the face validity of the children's questionnaire and trustworthiness (defined in *section 4.4.2, p. 117*) of the D&W and FGs, as well as a brief presentation of contextual results prior to *study 2*. Finally, the chapter presents a discussion around the lessons learnt within *study 1* and the impact of these and any changes prior to the research tools and intervention materials being implemented within *study 2*.

5.2 Rational for pilot study

This study is informed by Van Teijlingen & Hundley (2001) who highlighted 16 potential reasons for conducting a pilot from "*developing and testing adequacy of*

research instruments" to "*convincing other stakeholders that the main study is worth supporting*" (p2).

Study 1 aimed to initially test a new and unique portfolio of research tools that had not previously been used within dental public health (DPH) to research with children directly rather than relying on parent or teacher proxy reporting of children's behaviours (greater discussion around research with children in DPH and the background to the research tools can be found in *sections 4.3 & 4.6.3*. The designs of the research tools were informed by the requirement to understand the whole picture, facilitated through both qualitative (which helps to understand the context of the behaviour) and quantitative methods (Roberts, 2012). Additionally, as outlined by the Medical Research Council (MRC) framework, and the National Institute for Health and Clinical Excellence (NICE) PH6 guidance around behaviour change (*section 4.2*), *study 1* aimed to begin to address the need to develop a contextual understanding of the population the intervention is designed to operate in (NICE, 2007; MRC, 2008).

5.3 Research questions

Study 1 aimed to answer research questions and objectives relating to aim 2 of the thesis[51] as highlighted in *Figure 2-1 (below)*. These were answered using the portfolio of research tools:

- Children's questionnaire;
- Children's D&W;
- Children's FGs;
- Parent face-to-face semi-structured interviews;
- Teachers and local HS personnel FG.

[51] Improve the understanding of young children's knowledge and behaviour about oral health, toothbrushing and nutrition

Figure 2-1 The research framework of the thesis (highlighted Aim 2)

5.4 Study methodology – sample, design, implementation and methods of data handling and summation

The following sections outline the sampling strategy for *study 1,* followed by the methods (design, implementation and data handling and summation) relating to the portfolio of research tools and testing of the acceptability of the '*Brush Day & Night*' programme.

5.4.1 Sampling strategy – participating schools

A full description of the research area and population has previously been discussed in *section 1.3.2.*

Population: All primary schools in Salford were sampled*.* Salford schools were sampled across social-economic status (SES) with one school taken from each of a high, middle and low SES area (*Table 5-1*). This was designed to ensure the research tools were suitable for all children with potential differing developmental and learning abilities.

Sample: Schools were compiled into a table using the headings in *Table 5-1*, which allowed them to be ranked prior to the sampling process in relation to decayed, missing and filled deciduous teeth (dmft) rates and free school meal (FSM) figures. With support from the HS Coordinator, the ranking was confirmed. Some of the required information to construct this table was available freely, whilst other information, (e.g. FSM), was obtained using freedom of information requests.

This process of determining SES was designed to combine detailed knowledge of schools from the HS Coordinator with SES indicators. FSM are a common proxy measure for family income (Hobbs & Vignoles, 2010), although due to potential issues of inaccuracy, using FSM in conjunction with other indicators can minimise limitations. Within this research categories for FSM were: 0-19% high SES, 20–49% middle SES, over 50% low SES. As dmft has been shown (*Chapter 2*) to be related to SES, average dmft rates for Salford and the North West (NW) were also considered. Finally, the Index of Multiple Deprivation (IMD) 2007 for the school wards were accounted for. As IMD uses 38 indicators within 7 domains it provides a more comprehensive picture than FSM data alone (Department for Communities & Local Government, 2008).

Table 5-1 Key characteristics of *study 1* schools

School Classification	Number of children in year 2	Healthy School Status	MSOA 5yr olds Average dmft (2005/06)	MSOA 5yr olds% with decay experience (2005/06)	Ward 5yr olds Average dmft (2005/06)	Ward 5yr olds % with decay experience (2005/06)	Ward 2004 IMD	% entitled to FSM (FT) (2009)	Yr of Ofsted report	Overall grade Ofsted[52]	Overall Absences (%) (2008)	Persistent absences (%) (2008)	KS1-2 CVA Score	Effectiveness of early years foundation (KS1-2 cva)
High	29	NHS	1.01	30	1.11	36	9.88	3.6	2006	2	4.2	1.2	100.5	2
Middle	25	NHS	3.15	57	3.53	58	50.83	47.7	2007	1	7.4	9.0	101.3	3
Low	30	WTEHS	4.2	63	4.59	67	68.81	50.2	2007	2	6.0	2.2	101.5	2

Key to table abbreviations:

NHS – National healthy school status achieved; WTEHS – School working towards the enhanced healthy school award

MSOA – middle layer super output area (mean populations 7200, NHS Data dictionary 2011)
IMD – index of multiple deprivation
FSM- free school meals
FT – full time children entitled to FSM
Overall grade – the grade provide by Ofsted in report as to the standard of the school
KS1-2 CVA - measures the progress of a child while attending the school accounting for circumstances schools cannot control

[52] 1 = outstanding, 2 = good, 3 = satisfactory, 4 = must be improved

Once the schools were ranked, discussions with the local HS Coordinator supported the selection of the three pilot schools. The top school on the ranking list, the third bottom (it was not possible to access the two lower schools at the time of the pilot) school and then a school at the middle of the list were chosen. Greater guidance from the HS Coordinator was provided around selecting the middle school to ensure they felt it reflected a middle ground in terms of SES. The three schools (all with HS status) were then recruited through NHS Salford's HS Coordinator. Informed consent was gained from parents once schools had given permission. A letter, information sheet and consent form were sent home via the children (*appendix 13*). For children with parental consent verbal assent was gained as an ongoing process for each tool , once it had been explained.

5.4.2 Portfolio of research tools – Method of design, implementation and data handling

The following sections details:

- the design (*section 5.4.2.1*),
- implementation (*section 5.4.2.2*)
- and methods used for data preparation and summation (*section 5.4.2.3*).

In addition *section 5.4.2.1.4* provides an overview of how the portfolio of research tools relate to each other to improve comparison across the outcomes. Literature relating to the portfolio of research tools used with children (questionnaire, D&W and FGs) can be found in *section 4.6.3*.

5.4.2.1 Method: Design of the portfolio of research tools

5.4.2.1.1 Design of Children's questionnaire

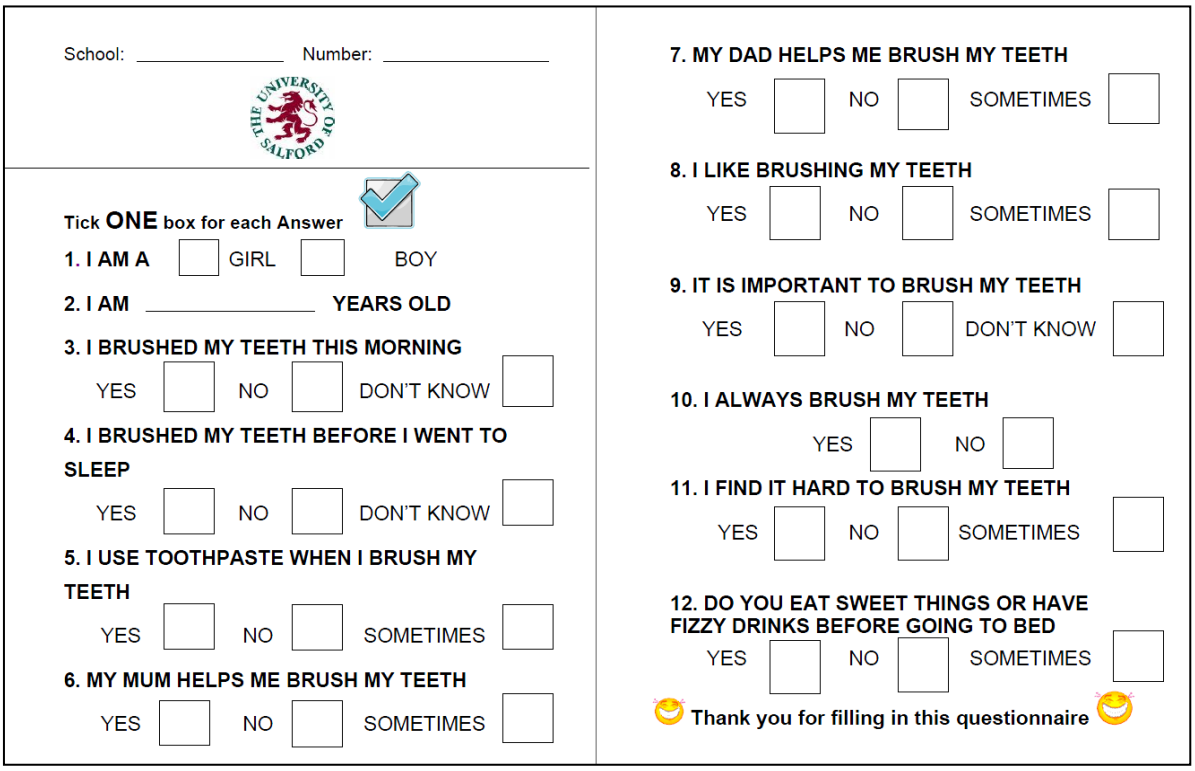
The bespoke children's questionnaire was developed by the researcher to allow self-reported data to be collected directly from the children (rather than by proxy reporting from parents and teachers). The purpose of the questionnaire was to ascertain children's self-reported behaviour and attitudes relating to toothbrushing and nighttime sugar-snacking.

For this study, the children's questionnaire design was informed by a questionnaire around smoking by Porcellato (1998). Porcellato's (1998)

questionnaire was used with the same aged children and was chosen as a template, because no suitable questionnaire existed for the topics of interest. The design style of Porcellato questionnaire was replicated (e.g. the number of questions, the look of the questionnaire and the style of how questions were written) but questions were changed to reflect the different subject area and informed by both the research questions and the relevant literature.

The questionnaire asked 12 questions around toothbrushing habits (24hr recall), support, and nighttime sugar-snacking (*Figure 5-1*).

Figure 5-1 Copy of Children's Questionnaire



School: _____ Number: _____

THE UNIVERSITY OF SALFORD

Tick **ONE** box for each Answer

1. I AM A ☐ GIRL ☐ BOY

2. I AM _____ **YEARS OLD**

3. I BRUSHED MY TEETH THIS MORNING

YES ☐ NO ☐ DON'T KNOW ☐

4. I BRUSHED MY TEETH BEFORE I WENT TO SLEEP

YES ☐ NO ☐ DON'T KNOW ☐

5. I USE TOOTHPASTE WHEN I BRUSH MY TEETH

YES ☐ NO ☐ SOMETIMES ☐

6. MY MUM HELPS ME BRUSH MY TEETH

YES ☐ NO ☐ SOMETIMES ☐

7. MY DAD HELPS ME BRUSH MY TEETH

YES ☐ NO ☐ SOMETIMES ☐

8. I LIKE BRUSHING MY TEETH

YES ☐ NO ☐ SOMETIMES ☐

9. IT IS IMPORTANT TO BRUSH MY TEETH

YES ☐ NO ☐ DON'T KNOW ☐

10. I ALWAYS BRUSH MY TEETH

YES ☐ NO ☐

11. I FIND IT HARD TO BRUSH MY TEETH

YES ☐ NO ☐ SOMETIMES ☐

12. DO YOU EAT SWEET THINGS OR HAVE FIZZY DRINKS BEFORE GOING TO BED

YES ☐ NO ☐ SOMETIMES ☐

Thank you for filling in this questionnaire

The questionnaire was developed to provide basic demographic information (Q1 & 2), allowing analysis of any gender or age differences. Questions 3, 4 and 10 aimed to understand their current self-reported toothbrushing behaviours. The use of recall of previous two brushing episodes was designed in accordance with the literature pertaining to time periods greater than this producing less reliable accounts (Baxter et al., 2009). As nighttime sugar-snacking also impacts on dental problems (*Section 2.3 & 2.4*) Q12 asked about their current behaviour. Fluoride toothpaste (≥ 1000ppm fluoride) is undisputed in the evidence of the preventative effect in relation to dental caries (Marinho et al., 2003; Twetman et al., 2003;

Walsh et al., 2010; Wong et al., 2011); hence Q5 measured reported toothpaste use. Questions 6 and 7 were designed to understand if children were still receiving parental support with brushing, (as advised by NHS guidelines until the child reaches 7 years old - Choo, Delac & Messer, 2001; NHS Choices, 2011). Question 11 aimed to provide information regarding any difficulties children had when brushing, (which could affect brushing rates). Questions 8 and 9 aimed to elicit the children's attitudes towards frequency of toothbrushing and whether they found toothbrushing a likable behaviour.

The choices of responses to all questions were kept simple, in terms of having no more than 3 categories of responses. Previous research shows that limiting the number of categories (no more than 3 advised for this age group) helps to provide better results (de Leeuw, Borgers, & Smits, 2004).

Piloting was guided by Peats (2001), 9 steps around questionnaire design to help improve the internal validity through testing it on the target population. Each point was considered both in the school (e.g. children discussing answers as they completed the questionnaire) and during the analysis phase (e.g. to determine if questions were answered and were they answered in a suitable way).

1 "*Administer the questionnaire to pilot subjects in exactly the same way as it will be administered in the main study*,
2 *Ask the subjects for feedback to identify ambiguities and difficult questions*,
3 *Record the time taken to complete the questions and decide whether it is reasonable*,
4 *Discard all unnecessary, difficult or ambiguous questions*,
5 *Assess whether each question gives an adequate range of responses*,
6 *Establish that replies can be interpreted in terms of the information that is required*,
7 *Check that all questions are answered*,
8 *Re-word or re-scale any questions that are not answered as expected*,
9 *and shorten, revise and, if possible, pilot again*" (p123).

This process allowed issues to be identified and any amendments made prior to progressing to *study 2*.

5.4.2.1.2 Design of Children's D&W

Within a school setting children are used to drawing and writing. Further, D&W is known to be a reliable method for researching health topics with children (Williams, Wetton & Moon, 1989; Prosser, 1998; Knighting et al., 2011).

Prosser (1998), informed by previous protocols, developed a process model to help researchers to be clear on the stages of developing a new D&W research strategy. This consists of a 10 step process from "*consultation regarding key questions to which answers were needed*" to "*dissemination and curriculum development*" (p281). The initial 5 steps were considered following *study 1* to ensure a suitable and robust tool was developed (*section 5.5.3.1).* The remaining steps are considered in *chapter 7 (section 7.5.4*). In addition, feedback during the development of statements (discussed below) was obtained from an academic advisor who had experience of using the method.

The aim of the D&W was to allow all children to provide greater detail to illustrate their current knowledge/understanding around a set of statements relating to oral health (OH) (e.g. toothbrushing behaviour in the morning and at night) and nighttime sugar-snacking. The statements were designed to help provide an understanding of children's answers in relation to:

- food and its effect on teeth;
- their behaviours and any influences on keeping their teeth healthy;
- how children depict and explain their morning and evening routines,
- how children report what it may be like to have problems with their teeth and who is able to support them.

Gaining information about these four components was crucial for context, as well as helping ascertain if the children were able to use the D&W tool.

As such the initial two statements aimed to ascertain children's current knowledge regarding OH:

- 'Draw & Write how you think what we eat might affect our teeth and how it will affect them.'

- ‘Draw & Write what you think will keep your teeth healthy and how you can tell that your teeth are healthy.’

Statement 3 aimed to understand how children recalled OH routines as occurring in their own homes and what support (if any) they received:

- ‘Draw & Write what you and your family do in the mornings and to get ready for bed. Think about anyone that helps or tells you what to do, and what you have to do to get ready.’

Finally, statement 4 was designed to help understand if 6-7 year olds were aware who is trained to help:

- ‘Draw & Write what you think it may be like or is like when we have problems with our teeth. Think about who might be able to help and what might be done to make us better.’

5.4.2.1.3 Design of Children’s FGs

The FGs were designed to complement the other methods and ask additional questions around OH (e.g. around brushing before school and also more detail around what they use to brush their teeth) and sugar-snacking/nutrition (e.g. around how children think food and sugar can affect our teeth and how often they have fizzy drinks or sweets).

The FGs allowed for more detailed responses to be gained from some of the children (participant selection outlined in *section 5.4.2.2.3*), both to inform the outcomes of *study 1* and to help provide some contextual results prior to *study 2*. FGs allowed the children to be with their peers as, for many, this was their first experience of research. It also allowed the differing opinions, levels of knowledge and interactions between the children around the topics to be understood.

The FGs were audio-visually recorded, to ensure all data was captured. The video allowed easier identification of who was speaking, as well as being able to see the interactions with props used in the FG (e.g. big mouth to brush and sugar in containers for questions around sugar content in carbonated drinks). The recording of the FG meant that it was not necessary to take notes and full attention

could be paid to the group. This was important to help facilitate the discussion and also to help the children not feel as if they were being tested.

Sugar-snacking/nutrition and OH topics were split into two groups. It was felt asking the children about both together would increase the FG length, which could negatively impact on the children's concentration and engagement, as well as potentially leading to confusion through switching topics. For 6-8 year olds Kennedy, Kools & Krueger (2001) and Gibson (2007) suggest that children are able to focus on research for between 45–60 minutes. The FGs lasted approximately 30 minutes (Porcellato et al., 2002), this was both to fit in with the time in schools around breaks in relation to the other research methods, and also to ensure the children did not lose focus.

Each FG was designed to begin with a newly developed icebreaker game using pre-printed cards (*Figure* 5-2) relating to dental health and nutrition. This was intended to demonstrate that FGs were not a normal class exercise or test and they should feel free to say what they thought. The FG was designed so that as long as everyone could speak, the children did not have to raise their hands, and their responses were valued, correct or not. Further, the ice-breaker game was designed to help bring the child's focus to relevant topics and away from previous class activities.

Figure 5-2 Ice breaker game cards used in pilot and feasibility study FGs with children

The use of an ice breaker was informed by Morgan et al. (2002), who conducted FGs with 7-11 year olds around asthma and highlighted the importance of '*setting the scene*' (p6) to encourage the children to speak, reduce power imbalance and

move away from school expectations. The design of the FG further reflected that of Morgan et al.'s (2002) work, which advocated the use of first names, sitting on the floor, using appropriate language or reflecting back children's own language.

Within the FGs the initial questions in both groups were based on 24-hour recall to link into the children's questionnaire and understand current habits in greater detail. In addition to the set questions during the FG, follow-up questions in relation to the children's responses and need for support with questions were added as appropriate.

Figure 5-3 Children's OH FG questions for *study 1*

Q1 – DO YOU BRUSH YOUR TEETH?	Q2 – DID YOU BRUSH YOUR TEETH THIS MORNING?	Q3 – DID YOU BRUSH YOUR TEETH LAST NIGHT?	Q4 – DID YOU BRUSH YOUR TEETH BEFORE SCHOOL YESTERDAY?
Q5 - DO YOU HAVE YOUR OWN TOOTHBRUSH?	Q6 - DOES SOMEONE HELP YOU TO BRUSH YOUR TEETH?	Q7 - HOW DO YOU BRUSH YOUR TEETH?	Q8 - DOES ANYONE BRUSH THEIR TEETH WITH YOU?
Q9 - WHY IS IT IMPORTANT WE BRUSH OUR TEETH?	Q10 - WHAT MIGHT HAPPEN IF WE DON'T BRUSH OUR TEETH?	Q11 - HOW DO GERMS AFFECT OUR TEETH?	Q12 - WHY ARE TEETH IMPORTANT?
Q13 - WHAT DO YOU THINK ABOUT BRUSHING YOUR TEETH?	Q14 - WHAT HAPPENS IF TEETH GO BAD?	Q15 - HOW CAN WE KEEP OUR TEETH HEALTHY?	Q16 - ARE BABY TEETH AS IMPORTANT AS BIG TEETH?

In the OH FG (*Figure 5-3*), Q6 and 8 asked about support children might receive in relation to toothbrushing to begin to understand the routine in the home. In order to understand the children's knowledge around OH and hygiene questions Q9, 10, 11, 12, 14, 15, and 16 were developed. Question 9, 12, 13 and 16 aimed to understand children's attitudes towards brushing and the importance they give to the behaviour. Question 5 aimed to help determine how many children in Salford had access to their own toothbrush. Finally Q7, through the use of props (e.g. tooth models), targeted their knowledge around toothbrushing technique.

In the sugar-snacking/nutrition FG (*Figure 5-4*) Q5, 6, 7, and 11 provided a way of understanding the children's current behaviours in relation to sugar-snacking and nighttime sugar-snacking.

Figure 5-4 Children sugar-snacking/nutrition FG questions for *study 1*

Q1 - DID YOU BRUSH YOUR TEETH THIS MORNING?	Q2 - DID YOU BRUSH YOUR TEETH LAST NIGHT?	Q3 - DID YOU BRUSH YOUR TEETH BEFORE SCHOOL YESTERDAY?	Q4 - DO YOU HAVE YOUR OWN TOOTHBRUSH?
Q5 – HAVE YOU HAD ANY FIZZY DRINKS TODAY?	Q6 – DO YOU HAVE ANY FOOD AFTER YOU BRUSHED YOUR TEETH AT NIGHT?	Q7 – DO YOU HAVE A DRINK DURING THE NIGHT?	Q8 – WHAT HAPPENS IF WE EAT OR DRINK ONCE WE HAVE BRUSHED OUR TEETH?
Q9 – HOW MIGHT FOOD AFFECT OUR TEETH?	Q10 – DOES SUGAR AFFECT OUR TEETH?	Q11 – HOW OFTEN DO YOU HAVE SWEETS AND FIZZY DRINKS?	Q12 – WHICH ONE SHOWS HOW MUCH SUGAR IS IN COKE? *NOTE: For slide visual aid used consisting of 3 can sized containers with differing levels of sugar for children to indicate which was the correct amount*
Q13 – DO YOU THINK BRUSHING OUR TEETH CAN PROTECT THEM AGAINST SUGAR?	Q14 – WHAT CAN HAPPEN IF OUR TEETH GO BAD?	Q15 – HOW CAN WE KEEP OUR TEETH HEALTHY?	

Question 4 helped to explore if any children had difficulty brushing due to not having access to a toothbrush. Questions 14 and 15 corresponded to questions in the OH FG to provide children with the opportunity to explain their knowledge around what can happen to teeth. Questions 8, 9, 10, 12, and 13 all targeted specific knowledge in relation to nutrition and the impact of sugar on teeth.

Props were designed to be used within the FG to help the children answer questions around sugar and brushing. Previous FGs with children around nutrition have used photographs to aid children taking part both through structured tasks and to aid retrieval (Neale, Otte & Tilston, 1995; Turner, 1997; Piscopo, 2004). As some children may struggle to explain how they brush their teeth or how much sugar they think is in Coca-Cola; allowing them to demonstrate this helps ensure accessibility. Morgan et al. (2002) reported concerns around the distraction of the props they used, however they also found allowing children to 'fiddle' helped the

children in the group to be relaxed and not always feel the eye contact from the researcher and other children when they were talking.

For the FG the predefined questions were typed onto A3 sheets to help the children remember them and to allow them to have more control by reading the questions. This was again aimed at reducing some of the power imbalances from the FG being fully researcher controlled. By giving children greater control while ensuring the FG was facilitated as necessary (e.g. allowing people a chance to speak and asking additional questions) it was hoped to enhance their understanding that their participation was important and their responses were valued.

5.4.2.1.4 Explanation of the relationship between the three children's methods

The three research tools used with the children were designed to overlap in order to improve the rigour of data collection and allow comparison during the analysis. *Table 5-2* below illustrates how the questions relate across the portfolio of research tools and link to the overall focus of the questions, which have been informed by the study objectives.

In the questionnaire (*Figure 5-1*) basic demographics were asked, i.e. their age and gender (Q1 & Q2). This was not repeated within the other data collection methods, as it was only necessary to collect this data once as children could be tracked across the different methods using unique codes. These codes were generated using four parts:

- the child's school code,
- study group number,
- child/parent unique code number
- and a code to indicate if the measure was completed by children or parents.

Each child/parent pair was provided with a unique code, used on all research tools relating to the pair. The unique codes ensured the confidentiality and anonymity of the participants for the duration of the study.

Table 5-2 Table of questions asked in children's questionnaire and related questions in D&W and FGs

Focus of the questions in the portfolio of research tools	Children's Questionnaire questions	Equivalent questions in other children's research tools		
		D&W	OH FG	Sugar-snacking/nutrition FG
Behaviour in relation to toothbrushing (routine)	I brushed my teeth this morning	Draw & Write what you and your family do in the mornings and to get ready for bed. Think about anyone that helps or tells you what to do, and what you have to do to get ready.	Did you brush your teeth this morning?	Did you brush your teeth this morning?
		Draw & Write what you think will keep your teeth healthy and how you can tell that your teeth are healthy.		
	I use toothpaste when I brush my teeth	Draw & Write what you think will keep your teeth healthy and how you can tell that your teeth are healthy.	How do you brush your teeth?	N/A
Support with toothbrushing	My mum helps me brush my teeth	Draw & Write what you and your family do in the mornings and to get ready for bed. Think about anyone that helps or tells you what to do, and what you have to do to get ready	Does someone help you to brush your teeth?	N/A
	My dad helps me brush my teeth		Does anyone brush their teeth with you?	N/A
Attitude towards toothbrushing	I like brushing my teeth	N/A	What do you think about brushing your teeth?	N/A

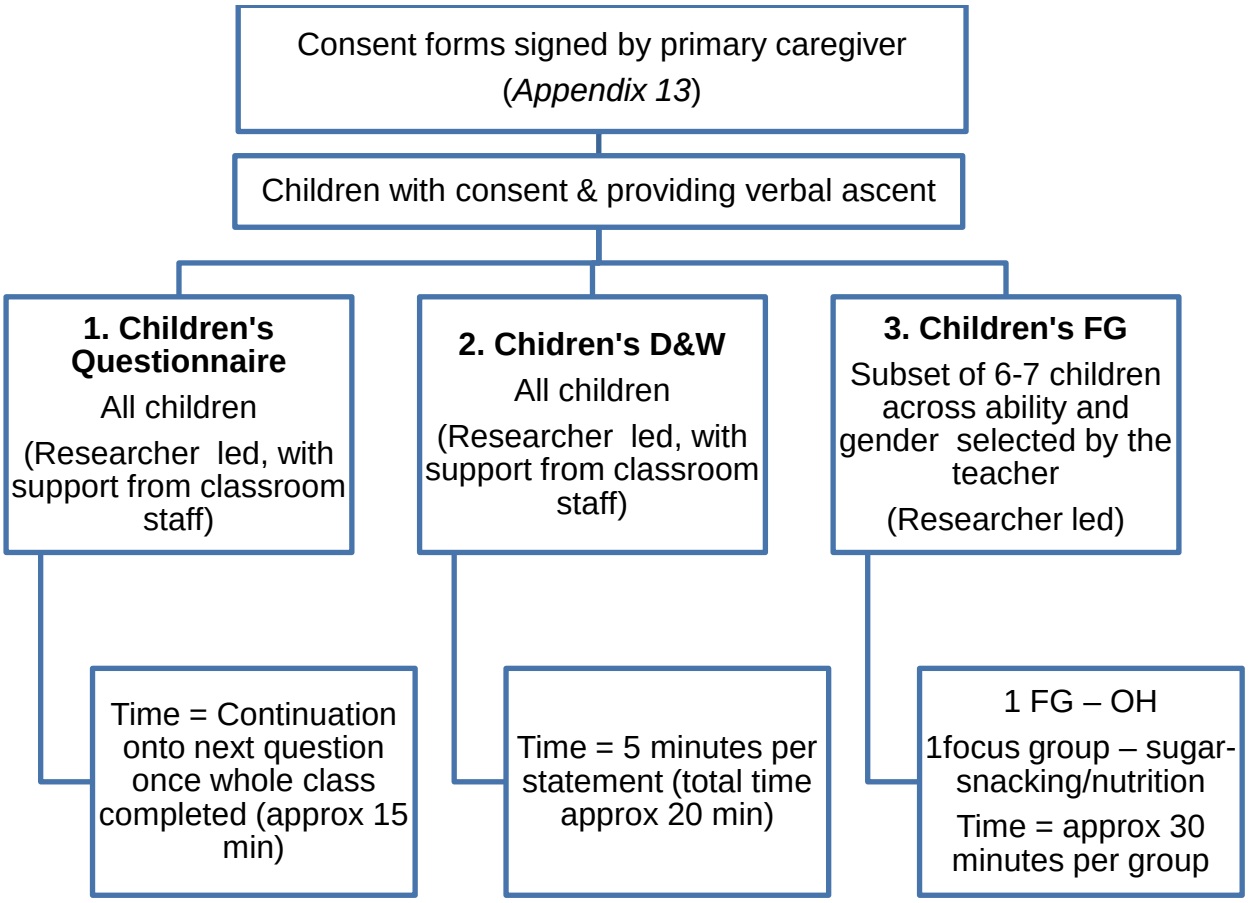
Focus of the questions in the portfolio of research tools	Children's Questionnaire questions	Equivalent questions in other children's research tools		
		D&W	**OH FG**	**Sugar-snacking/nutrition FG**
	It is important to brush my teeth	Draw & Write what you think it may be like or is like when we have problems with our teeth. Think about who might be able to help and what might be done to make us better	Why is it important we brush our teeth?	Do you think brushing our teeth can protect them against sugar?
			What might happen if we don't brush our teeth?	
			Why are teeth important?	How can we keep our teeth healthy (*prompted in relation to types of food and drinks and the impact on teeth*)?
			How do germs affect our teeth?	
			What happens if teeth go bad?	
			Are baby teeth as important as adults teeth?	
Behaviour in relation to toothbrushing (routine)	I always brush my teeth	Draw & Write what you think will keep your teeth healthy and how you can tell that your teeth are healthy.	How can we keep our teeth healthy?	N/A
	I find it hard to brush my teeth	N/A	How do you brush your teeth?	Do you brush your teeth?
			Do you brush your teeth?	
Behaviour in relation to nighttime sugar-snacking	Do you eat sweet things or have fizzy drink before going to bed	Draw & Write how you think what we eat might affect our teeth and how it will affect them.	N/A	Do you have any food after you have brushed your teeth at night?
				Do you have a drink during the night?
		Draw & Write what you think will keep your teeth healthy and how you can tell that		What might happen if we eat or drink once we have brushed our teeth?

Focus of the questions in the portfolio of research tools	Children's Questionnaire questions	Equivalent questions in other children's research tools		
		D&W	**OH FG**	**Sugar-snacking/nutrition FG**
		your teeth are healthy.		What happens if our teeth go bad?
	Additional questions asked which did not correspond to the children's questionnaire	No additional questions	Do you have your own toothbrush?	Do you have a drink during the night?
				Did you brush your teeth before school yesterday?
				Have you had any fizzy drinks today?
			Did you brush your teeth before school yesterday?	How might food affect our teeth?
				Does sugar affect our teeth?
				How often do you have sweets and fizzy drinks?
				Which one shows how much sugar is in coke?

5.4.2.2 Method: Implementation of the portfolio of research tools

For the children the research was conducted during a normal class lesson in a quiet area within schools, to ensure only those with consent and providing verbal assent were involved. *Figure 5-5* outlines how data collection was implemented in each of the three schools and the order that this was completed in.

Figure 5-5 Order of data collection with children and method of implementation per school visit



5.4.2.2.1 Implementation of Children's questionnaire

The children's questionnaire was completed as a class activity. Initially it was explained to the class: this was not a test, it was important to be honest and not to worry about what those around them put. Children were asked to tick only the box relating to their answer, and if they made a mistake to cross or rub out the answer before ticking the correct one. Each question was read aloud by the researcher (Borgers, De Leeuw, & Hox, 2000). Once it was checked, by the researcher walking around the room (supported by teaching assistants and the teacher), that everyone who wanted to had answered the question, the next one was read out

until all questions had been answered in this manner. This ensured that those children needing assistance with a particular question could be supported. If children needed support this was provided by the researcher, teacher or other classroom assistants. Questions were re-read, then explained in a way attempting not to alter the meaning e.g. '*I brushed my teeth before I went to sleep*' rephrased to '*did you brush your teeth before you went to bed last night*'.

In order to begin to ascertain the suitability and usability of the questionnaire during this study, the researcher went around the room as children were completing the questionnaire so some children could explain their answers (face validity to check the clarity of the wording, Border et al., 2007) and the researcher could understand if the answers provided corresponded with their more detailed explanations. This helped provide a check that answers provided in the tick boxes corresponded to how the children explained their answers. It also helped to provide an indication around the suitability of the level of the questionnaire, in relation to determining the understanding the children had about what each question was asking and whether they could provide an answer to the questions (usability testing).

Additionally, as part of the pilot it was possible to check the practical elements relating to the questionnaire with 6-7 year olds around clarity: of the wording/readability; instructions given to the children; gain feedback from them about the questionnaire both in terms of the questions and responses available; to check the functionality of the questionnaire and finally to ascertain if the complexity was suitable for this age group (Cohen, Manion & Morrison, 2010),

5.4.2.2.2 Implementation of Children's D&W

For the D&W each child was provided with an A3 sheet of paper split into four quadrants containing pre-printed questions. The D&W was completed in a class setting with all the class and school staff/teacher present.

Prior to the children beginning, the process was explained by the researchers; children were told they could draw and/or write on the paper sheets below the question; that there were no right or wrong answers and if they did not want to complete a question, this was their choice. Finally, the children were read each

statement in turn and given time to draw and/or write a response (approximately 5 minutes per statement/question - Porcellato, 1998).

For children unsure of the statement's meaning, it was explained to them individually by the researcher, teacher, or support staff (who had previously been advised it was important not to alter the meaning). If children did not understand words another similar word was used e.g. affect – impact. The researcher, teacher or support staff were available to scribe verbatum for the children if they indicated they needed some help.

5.4.2.2.3 Implementation of Children's FGs

Due to their knowledge of the children, teachers were asked to form two groups of 5-8 children from those with parental consent (Porcellato et al., 2002; Saks & Allsop, 2007). The teachers' understanding of the abilities and backgrounds of the children was intended to help ensure that a cross-section of children (of varying developmental ages) took part to ensure that a more inclusive sample would be achieved within each school (Critical Appraisal Skills Programme (CASP), 1994). Mixed gender FGs were conducted in a safe environment separate to the children's classroom (e.g. where the video would only capture those in the FG and where children could talk freely, confidentially and not be overheard by others) for audio-visual recording.

Children were told that it was important to provide honest answers around what they do and what they think, to try not to talk over each other so that everyone can be heard and that this was not a test (so they did not have to raise their hands and it did not matter if they were incorrect) but that as they were experts in what they did and know we just wanted to understand this (Morgan et al., 2002; Porcellato et al., 2002). Following an explanation about the FG, they were asked to provide verbal assent to being audio-visually recorded.

Initially the ice breaker game was played by children and researchers (to begin reducing power dynamics). Cards, containing a word and illustrations, (*Figure* 5-2) were picked out of a bag one at a time. Children and researchers were asked to say the first thing they thought of when they saw the card. *Figure 5-6* provides examples of images from the FG across the three SES schools.

Figure 5-6 Images of children's FG being conducted in *study 1*

Following the ice breaker game, either the OH or sugar-snacking/nutrition question sets were used (*Figure 5-3* & *5-5*). Each question was asked initially by the researcher but as the children got more confident they also opted to read the questions. Once the facilitator was happy all discussion around a question was complete the next question was asked.

As outlined in *section 5.4.2.1.3* to help answer some questions props were used. For example within the sugar-snacking/nutrition FG a question was asked around the amount of sugar that can be found in a standard size can of Coca-Cola – for this children were presented with three pots each with differing amounts of sugar to then say which they thought was correct. This was designed to illustrate how fizzy drinks can contain a large quantity of sugar that they cannot see and provide a more child friendly way of answering the question than asking them the quantity of sugar. In addition to this when children were talking about brushing their teeth they could use either a giant mouth model or a character with teeth to demonstrate brushing technique.

Once all of the questions were completed the facilitator brought the session to a close asking the children if there was anything else that they wanted to ask about the topic in general or about the FG. They were then thanked for their time, for talking to us today and for helping with the research.

5.4.2.3 Method of data handling and summation for the portfolio of research tools

The following sub-sections are designed to outline how the data was handled and the process of data summation for each of the three research tools used with the children.

5.4.2.3.1 Data entry & summation of Children's questionnaire

The children's questionnaires were coded in SPSS 16.0, which is commonly used for data management and statistical analysis and allows descriptive analysis to be conducted (Saks & Allsop, 2013). Codes were added in relation to the school the children attended to allow some analysis by SES to provide contextual level data.

5.4.2.3.2 Data entry & coding of Children's D&W

The D&W sheets were scanned and coded into the computer allowing analysis to be conducted for themes and via content analysis for statistical analysis of frequency of responses (Starkey & Orme, 2001; Franck, Sheikh & Oulton, 2008). Throughout this thesis analysis of drawings was used alongside the writing. Content analysis allows a large quantity of qualitative data to be coded using a pre-defined scheme into smaller chunked quantitative data. Defined by Krippendorff (2004) as a "*research technique for making replicable and valid inferences from texts to the contexts of their use*" (p18). Although there are criticisms of the method as being reductionist, the aim of the coding scheme is to ensure the essence of the research is not lost through too few or too many sub-categories within each main category.

The coding schedule was designed prior to the analysis of the pilot study, in a top-down manner, in relation to current OH, hygiene and nutrition literature and anticipated responses specific to the D&W questions (example in *Appendix 16*). *Figure 5-7* illustrates two of the content analysis coding schemes. The first box V1 statement 1 in *Figure 5-7* relate to the first D&W statement and aims to code the children's D&W responses to understand any reference to ways you can keep healthy (e.g. through toothbrushing or drinking milk). The second box V2 statement 3 aims to code the D&W responses in relation to what children had drawn or written about what might be done to help us with our OH. Each of the children's D&W sheets was individually analysed, with each statement being coded using the coding framework sheets by highlighting the responses which corresponded to those depicted on the children's sheets. Multiple answers could be coded under each variable (V) heading as was relevant.

Figure 5-7 Example coding framework for D&W content analysis

V1. Statement1 – Keep Healthy

- Toothbrush
- Toothpaste
- Mouthwash
- 5 a-day
- Milk
- Water
- Twice day
- Morning
- Night
- Other –
- No related answer

V2. Statement 3 – What might be done to help

- Taken out
- Go dentist
- Go doctor
- Medicine
- Brush
- No related answer

Where the child had drawn an image and then labelled it this was only coded once. If the child had not labelled an image, it was only coded if it was obvious what it was depicting to avoid risk of incorrect interpretation.

5.4.2.3.3 Transcription & process of analysis for children's FGs

The FG audio files in conjunction with the corresponding video files were partially transcribed. Pauses and utterances such as 'um' and 'er' were not included as this detail was not required for this research (e.g. conversation analysis was not conducted). In a few instances there were parts of the FG that were difficult to hear and understand. For example, when children were talking over each other (children were asked to then let each other speak and repeat what they had said but they did not always do this) or too quietly (these responses were in most instances repeated by the researcher so they were captured and as a way of checking they had been heard correctly), which did lead to a small proportion of responses being missed (discussion in *section 5.6.1*).

FGs were used to understand children's baseline knowledge of OH and sugar-snacking/nutrition. Additionally, for *study 1* the focus of interest in the results was the process of how the group functioned to determine any necessary changes

prior to *study 2* in relation to the questions and the answers relating to the other research tools (*section 5.7.3*).

The process for analysing the transcripts was informed and guided by Krueger (1998) and Bryman (2008):

- initially transcripts were read in detail a number of times
- when a 'concept' relating to the research questions was found within the transcript, they were marked and the section coded (see *appendix 17* for coding sheet and definitions)
    - Codes related to what happened, what children were doing, what they said about OH and sugar-snacking/nutrition, the context of quotes and impact of what they were saying
- when this same item reappeared across or within transcripts it was again coded
- the complete transcripts were coded, adding in new codes until all the transcript had been coded
- once all text had been coded each group of quotes relating to a code was pulled out from the main transcript
- following this codes were grouped into larger common themes

In relation to using coding to analyse FGs Krueger (1998, p17) writes "*perhaps the most useful strategy in qualitative research analysis is finding patterns, making comparisons and contrasting one set of data with another*" as such this occurred both across schools but also with the other methods. Within the results (*section 5.5.3.2*), similarly to the D&W, the FGs were considered with regards to trustworthiness as set out by Bryman (2008) and Yardley (2000) (discussed in *section 4.4.2).*

5.4.3 Testing the acceptability of the '*Brush Day & Night*' programme – Method of design, implementation, and data entry and summation

The following sections outline the design, implementation and data handling and summation for the second part of *study 1* around testing the acceptability of the '*Brush Day & Night'* programme with teachers and HS personnel. It also outlines

the details of face-to-face semi-structured parent interviews conducted to understand how the programme may integrate into the home.

5.4.3.1 Method: Design for testing the acceptability of the '*Brush Day & Night*' programme

5.4.3.1.1 Design of topic guide for teachers and HS personnel FG

This FG was designed to provide contextual information around how teachers report OH in year 2 and in schools, to begin to determine the suitability of the '*Brush Day & Night*' programme for English schools and identify any initial changes required (example information and consent forms can be found in *appendix 14). The* '*Brush Day & Night*' materials are designed to be accessible and relevant globally. As outlined in *chapter 3,* coincidentally many of the messages outlined in the DoH '*Delivering Better Oral Health'* toolkit are contained, in the '*Brush Day & Night*' materials. Prior to *study 2* a necessary step was to determine the initial perceived suitability of the programme to integrate into the year 2 National Curriculum (NC) within English schools as reported by teachers. The FG was designed to centre around four main topic areas:

- perceived differences in OH between Salford schools,
- teachers experiences of OH and OH related issues,
- how the school oral health programme (SOHP) would integrate in to different schools (across SES); specifically in relation to:
    - The teacher's pack – the power point slides, student worksheets, '*Teeth Chief*' cartoons and lesson guides
    - The parent's pack – the letter and information sheets
    - The children's pack – the brushing calendar and stickers
    - The supporting SOHP website
- The appropriateness of the '*Brush Day & Night*' programme for use in year 2 classes in Salford schools.

5.4.3.1.2 Design of parent face-to-face semi-structured interview guide

Face-to-face semi-structured parent interviews were designed to provide contextual information and some understanding of how the SOHP might transfer into the home and also how the SOHP may function in the home, given

information provided by parents. The interviews aimed to explore any facilitators and barriers parents had experienced in teaching their own children about toothbrushing.

Interviews rather than FGs were used to allow individual families to provide greater depth to their accounts around how brushing occurs in the home, how parents taught their children to brush and challenges they have with brushing.

5.4.3.2 Method: Implementation of testing the acceptability of the '*Brush Day & Night'* programme

5.4.3.2.1 Implementation of teachers and HS personnel FG

The FG was conducted by the main researcher and supported by a second researcher. Initially the teachers were provided with a short presentation giving an overview of OH across Salford and the '*Brush Day & Night*' programme (*appendix 15*). Teachers were also shown the SOHP website to highlight the features available to both support their delivery of the programme and children/parents taking part in the SOHP (www.brushdayandnight.com). This was accompanied by providing packs of all the materials to be evaluated as part of the research and background information to the project. This allowed the researcher to gain their views about OH and an intervention they had not previously seen.

Following this key outcome, questions were asked around the role of schools in health promotion:

- What are teacher's views on the role of schools in terms of general health promotion and OH promotion? Is there a perception of the impact on parental behaviour around health and OH?
- What are the perceptions of the current state of OH within individual schools and across the area?
- How has HS impacted health promotion within schools?

and in respect of the '*Brush Day & Night'* intervention:

- How could the literature be modified to best achieve behaviour change (to twice-daily brushing) in 6-7year olds?

- How could the literature be modified to be more relevant to families' thus increasing engagement of parents and other family members?
- How could the literature be modified to increase engagement of teachers and school 'system'?
- How could the website be modified to increase potential effectiveness of behaviour change?

A more detailed script was not produced to allow the teachers to express their opinions and to improve interaction between teachers taking part in the FG from different schools.

5.4.3.2.2 Implementation of parent face-to-face semi-structured interview

Short semi-structured face-to-face interviews (15 minutes) were conducted with parents to establish their own memories of being taught in childhood about the importance of OH. Sampling was opportunistic, asking parents if they would like to take part in a short interview around OH at the end of school and during a parents' evening. Prior to taking part the aims of the research were explained and participants were given details around their right to withdraw. Following this they were asked to provide verbal consent. All interviews were audio recorded to allow transcription.

Questions were divided into three parts relating to: their childhood, their children's OH and hygiene and nutrition. In addition to the questions outlined below, parents were asked further questions in relation to their responses (where appropriate).

Questions around parent's childhood:

- Can you remember when you started brushing your teeth?
- Do you remember anything about learning to brush as a child?
- Can you remember being taught anything as a child to help create the toothbrushing habit?
- What time of day do you brush?
- Can you remember anybody telling you about diet and your teeth?
- Did you, or do you, have any problems with your teeth?

Questions around their child's OH and hygiene:

- In terms of your own children what have you done about toothbrushing with them?
- Did any health professional teach you about technique or importance?
- From what age did your child or children start to brush morning and night?
- Do any of your children not like it, how did you cope with any issues?
- Do you help with any of child's brushing, or check their brushing?
- Do you ever brush with them at the same time?
- What types of toothbrush do they have?
- Where would brushing come in the routine?
- Do you visit the dentist regularly as a family?
- What do you think your children think about their teeth?

Questions around sugar-snacking:

- Do they ever have drinks after they have brushed? (questions did not specifically asked about night-time sugar-snacking to help gain a wider picture of behaviour at night relating to drinks)
- In terms of sugar in their diet are you conscious of that?

5.4.3.3 Method: Data handling around testing the acceptability of the '*Brush Day & Night*' programme

5.4.3.3.1 Data summation of teachers and HS personnel FG

The FG was voice recorded to allow transcription and analysis using the same method as outlined for the children's FGs (*section 5.4.2.3.3*). However, there were technical difficulties with the recording; therefore the two researcher's and the teacher's notes, taken during the FG, were used to generate the findings. To ensure trustworthiness of the findings member checking was used with the teachers along with dual analysis by two researchers.

5.4.3.3.2 Transcription and method of analysis of parent face-to-face semi-structured interview

These were transcribed and analysed following the same procedure outlined for the children's FGs (*section 5.4.2.3.3*) to allow analysis of common themes in relation to the sets of questions.

5.5 *Study 1* results

5.5.1 Characteristics of participants

Participant numbers are shown below.

Salford primary schoolchildren:

Within the sample there were n=43 boys and 11% more girls (n =54), with n=45 saying they were 6-years old and n=48 reporting they were 7-years old (*missing ages n=4*).

- Children's questionnaires n=97
- D&W n=50
- FG n=35 children took part in total

Variations in sample size between methods were due to FGs only being conducted with a subset of those with parental consent. Within one of the schools two year 2 classes completed the questionnaire but then due to other activities only one class took part in the D&W. However, it is often recognised that a sample of 100 is seen as adequate for initially testing the reliability and validity of a questionnaire (Peat, 2001; Wilson, Magarey & Mastersson, 2008).

Parents of 6-7 year old Salford primary schoolchildren:

- face-to-face semi-structured interviews n=10

Salford Teachers and HS personnel:

- FG n=1 (n=10 female participants)

5.5.2 Results: What is the face validity of the newly developed children's questionnaire as a new quantitative tool relating to toothbrushing and sugar-snacking for use with 6-7 year olds?

The children's questionnaire was tested for face validity in terms of the suitability of the language, the ordering of the questions and how the questions were perceived by the children. It should also be recognised that the research plan within this thesis consisted of a test-retest analysis on the children's questionnaire and comparison with an objective measure completed as part of *study 3* (*chapter*

8) allowing a more detailed understanding of the questionnaire to be gained during this study.

There were two questions children asked for support with more consistently than the others: Q10 ('*I always brush my teeth'*) and Q12 ('*Do you eat sweet things or have fizzy drinks before going to bed'*). Within Q10 some children struggled with the concept of '*always*' and other children did not want to tick 'yes' or 'no' as they forgot occasionally. Within Q12 some children were unsure about what constituted a sugary snack or a fizzy drink, as a result some examples were provided verbally. For Q6 ('*My mum helps me brush my teeth'*) and Q7 ('*My dad helps me brush my teeth'*) some children commented they did not answer as either, they only stayed with one parent or, one of their parents was not engaged in the toothbrushing routine for various reasons (e.g. shift patterns). Despite this no changes were made to the response allowed for Q6 and Q7 to allow children to mark not relevant as it was felt this would add too much complexity, but they could raise this or miss the question out. Variations in responses were found within the children's FGs when children talked about support in terms of either reminders from one of their parents (e.g. High SES "*My mum tells me*" and "*sometimes just so she makes sure I do my teeth she puts toothpaste on my toothbrush*") or not needing support when asked if anyone helps them or if they would like support.

As can be seen in *Table 5-3* with two of the questions (gender, Q1 and brushing before they sleep, Q4) there were no missing answers. Question 10 (*I always brush my teeth*) had the highest number of incomplete responses n=8 (8.2%) out of the n=97 which contained either missing or items unable to be coded (e.g. due to the addition of an extra box or the child had ticked both).

Table 5-3 Number of missing answers within the children's questionnaire (questions either not completed or not able to be coded)

	Q1	Q2	Q3	Q4	Q5	Q6
Total (n=97)	0	4.1% (n=4)	1.0% (n=1)	0	3.1% (n=3)	7.2% (n=7)
	Q7	**Q8**	**Q9**	**Q10**	**Q11**	**Q12**
	3.1% (n=3)	3.1% (n=3)	4.1% (n=4)	8.2% (n=8)	5.2% (n=5)	2.1% (n=2)

In relation to the 9 steps Peat (2001) outline for "*procedures to improve internal validity of a questionnaire*" (p123) the children's questionnaire was administered

as it was intended to be used within *study 2*. Throughout the questionnaire delivery feedback was sought from the children around questions. In terms of the time taken to complete the questionnaire as a class (approx. 15 minutes), this was deemed reasonable within the context of the rest of the proposed research tools. Upon completion of the questionnaire within *study 1* and analysis no questions were discarded or response options changed. This was because all the questions were deemed necessary and not too complicated for the children. Analysis of the questionnaire showed that the answers are able to contribute to the answers for the research questions and as shown in *Table 5-3* there was a limited number of questionnaires that had missing answers. The checklist for developing a new questionnaire and procedure for improving the internal validity as outlined by Peat (2001) has been both used and advocated by numerous studies developing a new questionnaire with both child and adult populations (e.g. van Teijlingen & Hundley, 2001; Wilson, Magarey & Mastersson, 2008)

Overall, the children's questionnaire showed that 6-7 year olds are able to provide answers relating to their current toothbrushing and behaviours nighttime sugar-snacking, and provide explanations for their answer if asked.

5.5.3 Results: What is the trustworthiness of FGs and D&W relating to toothbrushing and sugar-snacking designed for use with 6-7 year olds?

5.5.3.1 Results D&W trustworthiness

Prosser (1998) outlined 10 steps to help ensure a robust use of D&W (p281). Below the first 5 steps are reported (which were relevant for the pilot) and also how they were used/evaluated within *study 1* (adapted from p281):

- "*consultation regarding key questions to which answers were needed*" – as outlined in *section 5.3.2.1.1*, during the development phase feedback on the design of statements and advice was gained from a researcher who had experience using D&W. Alongside this, discussions were also had to ensure the statements not only answered the research questions within the study, but also complemented the other children's research questions.
- "*development of a research strategy from the questions*" – the implementation of D&W within this study is outlined in *section 5.4.2.2.2*. Printing the statements on A3 paper was designed to allow the children to

have a record of each statement while they were completing their answer. The time children were allowed to answer was guided by previous use of D&W with children of a similar age.

- "*pilot stage*" – the aim of *study 1* was to allow piloting of the D&W prior to *study 2* with results around context presented in *section 5.5.5.2* and below with regards the use and perception of the D&W.
- "*redevelopment of strategy*" – as outlined in *section 5.7.1* a number of edits were made to the statements prior to *study 2* to account for how they were received by the children during *study 1* and the answers that were provided.
- "*writing specific instructions for the teacher/researcher*" – guidance for the delivery of D&W was informed by the implementation section within *study 1*, with the implementation of the method for *study 2* (*section 6.6.2.2.3*).

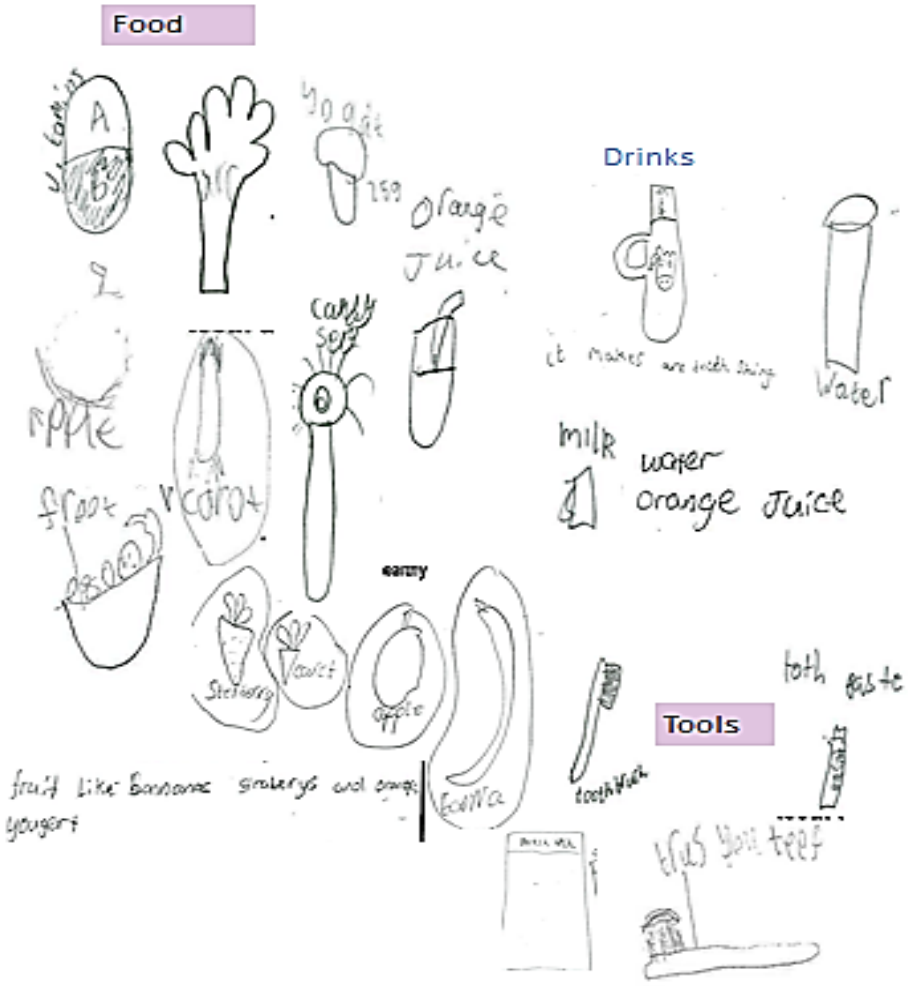
In order to understand how the children used the D&W within *study 1*, analysis was conducted around the method of answering and the number of items that could not be coded as part of the content analysis. Through this analysis it was found that a larger proportion of the children chose to draw their responses and then label the images, compared to those who chose to only write their responses (*Table 5-4* & *Figure 5-8*). For statements 1[53] and 2[54] over 60% of children drew and then labelled their responses. For the more complex statements (3 & 4) children were more likely to draw their response and not label or write their answer, and a higher percentage of children did not answer all aspects of the statements.

Table 5-4 Content analysis results for children's D&W in relation to the medium used to answer each statement

Statement Number	Drawing only % (n)	Writing only % (n)	D&W % (n)	Children who did not complete one of the parts of the statement % (n)	Children who did not complete any of the statement
1	35.4 (17)	2.1 (1)	60.4 (29)	2.1 (1)	n=2
2	35.4 (17)	0	64.6 (31)	0	n=2
3	36.2 (17)	6.4 (3)	27.7 (13)	29.8 (14)	n=3
4	30.6 (15)	2.0 (1)	20.4 (10)	46.9 (23)	n=1

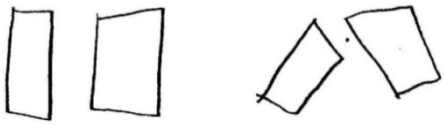
[53] Draw & Write how you think what we eat might affect our teeth and how it will affect them.
[54] Draw & Write what you think will keep your teeth healthy and how you can tell that your teeth are healthy.

Figure 5-8 Example of children's responses to statement 2[55]



As part of this analysis, it was found that in total 50 images were not able to be coded (approx. less than 1 image per child). *Figure 5-9* presents an example of a non-coded image drawn in response to the statement on problems with our teeth where it was not possible to determine, without interpretation, what the image represents.

Figure 5-9 Example of un-codeable image from D&W



[55] Draw & Write what you think will keep your teeth healthy and how you can tell that your teeth are healthy

5.5.3.2 Results: Children's FGs trustworthiness

To establish the trustworthiness of the children's FGs the concepts outlined by Bryman (2008) and Yardley (2000) are discussed below:

- Within the FGs the same method of delivery for each group was used within each school to ensure good practice occurred in the delivery of the research tools ('*Commitment and rigour*').
- Transcription allowed a more in-depth analysis than only using the audio files. The process of analysis of the transcripts allows greater transparency with the production of a theme coding sheet with basic definitions for others to follow. It is recognised by a number of authors that transcript based analysis of FGs, rather than analysis from only audio files produces the most rigorous analysis (Krueger, 1998; Onwuegbuzie et al., 2009).
- In relation to Yardey's (2000) '*sensitivity to context*' attempts were made to begin to reduce the power dynamics between the researcher (adult) and the children (e.g. through all playing the ice-breaker game, all sitting on the floor, and allowing children to read the main questions). Imbalance in power can impact outcomes, so there was a need to ensure the children knew their responses were important but also that there was going to be anonymity in the results.
- In order to help determine the credibility and rigour of the children's responses to the questions comparisons of outcomes were undertaken between the three different children's research methods ('*credibility*' and '*confirmability*'). This allowed for different accounts of the children's OH and sugar-snacking/nutrition behaviour, knowledge and attitudes to be considered to begin to allow confirmation of outcomes.
- As this study was a pilot, the outcomes were designed to inform any re-design of the research tools and provide some contextual understanding of the children's knowledge, behaviour and attitudes to determine the appropriateness of the SOHP ('*transferability*'). Although the outcomes provide some additional information for 6-7 year olds understanding the results should be considered within the context they were intended.

5.5.4 Results: What is the feasibility and acceptability of the new portfolio of research tools within dental public health research with 6-7 year olds?

Considering feasibility, within the schools the use of the three research tools with children were able to be implemented within the given time and also in the way it was intended. Within the schools the time allowed was normally the time between one break and the next break (between 1 and 1.5 hours).

Overall, the implementation strategies for each of the research tools were considered acceptable, both as stand-alone but also as a group of research tools. The order the research tools were implemented in (outlined in *Figure 5-5*) appeared to allow the children to move from their lessons to thinking about the topic of interest and then to move to more complex methods as the time in the schools progressed.

It was noticed that within the FGs the children in the low SES FG frequently required more support to answer, with questions having to be re-asked or re-phrased. It was evident through the FGs that as well as being able to answer the questions with less need for support, children in the high SES school had a better all-round level of knowledge on the topics. Additionally within the FG some children did not want to be videoed but were happy to be voice recorded; it was decided to allow them to take part as their responses were captured by one device.

5.5.5 Results: Contextual outcomes prior to *study 2* - Testing the suitability of the intervention materials for delivery in English schools

A necessary part of *study 1* was to determine if the intervention materials suitability for use with year 2 children (NICE, 2007; Bartholomew et al., 2011). The results are designed to illustrate answers to the following research questions:

- What level of knowledge do 6-7 year olds already have regarding toothbrushing and sugar-snacking?
- What are the habits, barriers and facilitators in relation to toothbrushing and sugar-snacking as reported by children and parents?
- Is the current SOHP material appropriate for use in English primary schools and what initial changes would be advised?

5.5.5.1 Children's questionnaire contextual results

Through the children's questionnaire, current reported brushing habits showed 71.9% (n=69) of children reported brushing twice-daily in the previous 24-hr time period (*Table 5-5*).

Table 5-5 Children's self-reported brushing frequencies using the children's questionnaire (*Q3 & 4*) and SPSS generated twice-daily brushing rate

Time of Day	Yes % (n)	No % (n)	Don't Know % (n)	Total n (missing n)
Morning	86.5 (83)	10.4 (10)	3.1 (3)	96 (1)
Evening	81.4 (79)	12.4 (12)	6.2 (6)	97 (0)
Brush twice-daily	71.9 (69)	19.8 (19)	8.3 (8)	96 (1)

However, when the children were asked in Q10 if they always brushed their teeth marginally more children (79%, n=70) responded 'yes', indicating a slight disparity in their reported brushing behaviour between questions that ask about brushing at set time points and questions that ask about brushing more generally.

As part of beginning to understand any barriers and facilitators children were asked about support with brushing, and over two thirds of all children reported having no support from either their mother (n=62, 68.9%) or father (n=70, 74.5%) (*Table 5-6*).

Table 5-6 Children's self-reported sources of support when brushing their teeth using the children's questionnaire (*Q6 & 7*)

Support with brushing	Yes % (n=)	No % (n=)	Sometimes % (n=)	Total n (missing n)
Mum	8.9 (8)	68.9 (62)	22.2 (20)	90 (7)
Dad	10.6 (10)	74.5 (70)	14.9 (14)	94 (3)

Further in relation to barriers and facilitators to brushing, despite 96.8% (n=90[56]) of children reporting hey thought it was important to brush (Q9), only 70.2% (n=66[57]) of children reported liking brushing (Q8). The decrease found in those who reported liking toothbrushing could, in part, be accounted for by the 19.6% (n=18) who reported they found toothbrushing difficult, and 8.7% (n=8) who sometimes found toothbrushing difficult (no (i.e. never found it difficult to brush) 71.7%,

[56] (no 2.2%, n=2; don't know 1.1%, n=1; missing n=4)
[57] (no 19.1%, n=18; sometimes 10.6%, n=10; missing n=3)

(n=66), missing n=5). During completion of questionnaires children explained difficulty in brushing in relation to loose/lost teeth, or molars that were difficult to brush through pain or not having the technique to brush them effectively.

In addition to understanding about brushing knowledge/behaviour, it was also necessary to gain an understanding about sugar-snacking behaviour. Within the children's questionnaire 56.8% of children (n=54) reported not having any sugary-snacks or drinks at night; with 26.3% (n=25) of children reporting sometimes having sugary-snacks at night. Only 16.8% of children (n=16) reported having sugary-snacks at night (Q12).

To begin to understand if there was any link between reported sugar-snacking and toothbrushing behaviour (the two targeted messages in the SOHP) a comparison of children's self-report of these behaviours was conducted. The majority of children (41.5%, n=39) reported brushing twice-daily and not having sugary-snacks at night (*Table 5-7*).

Table 5-7 Comparison of children's reported toothbrushing and nighttime sugar-snacking behaviour using the children's questionnaire

		Nighttime Sugar-snacking			
		Yes % (n)	**No % (n)**	**Sometimes % (n)**	**Total n**
Toothbrushing (in relation to 24-hour recall)	**Once**	6.4 (6)	10.6 (10)	3.2 (3)	19
	Twice	10.6 (10)	41.5 (39)	19.1 (18)	67
	Unsure how often brushed	0 (0)	4.3 (4)	4.3 (4)	8
Missing n=3	**Total**	n=16	n=53	n=25	n=94

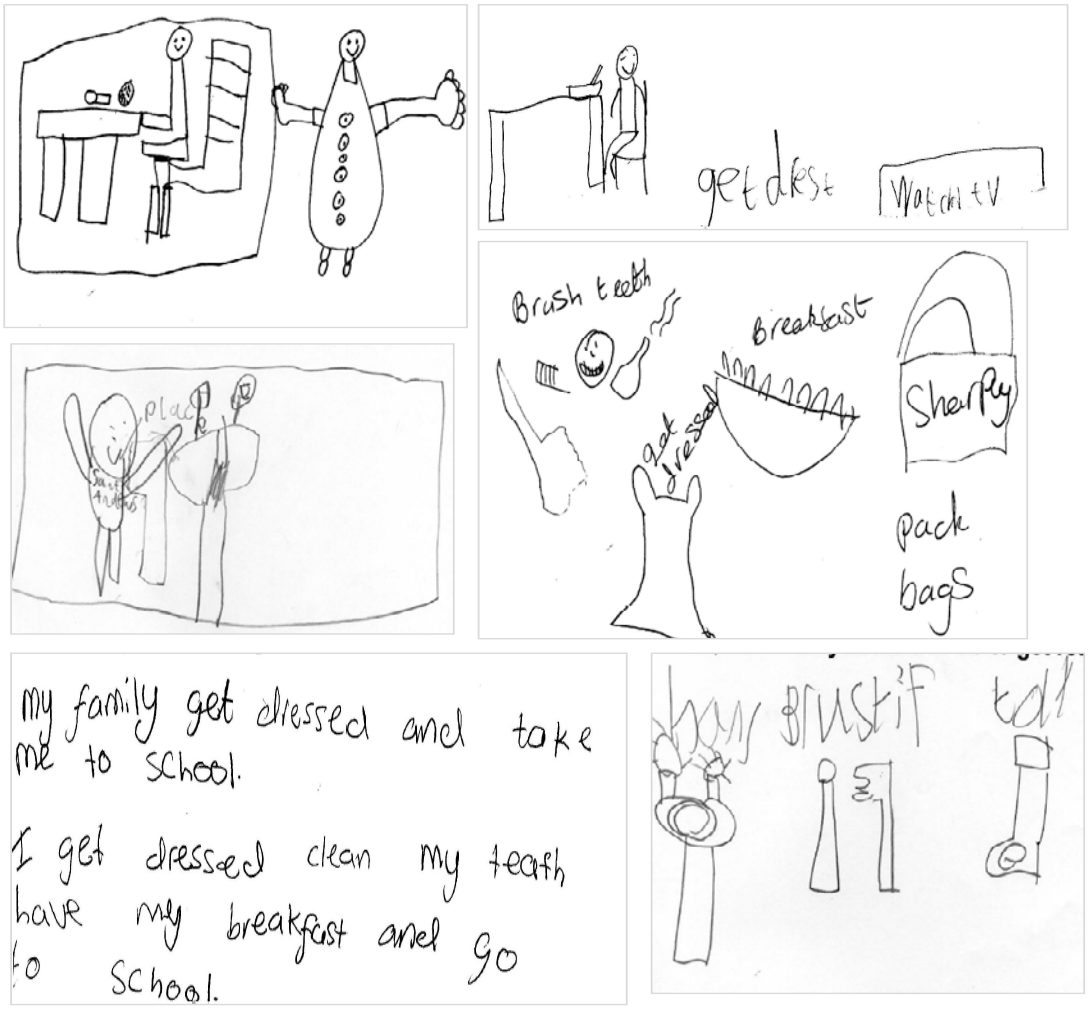
5.5.5.2 Children's D&W contextual results

Through the D&W it was possible to gain some greater detail to children's knowledge and behaviour. Within statement 2 there was limited mention of the tools used to help protect and clean our teeth (toothbrush = 12%, (n=6), toothpaste = 22%, (n=11), mouthwash = 0%); with no child depicting twice-daily brushing. This failure to mention toothbrushing and toothpaste for keeping our teeth healthy was also found in the children's FG; contrasting to the children's questionnaire where 94.7% (n= 89) reported using toothpaste. It may be that messages of healthy eating (e.g. '5 a-day') were promoted with more strength

compared to toothbrushing messages, so these were at the forefront of their thinking.

Within the D&W fewer children completed statement 3[58] around routines (n=33, 70%) which may have been due to the question's complexity and 36 of the images (72%) did not reference time of day. For those who included time of day, n=11 focused on the morning (22%) compared to n=2 for the evening (6%) routine. As seen in *Figure 5-10* (below) many images focused on only one or two behaviours children undertook at each time. Only n=9 (18.4%) answers contained images or words relating to toothbrushing.

Figure 5-10 Examples of children's responses to D&W *statement 3*



Through statement 4 children showed a moderate level of knowledge around what problems with our teeth would look like with respect to them being dirty (20%,

[58] Draw & Write what you and your family do in the mornings and to get ready for bed. Think about anyone that helps or tells you what to do, and what you have to do to get ready

n=10) and having holes (34%, n=17). There were lower levels of specific reporting around who to go to when seeking support if we have problems with our teeth (parents - 4%, (n=2), doctors - 2%, (n=1) to dentists - 4%, (n=2)).

Within statement 1[59] the children clearly demonstrated understanding around foods containing sugars being bad for teeth (*Table 5-8*). However, there appeared to be less knowledge around the impact of cariogenic drinks, with only 23 children mentioning fizzy drinks (46%). As the question did not directly ask about drinks, it is possible this affected responses. Two children depicted milk and apples as being both good and bad for our teeth.

Table 5-8 Content Analysis results from the D&W around 'How food affects our teeth'

Bad food Affect Teeth	D&W about % (n)	Did not D&W about % (n)
Sweets	78 (39)	22 (11)
Fizzy drinks	46 (23)	54 (27)
Chocolate	68 (34)	32 (16)
Crisps & Cake	36 (18)	64 (32)
Other[60]	50 (25)	50 (25)

For the second part of the statement about, how food will affect teeth, only one child answered in a simplistic manner stating, *"Crisps can get in your teeth*". However, this could be due to the statement, containing two parts being too complex.

From the results of statement 2[61] it can be seen that messages within the NC around '5 a-day' are understood, with many depicting fruit and vegetables (82%, n=41). Only 36% (n=13) of the children drew or wrote that milk can act as an aid to keeping our teeth healthy; with 20% (n=10) answering water. Only one child answered the second part of this statement in relation to milk making our teeth look shiny, which again could be a result of two parts being too complex.

5.5.5.3 Children's FG contextual results

From the FGs a very variable level of knowledge around OH, sugar-snacking and toothbrushing behaviour was evident. Overall, abstract concepts such as the

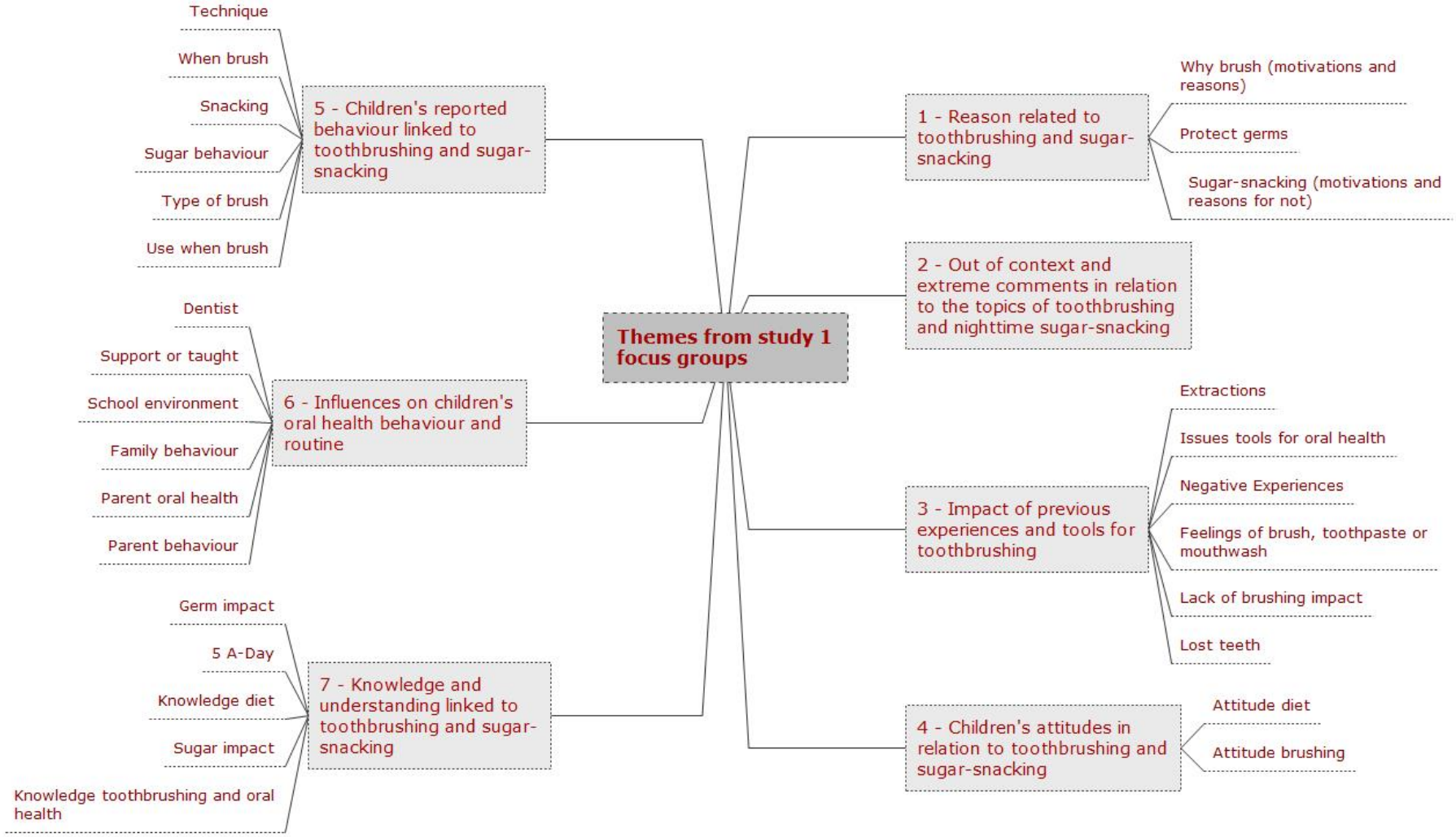
[59] Draw & Write how you think what we eat might affect our teeth and how it will affect them
[60] Most common other item drawn was ice-cream
[61] Draw & write what you think will keep our teeth health and how you can tell that your teeth are healthy

impact of germs and complexities of the impact of sugar on teeth were only described in basic terms, compared to more detail around what is good and bad for your teeth.

While the FG was able to capture children's current level of knowledge, this level of knowledge was variable for example those in the low SES group appeared to struggle to understand what germs were and how they affected our teeth saying, "*are they unclean*". When asked how sugar can affect our teeth one low SES child showed an understanding of the link between brushing and the impact of sugar "*all of the work you have done on your teeth will, will*", and then when prompted agreed with '*will stop*'; with another saying "*because they fall out*" and "*it makes them black*". Children in the low and middle SES group also appeared to have less developed understanding of the impact of sugar compared to the high SES children. However, some low SES children understood that you should not have sugar after you have brushed "*you have to have it before" and "or your teeth will get dirty again*". Through the FG children showed variable developmental abilities in relation to their knowledge with some children struggling and needing more prompts to answer each question.

In order to gain a fuller understanding of children's current knowledge and the suitability of the materials *Figure 5-11* presents a representation of themes which emerged through the FGs. There were seven main themes, which contained a number of sub-themes. Within the analyses there were places where sections were coded as being relevant to a number of the sub-themes (e.g. '*you have to go to the dentist and it hurts a lot and they pull it out*' was coded as being about both extractions and lack of brushing impact).

Figure 5-11 Theme map relating to the analysis of study 1 children's focus groups



Below is a description of each main theme and the types of quotes contributed to the theme. Detailed quotes are not provided for each theme (some quotes have been put in for illustrative purposes) as the analysis was carried out to begin to provide contextual information and establish the suitably of the research tool/materials.

Main theme 1 – Reason related to toothbrushing and sugar-snacking

The first theme was grouped together containing comments made by the children around what motivates them to brush and the reasons for brushing or not sugar-snacking at night.

Within this sub-theme the comments related to "*brush your teeth*" (low SES C1) or "*it [brushing] gets the germs off your teeth*" (middle SES C3) when the children were asked about germs and how we can protect against them.

Main theme 2 - Out of context and extreme comments in relation to the topics of toothbrushing and nighttime sugar-snacking

Within the FGs there were a number of comments that were out of context or out of line with the FG. These were often extremes in terms of experiences, behaviour or knowledge.

Within one of the low SES FGs there was one child who had experienced a number of dental extractions who also made comments that were grouped under this theme. As can be seen from the section below, although he said he had heard the dentist talking to his mum about sugar, this had not changed his views on sugar, later also referring to having a different type of teeth:

> Researcher– *So what does everyone else think? So you have your baby teeth and your adult teeth*.
> C3– *..and I have got these sugar teeth*.
> Researcher– *Sugar teeth, what are sugar teeth?*
> C3– *Black teeth…I never want to brush my teeth, sometimes I don't want get rid of the sugar between my teeth*.
> Researcher– *So why do you want the sugar between your teeth?*"
> C3– *so I can taste it*.

Researcher– *Is that because you like the taste of sugar?*

C3– *Yeah.*

C3– *I go to the dentist all the times and then when I were crying they were hurting me when they pulled my teeth and then they were hurting me and then I were crying and then I had to go to the doctor* (Researcher– *to get it all fixed?*) *to get all of them out*. (Researcher– *Does it still hurt?*) *I got all of them out but I have still got teeth there* (Researcher– *So you still have the bottom ones?*) *no not all of them just them ones there* (show front 4 teeth only).

Of note throughout the rest of the FG child C3 showed no sign that it was a problem having his teeth extracted or that it had caused a change in behaviour. This supports the finding that children's GA extraction retreatment rates can be up to 50% after 6 months (Amin & Harrison, 2009). The same child later said:

C3– I know all about germs but I heard them, I heard them they say to my mum you get decayed teeth.

Following the session the teacher explained extractions were an issue for the school through an increased need for speech therapy and support at meal times. Although this young boy was the extreme in the sample, there were other instances where extractions were discussed.

Main theme 3 – Impact of previous experiences and tools for toothbrushing

This theme related to experiences, attitudes and behaviour that were relayed by the children in the FGs that had an impact on their thoughts, behaviours, knowledge and current attitude towards OH and nutrition/sugar-snacking behaviours.

Main theme 4 – Children's attitudes in relation to toothbrushing and sugar-snacking

Within this theme comments made by the children that conveyed their attitude towards their OH and also their diets were coded.

Main theme 5 – Children's reported behaviour linked to toothbrushing and sugar-snacking

The fifth theme grouped together sub-themes that are related to the children talking about their behaviour both in terms of their OH but also their sugar-snacking behaviour. It also links in sub-themes around things which directly impact on them carrying out the behaviour.

Main theme 6 – Influences on children's OH behaviour and routine

The theme groups together sub-themes around influences on a child's OH behaviour, in respect to people and places.

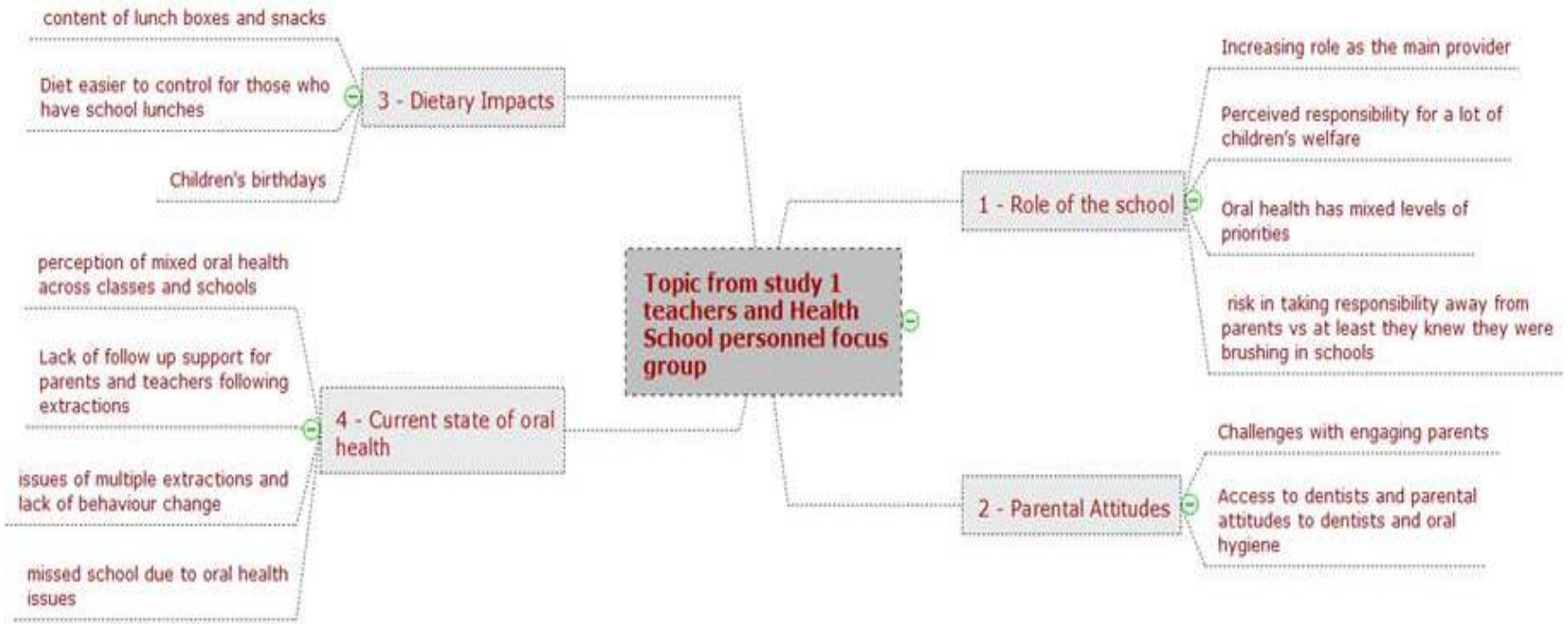
Main theme 7 - Knowledge and understanding linked to toothbrushing and sugar-snacking

This main theme related to contextual information that was provided by the children. As with the other methods within *study 1* this helped to determine the current level of knowledge that children have around topics prior to *study 2*.

5.5.6 Results teachers and HS personnel FG - Is the current SOHP material appropriate for use in English primary schools and what initial changes would be advised?

Figure 5-12 illustrates the key topic area identified which centred on perceptions of how schools are orientated in terms of health promotion and where OH comes within this. Prior to *study 2* these outcomes help provide details of how a new SOHP may integrate into Salford schools. It also helps illustrate how teachers view OH, which is likely to impact engagement with programmes.

Figure 5-12 Main topic areas from the teachers and HS personnel FG notes



Main topic 1 - Role of the schools:

- Increasing role as the main provider - Schools are increasingly being asked to be the main providers of health and other important behaviour for children rather than parents delivering the messages.
- Perceived responsibility for a lot of children's welfare - participants felt this now lies with the schools, despite the majority of health related activities taking place in the home.
- OH has mixed levels of priorities - some schools have components around nutrition and OH across different years and subjects.
- Risk in taking responsibility away from parent's vs at least they know they were brushing in schools - Although some schools had brushing programmes in the early years this was not always seen as positive. Some teachers felt there may be a risk in taking responsibility away from parents again but others viewed it positively saying that at least they knew they were brushing in schools.

Main topic 2 - Parental Attitudes:

- Challenges with engaging parents - this can be an issue for schools and with this project they felt it could be an issue.
- Access to dentists and parental attitudes to dentists and oral hygiene - seen as a key issue but one that is not easily tackled.

Main topic 3 - Dietary impacts:

- Content of lunchboxes and snacks - seemed to be an issue in some schools, can be difficult to change and not easy for teachers to control.
- Diet seemed to be easier to control for those who have school lunches - Teachers felt they can help ensure those who have lunches from school eat healthily and their snacks are healthy.
- Children's birthdays - Issues around birthdays and other times when children may bring in sweets - most schools seem to have put something in place to help stop this e.g. donate a book.

Main topic 4 - Current state of OH:

- Perception of mixed OH across classes and schools
- Lack of follow-up support for parents and teachers following extractions – perceived that it did not seem like schools or parents received much support – with schools having to deal with the effects of extractions e.g. speech problems and pain.
- Issues of multiple extractions and lack of behaviour change - Some teachers talked about children in their classes having multiple extractions but the families did not seem to change their behaviour. Perception that this can have an effect on the children in terms of their development or how other children treat them.
- Missed school due to OH issues.

Concerning the delivery of the intervention, teachers did not believe it was a problem that OH is not specifically in the NC in year 2 as it fitted with other topics and acts as good reinforcement when children are beginning mixed dentition. They felt that having the multiple methods in the intervention for reinforcement seemed to be a positive way of enhancing the intervention. To help with engagement with parents, teachers believed personalising elements to Salford would also help parents to feel more connected to the intervention.

5.5.7 Results of the face-to-face parent interviews - What are the current habits, barriers and facilitators in relation to toothbrushing and sugar-snacking?

Common themes that emerged during analysis highlighted some key issues important in the delivery of the SOHP such as how support, reminding and routines are reported to occur in the home. This begins to allow understanding how the SOHP may be integrated into homes and current toothbrushing routines.

In relation to barriers and facilitators to brushing behaviour, all of the parents recounted being taught to brush twice-a-day, with all but one saying this was by their parents. However, within the small sample they did not recall receiving any formal support from health visitors or within the NHS ‘Birth to five’ books around OH and toothbrushing. The impression of how parents remembered their

experiences of learning to brush their teeth, their own experience and their own knowledge of what was perceived as best impacted on their behaviour with their own children:

> *"Well I don't think she* [mother] *taught us correctly. I think more the dentist actually give a better view on the way to brush than my parents did"* (Parent 5).

> *"I've got really bad teeth, crowns… and I think it was just because my parents didn't educate us enough about dental health care. So I am quite conscious of it now with my daughter…just through the routine, with the bedtime routine. You know the fun toothbrushes. The singing toothbrushes, and flashing toothbrushes and stuff. The toothpaste that she likes and brush together"* (Parent 3).

All parents reported trying to encourage their children from an early age to brush, with fathers and mothers being involved in helping to teach their children. When asked if their children understood that it was important for them to brush their teeth, parents explained:

> *"I think they do because I say, rightly or wrongly, I will say to them that if you don't brush your teeth they will go black and fall out. So I think they think – oh I better look after the..."* (Parent 1).

> *"It is just part of the daily routine, you say have you brushed your teeth, so um 9 times out of 10 they have. I might have to remind them a bit more at the weekend as it is a different routine to in the week. I think they fair quite well with their teeth as far as children go"* (Parent 4).

The state of their children's OH was reported as important to parents both in terms of toothbrushing behaviour and ensuring they were regular not symptomatic dental attenders. All the parents interviewed stated that when they attended the dentist for check-ups, their children also attended.

Parents had mixed experiences with their children liking or resisting toothbrushing. This was also commonly reported in connection with toothpaste being 'too strong',

echoing the children's FG themes as this being a barrier (*section 5.5.5.3*). Parents reported they tried children's toothpastes but where possible would use the recommended family toothpaste for all:

> Parent 1– *"None of them liked it."*
> Interviewer– *"None? – so how did you get over that."*
> Parent 1- *"I can remember sitting on them, tickling them to death. No brushing teeth was a major thing in our house. Trying to get them to brush their teeth when they were little. Even to this day I have to brush certain children's teeth at night, as they are reluctant to do it themselves. They just think it's a bit of a hassle you know."*

> *"…well its getting her to do it some of the stuff – she doesn't like the toothpaste the spicy, so as soon as she is aware of that she stops. She more used to children paste – the sweet ones"* (Parent 5).

In order to facilitate brushing in the home one technique for overcoming the difficulty with brushing was explained through 'trade-offs' (e.g. stories). Within the SOHP being evaluated, rewards are designed to be given at the end of the month through stickers, which concurs with the parents reports, and recognises the need for motivation and reward while children are learning the behaviour. One mother explained her elder daughter's motivation to brush was more cosmetically orientated

> *"I think my daughter likes brushing her teeth – cos she got, would not say smelly breath but she has got quite a strong breath, you know her dad's got her into mouth wash now as well. As I think she likes the freshness of it, I think that was her motivation more than thinking about teeth, it just feels nice"* (Parent 1).

At present the NHS recommend children up to the age of 7 are supported in their brushing. Similarly within the SOHP materials parents are encouraged to support brushing and help reinforce the programme. However, many of the parents reported children younger than 7 brushing on their own or with supervision/checking:

> Parent– *"Erm I obviously brush my 4 years olds teeth although she sometimes insists on doing it herself."*
> Interviewer– *"Do you do it afterward if she does it herself?"*
> Parent– *"I do say can I check, she doesn't always let me as she is quite strong willed but I do try to check. And the other issue with her is toothpaste – she is a bit funny with toothpaste. She doesn't like the minty and then you try the strawberry – and then a week later 'I don't like that' so she will sometime just do it with water, which obviously isn't great."*

Another parent explained:

> *"She is fine, she will do it on her own now, where as we used to do it put the toothpaste on, but she is independent now... We supervise occasionally, but tend to leave her to it herself"* and went on to explain that although their child brushes independently *"We do tell her, er in the morning to do it otherwise if you don't she probably will just leave it, so you have to keep an eye".*

When parents were asked if they were taught about diet, one recounted, "*there was a connection between if you eat the biscuit you had to brush your teeth, I remember that*". One of the two key areas in the evaluated SOHP, and in terms of aiming to improve children's OH is reducing nighttime sugar-snacking. Within the interviews parents reported the children not having anything at night but those who did only had water ("*I don't encourage them to, any drinks that they have are regular sugar free – juice... I don't encourage them to have fizzy drinks*", Parent 4). The evaluated SOHP aims to raise the children's awareness around the impact of sugar. A barrier reported by all parents was despite knowing the adverse effect of sugar on teeth they said it was a problem to limit this in the children's diet (e.g. "*Yeah they do have too much sugar in their diet…Yeah it is hard. Um, I mean we do try to say its treat…"*). This is in line with findings by Smith & Freeman, (2009) where parents in Scotland reported struggling to restrict sugar in an environment where sugar is readily available (e.g. through sweets and fizzy drinks).

5.6 Discussion of the results of *study 1* and the impact on *study 2* and future OH research with 6-7 year old children

5.6.1 Lessons from *study 1*

Through this pilot to evaluate new methods of working with children in DPH, there were aspects of the methods that contributed to lessons that could be learned. There were a number of changes required to two research tools following *study 1* (*section 5.7*). The difficulty some children experienced with understanding the questions within the FG and the D&W could have affected their ability to contribute to outcomes in a way they wanted.

Due to the nature of the schooling system, where children are taught to try and get the correct answer and praised when they manage this, there is a risk of experimenter effects. This may have occurred despite constant reassurance that there was no right answer and the children needed to be honest. During the questionnaire some children explained their answers, which allowed understanding of their interpretation of the question and how their response fitted their answer.

Only one relatively small (n=10) teacher and HS personnel FG was conducted. More FGs were not conducted due to *study 1* being designed to gain only initial views and comments specific to the intervention being evaluated in *study 2*. Additionally, within *study 1* the teachers were not asked to try teaching a session only to provide their initial reflections on the materials based on their experience. A full pilot run-through of the programme was not conducted as pragmatically, at the time it was not considered feasible. Therefore obtaining feedback of the content/look of the materials was felt to provide sufficient detail prior to running the SOHP. Within *study 2* the SOHP was designed to be delivered in a set way (as outlined in *Table 6-2*) and as such it was also thought that by teachers providing the feedback on content/look of the material they would also be able to comment on how they envisaged the whole programme being delivered.

Within the teacher and HS personnel FG there was a technical issue with the recording equipment. To improve the trustworthiness of the findings member checking (Padgett, 2012) was carried out between the two researchers within the

FG and also the participants. This helped ensure notes taken were agreed by all and were seen as a reflection of the discussions that occurred.

Within the children's FG there were instances of limited interaction between the participants and the potential for questions around brushing behaviour to have been impacted by 'group think'. There were also limited instances of reduced audibility in the recordings. Both for adults and children Kitzinger & Barbour (1999) highlight challenges when participants *"interrupt or shout over each other*" (p15-16) but they also note this is often the time when the discussion is animated so is likely to be an area of interest to the researcher, with facilitators needing to learn how to manage this. However, Wilkinson (2011) recognises that "*transcriptions are not always complete…*" (p111) in part due to the nature of speech patterns and also the flow of conversations. Huang, O'Connor, Ke & Lee (2014) conducted a systematic review around ethical and methodological issues when researching with children on health topics and reported for the 30 included papers "*interview was the most popular data gathering method. In most studies, children were interviewed individually or in a focus group, while sometimes children were interviewed in pairs or with a friend"* (p. 14).

As the study by Huang et al. (2014) found there are many different methods used for researching with children and further research is needed into the most suitable method with children of this age to elicit more detailed qualitative responses (e.g. paired-interviews (e.g Chestnutt et al., 2012) or individual interviews (e.g. Irwin & Johnson, 2005)). Huang et al. (2014) highlight that in designing research with children there is a need to consider "*the age at which children are able to articulate their concerns and opinions has not been clarified"* (p. 15) following this with *"children's articulation might vary due to differences between research topics*" (p. 15). Although different methods (e.g. interviews) were considered FGs were used, due to their previous use with children this age, and considerations relating to researching children of this age. In this respect, FGs aim to minimise certain dynamics which can naturally occur between adults and children, through the facilitated discussions (e.g. power dynamics, reducing anxiety of taking part, engaging through activities) and taking away an intense focus some children may feel in individual interview (Smithson, 2000) Following *study 1*, and the analysis of

the FGs despite some of the challenges no change was made to the method used. It cannot be known if changing the FG method following the identification of some challenges in *study 1* (e.g. to individual/paired interviews) would have significantly impacted the outcome, this is a potential area for future research.

Within *study 1* the face validity of the children's questionnaire was determined. As such, this tool was not validated fully in this phase. This is recognised as a limitation; however it was aimed to be mitigated through the ability to compare responses across the other research tools (Greene, Benjamin & Goodyear, 2001; Bryman, 2012). Methods for validating questionnaires include gaining expert opinion and field testing (Peat, 2002). In this respect expert opinion was gained from a researcher involved in the design of the questionnaire this children's questionnaire was based on and also an expert in DPH. In addition, as the target of the questionnaire was children, they were considered to be experts and through *study 1* were able to talk about their answers and show the questionnaire was able to be used by 6-7 year olds to answer the set questions. Future research could also consider using 'think-aloud testing' (e.g. with adults French & Hevey, 2008; Gardner & Tang, 2014) with a cohort of children completing the children's questionnaire individually and discussing it with the researcher. This would allow detailed understanding to be gained around their answers and potentially improve understanding of the validity of their responses as an intermediary measure prior to a more robust test-retest study. Within *study 1*, this method was not used explicitly with children completing the questionnaire, but as the class were completing the questionnaire answers provided by some of the children were discussed with them. In addition, *study 3* had been planned and was designed to validate the tool against an objective measure through a test-retest study. This however was completed at a later date due to lack of availability of the data logging toothbrushes at this time (*chapter 8*).

5.6.2 Challenges of combining the research tools

Through this pilot there were a number of changes that needed to be made to two of the research tools used with children (D&W and FG, see *section 5.7*). This highlights the need to develop methods accounting for a 'bottom-up' perspective (Laverack & Labonte, 2000; MRC 2008, Bartholomew et al., 2011).

From the results of the three research tools it is possible to see that children are able to provide more detailed explanations of their answers to the questionnaire through the D&W and FGs. In relation to this Yardley (2000) writes that qualitative methods "*typically involve detailed exploration of the interwoven aspects of topics or processes studied, whereas quantitative studies more often employ a limited number of measures to summarise specific, isolated variables…*" (p215). The portfolio of research tools within this study aimed to combine the need for specific responses with more detailed explanation to gain a fuller picture of 6-7 years olds knowledge, behaviour and attitudes to OH and sugar-snacking/nutrition. This can also account for the finding that children report different things within different contexts and using different research tools. For example within the children's questionnaire most of the children reported not receiving support; however, during the FGs children more often reported their parents reminding or telling them when to brush, but this was not perceived as 'support' during completion of the children's questionnaires. Having a clear understanding as to how children define 'support' allows understanding of how intervention materials may be seen by the children and allow the use of definitions/language children use, which is vital in the design of effective interventions (Stewart & McWhirter, 2007; NICE, 2007; MRC 2000 & 2008). Demonstrating the importance of this insider perspective can only be obtained using child-centred methodologies.

Similarly through the D&W and the FGs when children were asked about how food can affect our teeth they responded differently. Within the D&W there was little reference to drinks and the focus was around '5 a-day', sweets, crisps and cakes. Within the FGs there was more reference to drinks – milk, water etc. and also children were able to elaborate on how food and drink can be good and bad for our teeth.

It is acknowledged that there are challenges of combining qualitative and quantitative methods, but that there is a growing recognition, especially within public health (PH), of the need to use a mixed-method paradigm (see *chapter 3*). Within the delivery of this study the children seemed to like and engage with all of the research tools, they also were able to develop their answers through the stepped approach from quantitative to qualitative tools (e.g. the questionnaire had the shortest answers with simple ticks; then the D&W allowed them to expand on

answers to some questions and finally the FGs provided a place to provide the greatest detail to questions verbally). Within this research each of the research tools looks at a slightly different perspective of the issue, but ultimately they all focus on OH, nutrition and sugar-snacking, adding the ability for them to complement each other. As some children did not want to take part in the FG, or complete aspects of the questionnaire, (which is their prerogative to choose), having the mixed-method approach improved the inclusivity. As the FGs were only conducted with a subset of the children, the D&W allowed those who were not taking part in the FGs to provide more detailed answers than in the questionnaire. This reiterated the value in their taking part and gave them further opportunity to contribute to the study.

As with any paradigm, mixed-methods have a number of strengths and weaknesses. Within this research some of the strengths of the combination of research tools are:

- The ability of pictures and children's narratives to add meaning to quantitative data; using a combination of methods has also allowed a broader set of research questions to be asked to both understand the tools and also gain contextual information prior to *study 2*;
- Through comparing the contextual results of each children's method it is possible to overcome some of the weaknesses that singular methods can have (e.g. issues around self-report in questionnaires);
- Collaboration of findings across methods also provides stronger support for conclusions that can be drawn (Johnson & Onwuybuzie, 2003).

Some of the weaknesses with the research tools that need to be considered are:

- Within the children's questionnaire, it is anticipated that over-reporting is likely to have occurred and should be taken into account when interpreting the results.
- Within the children's FGs some of the children took time to relax away from how discussions occur in class (i.e. putting your hand up to talk) and establish a conversation between different children (to establish the interaction within the FGs).

In addition, the mixed-method approach required the researcher to have skills in delivering different styles of research tools; and within this research it is felt that the pilot was also a learning experience for the researcher.

Using a portfolio of research tools, was felt to provide a greater understanding of the children's behaviour and views around OH and sugar-snacking, due to the increased depth and breadth of results captured.

Within *study 1* the interaction of research tools should be considered, as each method will raise the children's awareness around the topic. Within the school the same process and order for delivering the methods was used, so it is not possible to know if changing the order may have impacted the outcomes. Not changing the order of the delivery of methods was for practical reasons to allow work with the whole class before taking out a subset of the children. As a result, it is possible that some carryover or order effects occurred (Bryman, 2012), with the preceding tool influencing the answers provided in the next tool due to the fact the same or a sub-set of the same participants were used for each method. Within this study a concurrent design was used to collect the data, meaning there was always an intention to use the different data types to improve the understanding of the participant responses (Teddlie & Tashakkori, 2009; Creswell & Plano Clark, 2011). There is currently a dearth of literature around how the order of delivering research tools within mixed-methods research with this age children may impact outcomes when using a within subjects concurrent or convergent design.

5.7 Discussion – Modifications to the portfolio of research tools prior to *study 2*

5.7.1 D&W modifications following *study 1*

Following piloting, changes were needed prior to *study 2* to improve accessibility. These were as a result of children struggling with statements (e.g. because there was two parts to the questions and words they were unsure of) requiring wording to be adapted, or additional comments to help them understand. The second parts of the statements were commonly unanswered by the children suggesting they only focused on the first part. As the statements were designed initially in a top-down manner the problems of combining two elements in a statements around

understanding of a topic (e.g. effects of food) and then the reasons why these have an effect had not been fully appreciated.

Statement 1 was rewritten to make it less complicated to '*Draw & Write how you think what we eat might affect our teeth*'; Statement 2[62] remained unchanged. Statement 3 and 4 were too complex for the children to effectively understand. For *study 2* (*chapter 6 & 7*) the statements were simplified to only contain one part, with hints in brackets to standardise support:

- Statement 3 - '*Draw & Write what you do in the mornings and to get ready for bed'* (think about anyone that helps or tells you what to do, and what you have to do to get ready),
- Statement 4 - '*Draw & Write what you think it is like when we have problems with our teeth*' (who might be able to help and what might be done to help).

A limitation was the lack of opportunity to retest the revised D&W statements and FG questions (*section 5.7.3*) due to the timing in relation to *study 2*'s delivery. However, as the statements were less complex and the design accounted for how children answered them during *study 1,* within *study 2* it was anticipated that children should be able to answer them with greater ease than in *study 1* and also be able to fully convey their response to the simplified statements, rather than there being too many components to try and answer.

5.7.2 Children's questionnaire modifications following *study 1*

From conducting the questionnaire and talking to the children as it was completed, it was found they were able to understand the questions and what was required. As a result of this no changes were made to the questionnaire prior to *study 2*.

For Q10 ('*I always brush my teeth'*) children wanted to add '*sometimes*', however this was not added due to the nature of the question. For Q10 a handful of children added their own box for '*sometimes*', as they did not want to put '*no*' justifying this as "*I don't forget very often*". For these children the question was explained to them but they still felt '*sometimes*' was the correct response. Additional, one child reported they only sometimes forgot to brush their teeth, but more often

[62] Draw & Write what you think will keep your teeth healthy and how you can tell that your teeth are healthy.

remembered so this means they should not put '*no*'. These children were aware that '*no*' could be seen as incorrect so wanted to adapt the response to what fitted best with their perception of an acceptable response. An additional impact may have been that at the age of 6-7, perception of time over a longer period is still developing, but Droit-Volet (2012) highlight how young children "*process a basic mechanism that allows them to process time*" (p589) and as children develop they are able to better relate time to certain contexts.

For Q6 and Q7 around parental support, when talking in the FGs many explained they were reminded and this was seen as different to help. Despite some children seeing these two things as different the question was not changed as adding in 'do they support or remind you' was thought to be too complex. Instead it would be explained that helping could mean reminding as well as helping with brushing or getting the toothpaste on the brush.

Within *study 1* for Q12 ('*Do you eat sweet things or have fizzy drinks before going to bed'*) many children required examples or support to answer in relation to what constitutes a sugary snack (e.g. biscuits, sweets, fizzy drinks). However, the text for Q12 was not altered, as adding examples could potentially lead to incorrect responses if something that the child has that contains sugar was not on the list. Within *study 2* and *study 3* examples would be provided verbally, with children being able to seek additional supported where necessary.

5.7.3 Children's FGs modifications following *study 1*

From conducting the FGs, as well as gaining important information about the current levels of children's knowledge and behaviours, methodological issues were also highlighted. There was a need to adapt some of the original questions *(*shown in *Figure 5-3* & *5-4*) prior to *study 2* in relation to children's understanding and how the questions were able to elicit the desired responses (there were a higher proportion of altered questions in the OH FG, *Table 5-10)*. Questions in *Table 5-9* and *5-10* highlighted in bold (and shaded boxes) were rephrased in relation to children's understanding, need for prompts or added as a result of *study 1*. Additionally, questions were re-written to ensure they were not leading (e.g. '*Does sugar affect our teeth?' was changed to 'Do you think sugar has an effect on our teeth?*'). In both tables those with a * contained additional images on the slides.

Table 5-9 Revised OH FG questions following *study 1*

Did you brush your teeth this morning?
Did you brush your teeth last night?
Did you brush your teeth before school yesterday?
Does anyone help you to brush your teeth?
Who reminds you to brush your teeth?
Do you brush your teeth on your own or with someone else?
Who taught you about brushing your teeth?
What happens if we don't brush our teeth?
How can germs affect our teeth? *
What do we use our teeth for?
What do you like about brushing your teeth?
What do you not like about brushing your teeth?
What might happen if we have problems with our teeth? *
What other things help to keep our teeth healthy?
Are our baby teeth and adult teeth both important?
What can we do to help our teeth if they go bad? *

Changes in the sugar-snacking/nutrition FG related to improving understanding that the focus was not just food but also drink.

Table 5-10 Revised sugar-snacking/nutrition FG questions following *study 1*

Did you brush your teeth this morning?
Did you brush your teeth last night?
Did you brush your teeth before school yesterday?
Have you had any fizzy drinks or sweets today? *
How often do you have snacks between main meals?
If you have snacks or chocolate bars do you eat them all at once or in little bits?
Do you ever have food or drinks after you have brushed your teeth at night?
Do you ever have a drink during the night?
What might happen if we eat or drink once we have brushed our teeth?
How might food affect our teeth? – addition of images to help children
Do you think that sugar has an effect on our teeth?
How do you think brushing our teeth helps them?
What can happen if our teeth go bad? *
What are the most important things to keep our teeth healthy?
What can we do to help our teeth if they go bad?

In addition, the questions around access to a toothbrush were removed, because it was noted that not all children appeared comfortable with this question even in small groups and that some children reported not having a toothbrush.

5.7.4 The delivery of the portfolio of research tools used with the children

Following *study 1*, although changes were made to the individual research tools, no changes were made to how they were planned to be implemented as a package, as the timings of the data collection were not felt to be an issue.

5.8 Discussion - Is the current SOHP material appropriate for use in English primary schools and what initial changes would be advised?

A number of recommendations were made by the teachers about how the materials could be best adapted for use in England. Some of the changes were language orientated e.g. on the parents letter 'mom' to 'mum'. It was also felt by the teachers that the creation of a localised OH report *for parents (appendix 18) would* be beneficial as many may not be aware of the state of OH in Salford and this may help them understand the importance of the intervention, and a way of re-enforcing the three key OH messages[63].

To aid the delivery of the intervention and help to improve sustainability after the evaluation, copies of all packs and media were provided on '*Brush Day & Night*' USB drives. Teachers reported the benefit of not having to obtain material from the website or scanning/photocopying elements themselves. The USB sticks also allowed evaluation specific information to be located in one place electronically.

Note: it was not possible to make any changes to the supporting SOHP website that accompanied the programme for the studies in this thesis. As such the teachers were shown the website and provided their opinions, but changes as detailed below to mirror the changes to the printed materials were not possible. This was due to the global template used for the website.

[63] Brush twice-daily with a fluoridated toothpaste; visit a dentist regularly; don't have sugar snacks and drinks at nighttime after brushing.

5.8.1 Discussion of contextual results in relation to the SOHP materials and context

When provided with child-orientated research tools, the children were able to express their knowledge, beliefs and current behaviours in a manner that provided a valuable contribution to the research area and to help understand the suitability of the new portfolio of research tools.

From the children's reporting of their behaviour it can be seen they are able to self-report about toothbrushing and have an understanding of the reasons for brushing and what may happen if they do not brush. This suggests that year 2 children are able to understand about toothbrushing sufficiently to learn from the key messages contained within the SOHP. It is also clear from the FG and D&W that there are some aspects around germs and the impact of sugar which they understand less. This suggests that, the elements within the SOHP relating to germs, and the impact of sugar will be appropriate for year 2 children (with the additional slides – see *section 5.8.2*) to help them build their knowledge at an attainable level.

Within the parent interviews it was clear that parents felt children had mixed views on brushing and its importance (e.g. they would rather do other things than brush). It was also clear that as reported by the children only limited levels of support were being provided. It is anticipated that the design of the SOHP will allow parents to have something to use to remind the children and help children record their brushing using the charts. In addition having an activity that parents can support may also help to encourage greater engagement. Within the SOHP although the main targets are 6-7 year olds, parents are provided with information about OH and helping children learn key behaviours from 0-12. This provided the potential for other children in the family to also benefit from new knowledge gained by parents.

The teachers all recognised that OH and sugar-snacking were important topics, with many having experience of children who have had dental issues. The teachers felt that year 2 was a suitable age for the material but recognised some children may struggle compared to others. With this in mind, in response to the results in *section 5.5.6* and as outlined in *section 5.8,* some initial changes were

made to the programme (e.g. the creation of a Local OH report), and supporting the children (e.g. through addition of more slides).

Overall from the contextual results from *study 1* it is anticipated that children in year 2 have sufficient baseline knowledge to learn from the programme and understand the main messages/concepts. There are initial observable differences in the ability of the children to effectively communicate their answers according to the SES location of the school they attended, but due to the small sample size greater research would be needed to fully understand these. For example, through the FG and the D&W it was anticipated that some children with a lower level of ability may struggle with abstract concepts, reasons why and the process of dental decay linked to germs/sugar.

5.8.2 Lesson aids – Recommendations for adaptions to the lesson aids following *study 1*

To better support the planned lessons teachers suggested the addition of slides 1, 3, and 4 (outlined in black) - with images taken from existing graphics found in teachers' hand-outs (*Figure 5-13*).

Figure 5-13 Slides provided as part of the teachers pack showing the three additional slides developed as a result of *study 1*

5.8.3 Implications for delivery of intervention – recommendations for adaptations following *study 1*

Within *study 2* lessons were designed to be delivered once-a-week over the study period. This time-frame was deemed sufficient (in consultation with both a dental hygienist and an NHS Consultant in DPH) for any initial changes in behaviour to be observed in the children's plaque scores. The teachers were given flexibility to choose when within the week to deliver the lesson, allowing an understanding of

how they perceived the intervention would integrate into other NC subjects and their planned school days.

In England, teachers are required to produce lesson plans for all taught lessons. As a result of *study 1* lesson plans were produced by the researcher in conjunction with Unilever and issued as part of the revised pack (*Figures 5-14-5-16*). The additional lesson plans helped to provide greater structure to the lessons and ensure all the teachers understood what they needed to deliver. They also outlined activities that would help to promote certain behaviour e.g. to demonstrate brushing on the provided mouth model. All changes and the addition of extra materials relating to the '*Brush Day & Night*' SOHP were made by Unilever in conjunction with detailed feedback and approval provided by the researcher. This ensured the materials remained the same quality and changes did not interrupt intervention material designs.

Figure 5-14 Lesson plan developed for lesson 1 as a result of *study 1*

Lesson Plan

Teacher:	Year/Class/ability group: **2 (KS1)**	Subject: **Oral Health Programme**	Date:	Time:
Background about the class/group				Lesson Number: **1**
Prior Learning:	Resources: **Work sheet 1, Slides, Big mouth, teachers sheet 1(The Mouth, The Teeth and their roles)**		Curriculum Links: **PSHCE (3a,3b,3c) SRE (2i)**	
Vocabulary: **Incisors, canines, pre-molars, molars, primary teeth, mixed dentition,**		Aids: **Slides 1, 2, 3, 4 and 5, pictures of different stages of teeth erupting and types of teeth, videos 1 and 2**		
Maths /Literacy Unit: Success Criteria/Outcomes: **Able to complete Brush Day & Night Sheet 1 questions 1 – 3 correctly and understand the notion of Brush Day & Night**	Learning Objectives: • **To understand about the different types of teeth and their different uses** • **To learn about primary teeth and moving to having adult teeth** • **To learn about the importance of Brushing Day & Night**	Teaching Points /Input: • **The different types of teeth and what we use our teeth for.** • **The make up of the tooth and the functions of the different parts.** • **How we move from primary (baby teeth) through mixed dentition to adult teeth and the ages each stage of change.** • **The importance of primary teeth and why we have to be especially careful during mixed dentition.**		
Guided Activities: **At end of the lesson work through Brush Day & Night Sheet 1 as group but answers individually.**		Individual/Paired/Independent Work: **Possible discussions around what teeth they have lost and adult teeth they have in pairs of groups, and also draw or write about how they think teeth are important and why we need to brush them.**		
Home work: **Reminder about brushing at home and reward games on website for frequency of toothbrushing**		Teachers Comments:		
Children Absent from Lesson:				

Figure 5-15 Lesson plan developed for lesson 2 as a result of *study 1*

Lesson Plan

Teacher:	Year/Class/ability group: **2 (KS1)**	Subject: **Oral Health Programme**	Date:	Time:
Background about the class/group				Lesson Number: **2**
Prior Learning: **Lesson 1**	Resources: **Work sheet 2, Slides, Big mouth, teachers sheet 2 (The main teeth problems: Germs & Cavities)**		Curriculum Links: **PSHCE (3a,3b,3c) SRE (2i)**	
Vocabulary: **Dental decay, germs, enamel, acid,**		Aids: **Slides 5, 6, 7 and 8, graphics on page 2 of teachers sheet showing stages dental decay, videos 3 and 4**		
Maths /Literacy Unit: Success Criteria/Outcomes: **Able to complete Brush Day & Night Sheet 2 questions 1 – 3 correctly and understand the notion of Brush Day & Night in realtion to germs**	Learning Objectives: • **To be aware of how dental decay occurs and learn about the stages of dental decay** • **To learn how food affects the process of dental decay** • **To learn about the importance of Brushing Day & Night**	Teaching Points /Input: • **What are germs and how do they affect teeth** • **How cavities form** • **Exlplain how food and germs affect our teeth and mouth** • **How the acid in our mouth affects the enamel on our teeth** • **How food can frequency of food can effect our teeth**		
Guided Activities: **At end of the lesson work through Brush Day & Night Sheet 2 as group but answers the questions individually.**		Individual/Paired/Independent Work: **Possible discussions around germs and other types of to aid childrens understanding and discussion or drawing/writing around any dental decay problems the children have had or know someone who has had.**		
Home work: **Reminder about brushing at home and reward games on website for frequency of toothbrushing**		Teachers Comments:		
Children Absent from Lesson:				

Figure 5-16 Lesson plan developed for lesson 3 as a result of *study 1*

Lesson Plan

Teacher:	Year/Class/ability group: **2 (KS1)**	Subject: **Oral Health Programme**	Date:	Time:
Background about the class/group				Lesson Number: **3**
Prior Learning: **Lessons 1 and 2**	Resources: **Work sheet 3, Slides, Big mouth, teachers sheet 3(The main Solution Brush day&night with a fluoridated TP (& brushing technique))**		Curriculum Links: **PSHCE (3a,3b,3c) SRE (2i)**	
Vocabulary: **dentition, cavities, fluoride, remineralisation, demineralisation**		Aids: **Teachers sheet 3 (Brushing day & night with a fluoridated toothpaste), slides 8, 9 and 10, Videos 5 and 6**		
Maths /Literacy Unit: Success Criteria/Outcomes: **Able to complete Brush Day & Night Sheet 1 questions 1 correctly and understand the notion of Brush Day & Night**	Learning Objectives: • **To understand how brushing and flourinde help to protect our teeth and prevent cavities** • **To learn about the importance of Brushing Day & Night** • **To learn about the correct toothbrushing technique**	Teaching Points /Input: • **The preventability of tooth decay (cavities) through twice daily brishing with a flourids toothpaste** • **How fluoride works to protect our teeth** • **Demonstrate (or have class too) the correct brushing technique on the mouth model provided**		
Guided Activities: **At end of the lesson work through Brush Day & Night Sheet 3 as group but answers individually.**		Individual/Paired/Independent Work: **Possible work around other ways we can protect our teeth and other ways in which we get fluoride (milk, salt, varnish, mouth rinse, fluoride drops, some water in certain areas)**		
Home work: **Reminder about brushing at home and reward games on website for frequency of toothbrushing**		Teachers Comments:		
Children Absent from Lesson:				

5.9 Behaviour change techniques (BCT)

Following the completion of *study 1* the revised '*Brush Day & Night'* SOHP was re-analysed against the BCT. From the initial evaluation outlined in *Table 3-3* (see initial table for definitions and full list of 26 BCT), *study 1* led to the addition of 4 BCTs through the provision of detailed lesson plans. Through these additional resources and BCT they added it was hoped to increase both the sustainability and effectiveness of the intervention evaluated in *study 2*. Within *study 2* it was the updated version of the SOHP that was used (e.g. with lessons plans, local OH report and language changes).

Table 5-11 Comparison of original and additional BCTs found in the '*Brush Day & Night*' SOHP following *study 1* (adapted from Abraham & Michie, 2008)

Technique (theoretical framework)	Found in original '*Brush Day & Night*' SOHP materials	Additional BCT as a result of new materials produced as a results of *study 1*
1. Provide information about behaviour health link	Teachers' Materials and Pablo & Oliver videos	
2. Provide information on Consequences	Teachers' Materials, Teacher sheet 1 and Pablo & Oliver videos	
4. Prompt intention formation	Teeth Chief Cartoons (No. 4)	
5. Prompt barrier identification	Lessons	
8. Provide instruction		Teacher Lesson plan wk. 1
9. Model or demonstrate the behaviour		Teacher Lesson plan wk. 2
10. Prompt specific goal setting	Teeth Chief Cartoons	Teacher monitoring brushing calendar through lesson plan guidance
12. Prompt self-monitoring of behaviour	Children's Brushing Calendar	
14. Provide contingent rewards		Teacher Lesson plan wk. 3
15. Teach to use prompts or cues	*Brush Day & Night* – prompt for time of day	
21. Prompt identification as a role model	Teeth Chief Cartoons (No. 6)	
22. Prompt self-talk	Teeth Chief Cartoons	

5.10 Overall summary

This chapter presented the development, initial evaluation, and testing of a new portfolio of research tools (Children's questionnaire, FGs, and D&W) for use with 6-7 year olds. The main points relating to *study 1* are presented below:

1. describe the design of and pilot the feasibility and acceptability of the new portfolio of research tools designed for this research,

The pilot demonstrates 6–7 year olds' ability, when provided with age-appropriate research tools, to express their knowledge, beliefs and current behaviours in a manner that provides a valuable contribution to the research areas which is often under explored. This research reiterates the need to develop tools accounting for '*bottom-up'* perspectives, and as in this study, incorporate these in any redesign of the tools.

2. pilot the individual research tools in terms of their face validity (Children's questionnaire) and trustworthiness (FGs and D&W),

Within *study 1* the face validity of the children's questionnaire was tested (full test-retest conducted as planned in *study 3*). Additionally the 9 steps aimed at improving the internal validity of questionnaires, as outlined by Peat (2001), were used to help guide the assessment of the questionnaires validity.

For the qualitative methods, the trustworthiness of the D&W was explored using the initial 5 steps of the 10 step guide by Prosser (1998) and an analysis of how the children used the tool. Further, the trustworthiness of the FGs was explored in relation to different but related criteria set out by Bryman (2012) and Yardley (2000).

Through exploring the validity, reliability and trustworthiness of the methods s*tudy 1* allowed methodological changes to be made prior to *study 2* to help improve effectiveness of the research tools and intervention materials. Throughout *study 1* the children were able to report on and discuss their OH behaviour in terms of frequency, support and what they thought about toothbrushing. Importantly, the children's input allowed for a more '*bottom-up*' design to be incorporated into the new portfolio of research tools, and to redesign elements of the FGs and D&W prior to the use in *study 2*.

3. test the appropriateness of the '*Brush Day & Night*' programme from teachers' and HS personnel's perspectives, in order to understand any local adaptation required (supported through children's contextual results), and to ensure the '*Brush Day & Night*' programme was relevant for English schools prior to *study 2* (*Chapters 6* & *7*).

The FG with teachers highlighted the conflict between schools being increasingly expected to deliver health information and the location of many of these behaviours. The '*Brush Day & Night*' SOHP has a home element that aims to bridge this gap to where the behaviour naturally occurs, thus potentially improving the chance of sustainable behaviours being developed. Health promotion interventions need to be able to integrate with the wider NC (e.g. Science & English) not just focus on PSHE content for key stage 1 & 2. There are tensions between delivering the information, ensuring children have the opportunity to practice the behaviour and also ensuring support is given to form the habits in the correct environment. Teachers' perceived the SOHP to be suitable for 6-7 year olds (which was also reflected through the baseline knowledge the children exhibited) and through their input, some initial changes were made to ensure its suitability for use within the English NC.

4. to provide initial contextual information around toothbrushing and sugar-snacking relating to the current level of knowledge 6-7 year olds have, and how current habits, barriers and facilitators are reported by children and parents.

Contextually there were observable differences in the ability of the children to effectively communicate their answers according to the SES location of the school they attended. Future research needs to ensure the study is accessible for all children across different developmental abilities, as the sample size within this research was too small to fully determine the differences. It was evident through the FGs and D&W that children understood what was bad for their teeth, but struggled with why something was bad for your teeth (the more complex concepts). Many SOHPs (*Chapter 2*) include aspects relating to sugar and germs, so understanding the current level of knowledge is important to ensuring the materials are targeted at the right level, information and language. Hawkins et al. (2000) also reported younger and older children struggle with complete

understanding of germs and how they are involved in OH problems (e.g. plaque). Within *study 1* it was possible to gain some understanding of the way children define certain terms (e.g. support), which is important to understand for the design of interventions. Gaining the insider perspective around language use is only possible when children are engaged directly through child-centred research tools.

5.10.1 Chapter conclusion

Overall through conducting *study 1* there were a number of changes made to two of research tools (children's FGs and D&W), with no changes being made to one (children's questionnaire); further some initial changes were made to the SOHP materials prior to *study 2.* No changes were made to the implementation strategy for the research tools. Through these initial piloting procedures it can be deemed that the questionnaire had good face validity and the FGs and D&W had suitable levels of trustworthiness.

Study 1 adds to and strengthens the current literature around children's own reporting of knowledge, behaviours and attitudes towards OH and sugar-snacking, and begins to provide an insight into children's routines in the home through D&W. The chapter also further outlines a new portfolio of research tools that can be used (and adapted) by future research to provide greater insight into children's own reported behaviour (rather than proxy reporting) through the use of mixed-methods and inform the evaluation of complex interventions.

Chapter 6 - Study 2 - Conducting a child-centred evaluation of a complex school oral health programme – An exploratory matched cluster-controlled trial: clinical and behavioural outcomes

6.1 Chapter overview

Study 2 was an exploratory matched-cluster controlled trial (n=8 intervention and n=5 control clusters, n=256 children) with 6–7 year old children designed to determine intervention effectiveness. This chapter outlines how the '*Brush Day & Night*' programme and trial methodologies were delivered within schools:

- to determine the effectiveness of the School Oral Health Programme (SOHP) in relation to clinical outcomes (changes in plaque scores), self-reported behaviour (changes in self-reported toothbrushing behaviour and nighttime sugar-snacking) and knowledge outcomes from the children's and parent's perspectives (aim 3).

Study 2 used two different geographical areas matched by the Children's Services Statistical Neighbour Benchmarking Tool[64] (explanation in *section 6.4*) with similar health and economic profiles (Intervention – Salford; Control – Tameside, *section 1.3, page 31*). As the intervention was delivered to the whole class, clustering occurred at the level of the school rather than at the level of the individual (Worthington et al., 2001).

Reporting of *study 2* is divided into two chapters; within this chapter the methodology and outcomes of the SOHP intervention's effectiveness are discussed from the children's and parents' perspectives, in relation to clinical and behavioural outcomes and knowledge. A process evaluation is reported in *chapter 7,* along with the outcomes from the teachers' perspective.

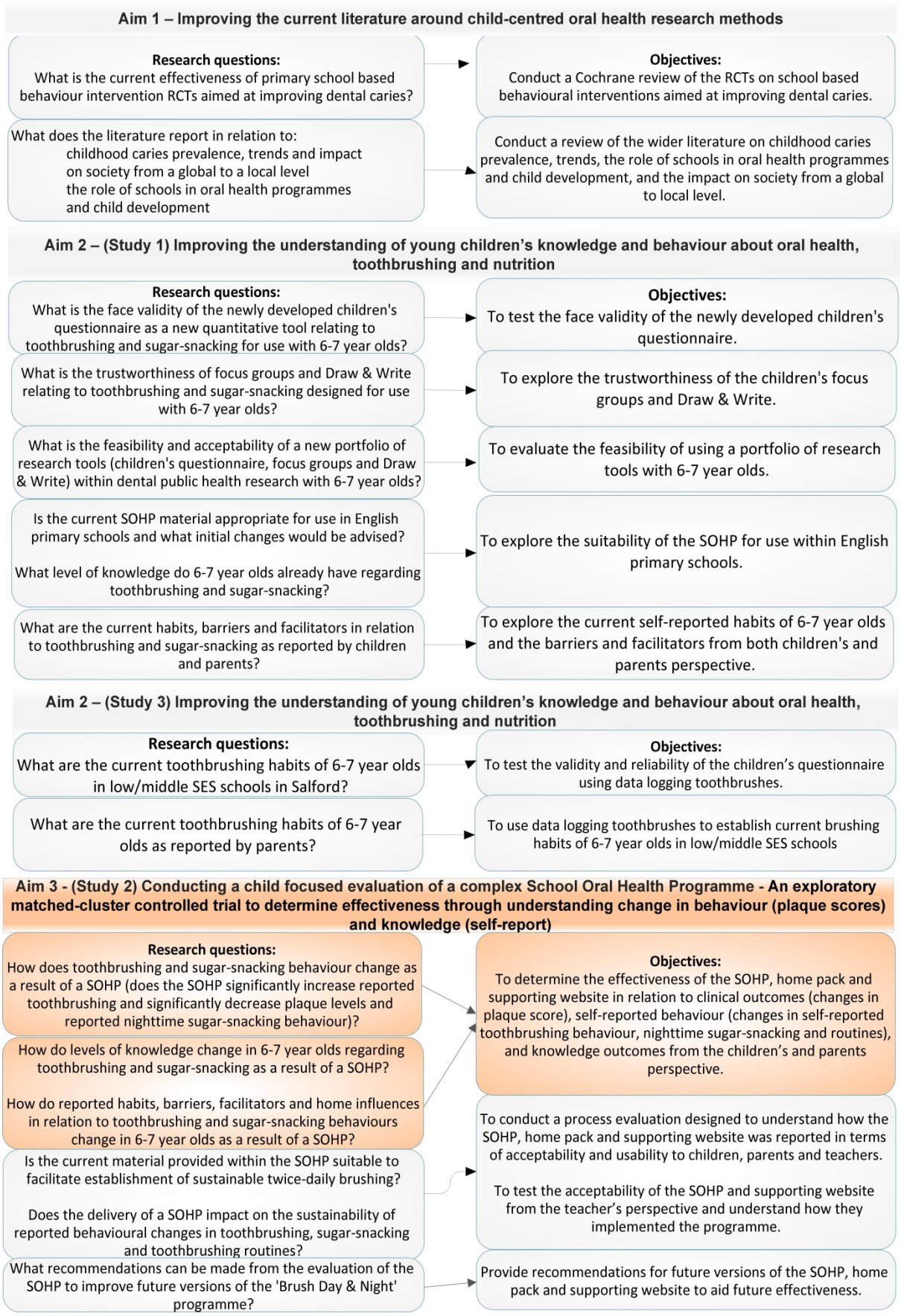
6.2 Study 2 research questions

Study 2 aims to answer questions related to aim 3[65] of the thesis (highlighted boxes, *Figure 2-1, below*).

[64] Available from http://webarchive.nationalarchives.gov.uk/20130405025149/http://education.gov.uk/rsgateway/db/sta/t000712/index.shtml

[65] Conducting a child focused evaluation of a complex School Oral Health Programme – An exploratory matched cluster-controlled trial to determine effectiveness through understanding change in behaviour (plaque scores) and knowledge (self-report).

Figure 2-1 The research framework for the thesis (Aim 3)



Within this study the primary comparison was baseline to post-intervention for study subjects within and between the two geographical areas, with sustainability of any change being measured at follow-up. *Study 2* used the following research tools:

- *Primary outcome measure:* Presence of dental plaque (changes in plaque pre and post-intervention).
    - Children's plaque measure (*Design 6.6.1.1.1; implementation 6.6.2.2.1; data entry and summation 6.6.3.1.1*)
- *Secondary outcome measure:* Behavioural outcome (Changes in children's self-report toothbrushing and nighttime sugar-snacking behaviour).
    - Children's questionnaire (*Design 6.6.1.1.2, implementation 6.6.2.2.2; data entry and summation 6.6.3.1.2*)
    - Parent questionnaire (reporting of their own and their child's behaviour - *Design 6.1.1.1; implementation 6.6.2.2.5; data entry and summation 6.6.3.2*)
- *Tertiary outcome measure:* Knowledge outcomes relating to toothbrushing, sugar-snacking and routines.
    - Children's focus groups (FG) (*Design 6.6.1.1.2; implementation 6.6.2.2.4; data entry and summation 6.6.3.1.3)*
    - Children's draw & write (D&W) (*Design 6.6.1.1.2; implementation 6.6.2.2.3; data entry and summation 6.6.3.1.3*)
    - Parent questionnaire

As outlined in more detail later on in this chapter during *study 2* the intervention group received the '*Brush Day & Night'* school and home programme. The control group had no additional activities between baseline and follow-up. Participants in both the intervention and control group completed the research tools at baseline, post-intervention and follow-up. With the intervention group completing process evaluation measures post-intervention and at follow-up (*chapter 7*). Baseline measures were taken prior to a 3 week delivery of the SOHP by teachers. Upon completion of the SOHP post-intervention measures were taken followed by a 6 month (from baseline) follow-up.

6.3 Specific ethical consideration when researching with 6-7 year olds

Ethical approval for this study was granted by University of Salford ethics committee (REP10/047, May 2010). Prior to implementation, the Healthy School (HS) Coordinator for NHS Salford and Tameside reviewed the SOHP and provided their approval. Permission for *study 2* to take place in each school was gained from relevant stakeholders.

All research methods used were deemed to have minimal risk of potential harm to children, with their anonymity ensured through participant codes. Each child and parent grouping was allocated a unique code, allowing cross-comparison. Data was collected, and stored following the '*Research governance framework for health and social care'* (DoH, 2005c). All paper records were kept in a locked, fireproof cabinet at the University of Salford. Electronic files and databases were password protected and backed-up at all times. Children's plaque recording sheets (with the child's name on the top) were kept in a separate room in locked cabinets. Schools were identified by their study number.

Parents were asked to provide informed consent for themselves and their children (The British Psychological Society, 2011, *appendix 19 & 20*). Children with parental consent were asked to provide verbal assent at baseline, post-intervention and follow-up, once the research had been explained (Porcellato, 1998).

6.4 *Study 2* trial design, power calculation and sampling procedure

Looking at the power calculation, guidance around the sample size for *study 2* was taken from Ashcroft, Burnside & Pine (2005) following a similar study that measured plaque, although it only contained an intervention group. The study by Ashcroft, Burnside & Pine (2005) reported a 22% reduction in the intervention group's plaque index post-delivery of a SOHP ("*1.8 surfaces to 1.4*", p12). This study informed the number of individual children that would be needed as part of this exploratory cluster-controlled trial, which was designed to evaluate the impact of the '*Brush Day & Night*' SOHP and also to inform future power calculations parameters (see *section 6.8.3*). Following consultation with a dental statistician (Burnside, personal communication), the calculated sample size of 300 children

(using 1 class per school) was required, equating to 150 children per group. This was a practical level of children for an exploratory trial and still allowed for variation between clusters to be analysed in relation to the primary clinical outcome (plaque) using a significance level of 0.05. This sample size allowed for 10% attrition of children during *study 2*.

Within *study 2*, for matching purposes two geographically separate but socio-economically comparable (benchmarking areas) areas within Greater Manchester were used. Benchmarking areas are the closest demographic neighbours to an area in relation to each background variable. For this study the children's services statistical neighbour tool was used which calculated relevant benchmarked areas [66]. From the available benchmarked areas (10 ranked in relation to closeness – all ranked very close) the control was located in Tameside (the only area at the time in Greater Manchester e.g. of others Liverpool, Knowsley, South Tyneside) and the intervention in Salford, with both being urban areas.

All primary schools within Salford (n=77) and Tameside (n=73) were included in the sampling frame, and were stratified according to socio-economic status (SES) which was determined using Free School Meals (FSM), ward Index of Multiple Deprivation (IMD) 2004 and data from the 2005/06 survey of the dental health of 5 year old children. The ranking table constructed as part of *study 1* (for all schools within Salford) was re-used. In addition, a ranking table for Tameside was constructed in the same manner (*section 5.4.1*). The number of classes needed to be sampled was calculated from the sample size of children and estimating the average number of children in classes to determine the number of schools to be invited. Sampling of schools was then conducted by taking schools from the top, middle and bottom of the ranking table, with invitations being sent to head teachers through the HS coordinators.

Schools were pre-selected into the control and intervention groups in relation to the geographical split used in the study prior to the consenting process (for discussion of the impact of this see *section 6.8.2*). To improve the quality of the matching process, in relation to the information shown in *Table 6-1* the expert

[66] Uses scores relating to: KS2 percentage of L4 English, maths & science; number of children killed or seriously injured by road traffic accidents (2010) and the percentage of looked after children for at least 12 months aged 10+ and were convicted or subject to a final reprimand during 2011.

knowledge of the HS coordinators were used as part of a post-hoc check to ensure that schools sampled had similar characteristics (other than the measurable quantitative factors, e.g. IMD). Post-hoc discussions with the HS coordinators following sampling of schools resulted, in advice being given of a need to change a sampled school, as conducting a study in that school would not have been appropriate following measures taken as a result of a recent inspection. Further, the HS coordinators' judgement was important in respect of their knowledge of factors around the matching, for example in relation to school ethos, and school engagement with the National Healthy Schools Programme (NHSP).

None of the schools, children, or parents had previously been exposed to the '*Brush Day & Night*' SOHP.

Table 6-1 School matching information for *study 2*

	School Number	MSOA 5yr olds Average dmft (2005/06)	MSOA 5yr olds% with decay experience (2005/06)	Ward 5yr olds Average dmft (2005/06)	Ward 5yr olds % with decay experience (2005/06)	Ward 2004 IMD	% entitled to FSM (FT) (2009)	Yr of Ofsted report	Overall grade Ofsted[67]	Overall Absences (%) (2008)	Persistent absences (%) (2008)	Effectiveness of early years foundation (KS1-2 cva)
Intervention	03/1	1.01	30	1.11	36	9.88	3.6	2006	2	4.2	1.2	2
	01/1	1.01	30	1.11	36	12.89	4.3	2008	2	4.8	0.8	3
	06/1	1.99	44	1.99	44	27.44	16.5	2009	2	6.5	1.1	2
	05/1	2.57	63	2.40	58	45.34	19.7	2008	2	4.9	1.6	2
	04/1	2.65	59	2.64	59	35.48	27.7	2009	3	5.3	1.7	2
	08/1	2.68	55	2.45	55	31.38	41.4	2009	3	4.8	2.6	2
	02/1	4.2	63	4.59	67	68.81	50.2	2008	2	6.0	2.2	2
	07/1	2.57	63	2.40	58	31.38	19.7	2008	1	4.7	1.1	2
Control	11/2	1.18	36	1.22	43	26.83	2	2007	2	FOI request data not provided		
							1	2009	3	4.0	0.9	
	13/2	0.98	35	1.44	48	27.06	22	2009	3	6.4	4.7	3
	09/2	2.72	47	2.76	50	36.24	9	2009	2	4.7	2.9	2
	12/2	3.41	59	3.25	63	30.97	28	2008	2	6.4	1.4	2
	10/2	Insufficient numbers examined to obtain valid outcome				26.83	31	2009	1	7.4	5.3	1

Key to table abbreviations:

NHS – National healthy school status achieved; WTEHS – School working towards the enhanced healthy school award

MSOA – middle layer super output area (mean populations 7200, NHS Data dictionary 2011)
IMD – index of multiple deprivation
FSM- free school meals
FT – full time children entitled to FSM
Overall grade – the grade provide by Ofsted in report as to the standard of the school
KS1-2 CVA - measures the progress of a child while attending the school accounting for circumstances schools cannot control

[67] 1 = outstanding, 2 = good, 3 = satisfactory, 4 = must be improved

The recruitment of intervention and control group parents and children used the following steps:

Parents of year 2 children in control and intervention schools: A letter, information sheet and consent form was sent to parents of all year 2 children within a participating schools class. The letter invited parents to consent to their children and themselves taking part in the study.

Intervention teachers: Year 2 teachers (who were responsible for delivering the SOHP) were provided with information sheets and asked to provide consent to confirm that they were happy to deliver the programme and provide their feedback as part of the process evaluation reported in *chapter 7* (*Appendix 22*).

Control teachers: Year 2 teachers in matched control schools were asked to allow children and parents within their class to be recruited and for the research tools to be conducted at baseline, post-intervention and follow-up.

(For figures relating to the flow of participants and final number of participant see section 6.7.1 and for discussion on the power calculation and impact of sample size on the outcomes see section 6.8.3).

6.5 Implementation and treatment fidelity of the '*Brush Day & Night*' SOHP

6.5.1 Brief synopsis of the design of the SOHP

As described in *chapter 3* (*section 3.4* and shown in *Figure 6-1*) within *study 2* the evaluated components of the SOHP were the:

- school programme delivered by teachers,
- 6 '*Teeth Chief*' cartoons,
- children and parents home pack,
- '*Brush Day & Night*' supporting website.

Within *study 2* there was no independent way to assess website usage, as such it was only possible to gain usage measures through process evaluation questionnaire feedback (detailed in *chapter 7*).

Figure 6-1 Snapshot of '*Brush Day & Night*' materials provided to teachers, children and parents in *study 2*

6.5.2 Intervention lesson delivery and measures taken in relation to treatment fidelity

In order to help ensure the fidelity of delivery of the intervention evaluated within *study 2* all intervention schools were provided with standardised procedures. Gearing et al. (2010) define intervention fidelity as the "*extent to which core components of the intervention are delivered as intended by the protocols*" (p79).

Each teacher was provided with a guide that outlined how the intervention should be delivered in terms of the lessons, worksheets and cartoons (*appendix 24*). It also outlined how *study 2* would be implemented, including the importance of feedback. Further, they were sent guidance around how the programme was intended for use and who it should be delivered to (*appendix 1 & 23*). As part of this teachers were asked to ensure delivery of the SOHP was as intended. Standardisation of the delivery of the 3 lessons was aided by lesson plans developed as a result of *study 1* (*Figure 5-14-5-16*) and a study specfic teacher guide (*Appendix 24*). These were designed to improve consistency of delivery, aid

understanding of facilitators and barriers to the SOHP, while trying to reduce individual teacher effects.

Meetings were arranged with the teachers when the school packs were delivered to provide verbal details about the content of the teacher's packs and children's folders and provide the opportunity for them to ask questions.

Prior to the start of the *study 2* teachers were asked to ensure they were familiar with the '*Brush Day & Night'* SOHP introduction sheet (*appendix 1*) so they had an overview of: the main aim of the lessons; the overall programme; and their role as facilitators. Teachers were instructed to ensure lessons were delivered in the correct order and they used the teaching sheets provided (1, 2 or 3) to help with delivery and provide all the information. Lessons were accompanied by relevant PowerPoint slides (*appendix 6*) to aid teaching.

Following the completion of each lesson teachers were asked to use the corresponding worksheet (1, 2 or 3) to help the children consolidate the lessons and then go through them as a class. The children's worksheets were contained in individual children's folders, to be given out after each lesson. Each folder had the child's name on the outside and sheets were numbered with their individual code (to ensure confidentiality folders were left at the school following completion of the study with only the worksheets removed). Teachers were asked to remind the children they needed to use the sheet in their folder and to put it back when it was completed. Upon completion of the worksheets teachers were asked to collect each folder for safe keeping.

In addition to the taught component, six '*Teeth Chief*' cartoons lasting between 3.45 and 5.25 minutes were provided on a USB stick. These were to be spread through the three weeks and shown during the lesson (two cartoons per 1-hour lesson), followed by a discussion. Each cartoon contained key messages around toothbrushing (e.g. the length of time to brush and when to brush) and sugar-snacking (e.g. not to have snacks after you have brushed your teeth). These messages were delivered by cartoon children who developed superpowers when they brushed to defeat the plaque'os who were trying to take over the town (symbolising the mouth).

Table 6-2 provides an overview of how the SOHP was run in schools and, who delivered aspects of the programme and how this corresponded to *study 2* research tools. The running of the SOHP was fixed over 5 weeks, with the initial and end weeks allowing for data collection and the middle 3 weeks consisting of a weekly 1-hour lesson. This timing reduced the impact of holidays on the intervention.

Table 6-2 Illustration of the delivery of intervention lessons in schools and corresponding *study 2* research tools

Staggered Week	SOHP Activity	Delivered by	Lesson content and teacher feedback – Whole class inclusive of those who have not been provided with consent		For children with positive consent and providing verbal assent
Week 0	Baseline research tools	Research Team (*section 6.6.2.2*)			Deliver all packs and resources to school. Home pack sent home via children for parents and children – baseline questionnaire sent to parents
Week 1	Lesson 1 '*Teeth Chief*' cartoon 1 '*Teeth Chief*' cartoon 2	Teacher	The mouth, the teeth and their roles and children's worksheet 1	Teachers' feedback to the researcher via lesson plan and online blog following each lesson	
Week 2	Lesson 2 '*Teeth Chief*' cartoon 3 '*Teeth Chief*' cartoon 4	Teacher	The main teeth problems: germs and cavities and children's worksheet 2		
Week 3	Lesson 3 '*Teeth Chief*' cartoon 5 '*Teeth Chief*' cartoon 6	Teacher	The main solution '*Brush Day & Night*' with a fluoridated toothpaste and children's worksheet 3		
Week 4	Post-intervention research tools	Research Team		Post-intervention teachers questionnaire	Post-intervention questionnaire completed by children and version sent home for parents
6 months	Follow-up research tools	Research Team			Follow-up questionnaire completed by children and version sent home for parents

6.5.3 Details of procedures relating to intervention school children without consent

For practical reasons, children who had not been provided with parental consent were still provided with children and parents home packs. They were included in lessons through un-coded worksheets and these were retained in a separate folder at the end of each session and study by the teacher. This process was implemented as it was not appropriate to exclude children from lessons or withhold home packs (they were only excluded from data collection).

6.5.4 Implementation in control schools

Within the control schools the teachers distributed letters and parent questionnaires as well as helping with selecting a sub-set of children with consent for the FGs. No other activities took place in the control schools in between data collection visits and they were asked to continue with their planned National Curriculum (NC) lessons.

Wait-list control: Following completion of the follow-up, control schools were provided with SOHP packs (both in print and electronically, including the cartoons), and a copy of materials given to parents and children. The delay ensured the SOHP was not used between baseline and follow-up, thus minimising contamination. Subsequent to the follow-up data collection visit all children in control schools (both those with and without consent) were provided with toothbrushes, toothpaste, pencils and rubbers but not brushing calendars due to the limited availability of these resources.

6.6 Trial methodology - design, implementation and data entry and summation of children's and parents research tools

Section 6.6 reports the design, implementation and data entry and summation of the research tools, for children then parents.

6.6.1 Method: Design of research tools

The following sections describe the design of the plaque measure (objective clinical outcome) and signposts to details about the children's research tools. The parent research tool is then detailed.

6.6.1.1 Method: Children's research tools

6.6.1.1.1 Design of Children's plaque measure (modified Silness & Löe)

Within *study 2* the modified Silness & Löe (1964) plaque index was used, which is a previously validated and reliable tool. This method has been used in earlier research with the same age group (e.g. Worthington et al., 2001; Vanobbergen et al., 2004; Tai et al., 2009) and within the evaluation study for the Unilever '*Signaline*' programme in France (Pine, 2007). The principal aim was to capture changes in oral cleanliness as a result of toothbrushing behaviour rather than total plaque volume.

6.6.1.1.2 Design of Children's questionnaire, D&W and FGs

Each of these tools was taken from those tested and redesigned as part of *study 1*, for details of their design refer to:

- Children's questionnaire - *section 5.4.2.1.1, p. 138*
- redesigned Children's D&W - *section 5.4.2.1.2, p. 141*
- redesigned Children's FG - *section 5.4.2.1.3, p. 142*

6.1.1.1 Design of Parents research tools - Parent questionnaire

The parent questionnaire (*Appendix 28*) was constructed from three parts:

1. A standard demographic questionnaire provided by NHS Salford used within their questionnaires (16 questions, personal communication, 2010) (p588-591).
2. The central part was based on the '*Finnish Family Competence Study'* (Mattila et al., 2005). This is a pre-validated questionnaire (33 questions) used with parents of young children in a longitudinal study in Finland, which contained questions in domains of interest to the study (p581-588).
3. The '*child routine inventory'* (now also referred to as '*child routine questionnaire'*) was incorporated to explore the role of children's routines within the home. A 5-part likert scale (never to nearly always) allowed parents to indicate how often the 36 statements occurred (p585-587). This was previously standardised for children from 5-12 years, and shows good internal consistency (CRI - Sytsma, Kelley & Wymer, 2001; Jordan, 2003). It targets behaviours relating to four domains: daily living, school/homework,

discipline and responsibilities in the home (Henderson et al., 2011). As routines within families may differ for children, relating to age, it was important the CRI responses only related to the 6-7 year olds taking part.

6.6.2 Method: Implementation of research tools

6.6.2.1 Overview of distribution methods and practices used within interventions and control schools

For both control and intervention schools *study 2* had a staggered start across different days over a 2-week period to allow time to use the different research tools with all the children at baseline, post-intervention and follow-up (*Figure 6-2*). Schools were visited, where possible, at the same time of the day on each occasion (baseline, post-intervention and follow-up) to improve comparability.

For intervention children with consent, packs were made-up and delivered to schools with the children's names on '*Brush Day & Night'* bags which contained:

- *For the children* – toothbrushes, toothpaste, pencil, rubber, 1-year brushing calendar and stickers,
- *For the parents* – age information sheets, local OH report, a letter about the stage of the study and the relevant parent questionnaire.

Named bags ensured the coded parent questionnaires and brushing calendars where taken home by the correct child. These were distributed by the teachers at the end of the school day corresponding to the running of the baseline measures.

School packs were also made up for each teacher with all required resources and a separate box with a folder for each child containing their numbered worksheets. An example of the distribution method and contents of items provided is shown in *Table 6-3* below (*Appendix 21* provides full details of packs in relation to cluster and consent).

Table 6-3 Example of how information and research tools were distributed in relation to consent groups

Folder Recipient	Contents in relation to SOHP	Research tools	Distribution method	Distribution Week(s)	Distributed by	Completed by	Coding method
INTERVENTION GROUP							
Children (Positive consent received)	Toothbrush, Toothpaste		Bag	Baseline	Teacher	For child to keep (Parent and child)	N/A
	Calendar and stickers						Child's Code
	Worksheet 1		Child's Folder	Wk 1		Child	Child's Code and for plaque exam also sheet with name and scores kept separately as a check
	Worksheet 2			Wk 2			
	Worksheet 3			Wk 3			
		Plaque exam	Dental Hygienist	Baseline, post-intervention, follow-up	Dental Hygienist	Dental Hygienist and Child	
		D&W	Research team		Research team	Child	
		Child Questionnaire					
		FG					
Parent (home) (Positive consent received)	Salford OH Report (constructed as a result of *study 1*)		Sealed Envelope	Baseline	Teacher in envelope to be taken home	For parent to keep	N/A
		Questionnaire		Baseline, post-intervention, follow-up		Parent	Parent Code
	Letter (consent)			With each questionnaire		For parent to keep	N/A
	Parent Pack			Baseline		For parent to keep	
		Parent Blog	Website	Wk1–6 months	Research Team via letter	Parent	

Note: There was no set homework within the intervention to complement lessons, with the home component consisting of the brushing calendars, parent information and the website which contained: additional information, activities and the ability to reward children with time on games.

6.6.2.2 Method: implementation of children's research tools

Figure 6-2 details how the portfolio of children's research tools was implemented within schools at each visit. Plaque exams were carried out by a qualified dental hygienist with experience of conducting exams in schools and for trials using the modified Silness & Löe plaque index (detailed procedure in *section 6.6.2.2.1* to minimise impact of time of day, where possible plaque exams took place at the same time of day). At times support was provided to the researcher by: teachers; teaching assistants; or colleagues, but the researcher led all processes.

Figure 6-2 Research tool data collection method per school visit for control and intervention groups

	Research tools carried out in parallel where possible			Carried out following other research tools
Research tools	Plaque Exam (Dental hygienist)	FGs	Children's Questionnaire	Children's D&W
Procedure for use of research tool	1 child at a time Procedure approximately 5 minutes per child	1 focus group – oral health 1 focus group – nutrition/sugar-snacking Time = ~30 minutes per	1 child at time – Children's Questionnaire Time = 5 minutes per questionnaire	As a class group Time = 5 minutes per statement
Children who completed research tools	All children with parental consent and providing assent	Groups of 6-7 children cross ability and gender from those with parental consent and providing assent	All children with parental consent and providing assent	All children with parental consent and providing assent

Prior to any of the research tools being delivered to the intervention and control group children the researcher explained to all those with consent the process of the data collection. For the plaque exam, questionnaire and D&W this was delivered within a class setting. The FG process was explained to those taking part in the area that the FG was to be conducted in. During this time it was explained that their responses were very important, that it was important that they were honest and just said what they thought. In addition, it was explained that it was not a test and it did not matter if they were right or wrong. Children were reminded that even if their parents had given consent that it was their choice to take part, that they would only be known by a number to ensure answers were confidential and if they decided they did not want to take part any more to just let a teacher or the researcher know.

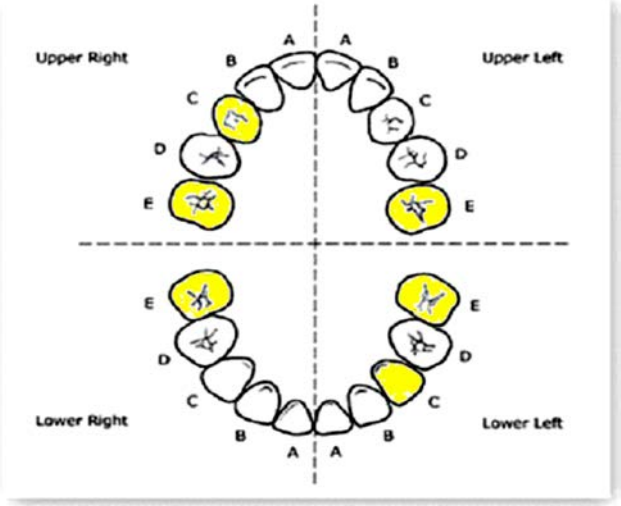
6.6.2.2.1 Implementation of Children's plaque measure (modified Silness & Löe)

All exams (baseline, post-intervention and follow-up) were carried out by the same qualified dental hygienist. Throughout all plaque exams lighting of the mouth was standardised through the use of the same portable dental light.

The Silness & Löe index was scored using a four point ordinal scale from 0–3. The mesial-buccal surface was scored on the 4 e's (second deciduous molar teeth) and the distal-buccal surface was scored on the upper right c (canine) and lower left c (*Figure 6-3*).

The prospect of having a dental exam was more daunting for some children than other parts of the research. It was important to reduce their anxiety by making sure that they knew it was voluntary and that there would be one of their classmates with them completing the children's questionnaire (adapted during the first session of *study 2*, *section 6.6.2.2.2).* If a child did not want to take part in the plaque exam but provided assent for the other research tools this was allowed (Shaw, Brady & Davey, 2011).

Figure 6-3 Illustration of teeth (highlighted in yellow) used for plaque assessment and scoring protocol used



0: tooth surface is clean	1:plaque seen after using probe adhering free gingival margin and adjacent area of tooth	
2: plaque is visible along the gingival margin	3: the tooth surface is covered with abundant plaque	9: surface excluded

The c's and e's are the deciduous equivalent teeth in children to the Ramfjord (permanent) teeth[68] used in adult Silness & Löe plaque indexes. The 6 teeth scored in adult exams are reported by Ramfjord (1967) to provide an accurate representation of an individual's overall periodontal status. Children aged 6-7 years are experiencing mixed dentition so measuring plaque on the front anterior teeth, which can provide a more direct measure of oral cleanliness, would not have been feasible. In this study no anterior deciduous teeth were included as these were likely to be shed or shedding for this age group; and the permanent teeth not fully erupted.

Prior to the examination the dental hygienists used a '*show-tell-do*' technique to help the children feel at ease (Clinical Affairs Committee - Behavior Management Subcommittee & Council on Clinical Affairs, 2011). Using a small mouth model they demonstrated how the probe was used, explained the procedure and why we were looking at plaque. This provided an opportunity for the children to ask questions and if they were nervous, decide if they wanted to take part. Sample probes allowed children to hold and try them on their hands to see how they felt.

[68] http://www.whocollab.od.mah.se/expl/ohisiloe64.html WHO oral hygiene indices description

The dental hygienist used a dental mirror and periodontal probe to firstly look at each tooth and then run the probe across the tooth surface near the gingival area to measure for the presence or absence of plaque (Silness & Löe, 1964; Fischman, 1986).

As part of the process children were asked to write the numbers relayed (in 2 groups of 3) by the dental hygienist on the pre-prepared sheet (*Figure 6-4*, *Appendix 26*), rather than the hygienist requiring assistance recording scores or having to remember them. It was felt this would help with alleviating anxieties about the plaque exam as the children became an important assistant, not just a subject. The dental hygienist checked the children were recording the correct numbers and provided assistance if necessary.

Figure 6-4 Example of plaque exam taking place and a child helping complete the child plaque record sheet

On completion of each exam the dental hygienist transferred the numbers to the data collection form to make any additional notes (*Appendix 25*).

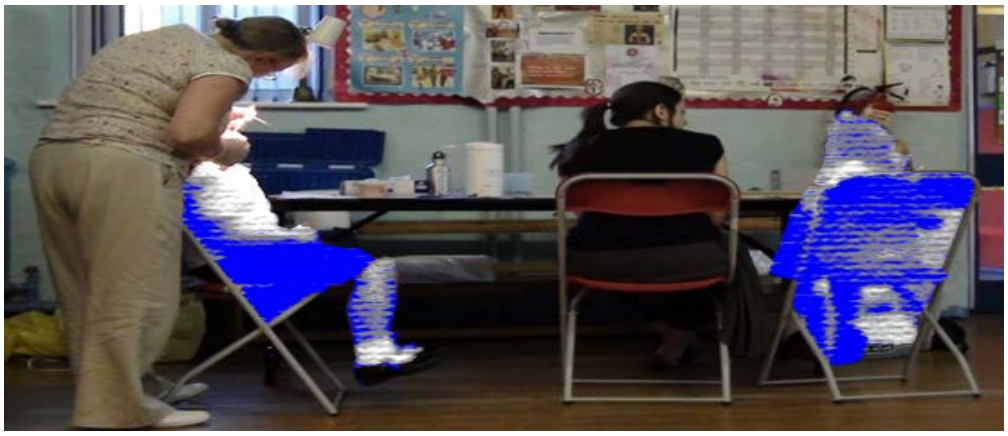
6.6.2.2.2 Implementation of Children's questionnaire

At baseline, post-intervention and follow-up children in both groups were asked to complete the children's questionnaire (*Figure 5-1*) on their own or with support if requested. Unlike the pilot where the questionnaires were carried out as a class, children completed the questionnaire while they were waiting to have their plaque exam (*Figure 6-5*). The change to completing the questionnaire not as a class (as

in *study 1*) occurred within the first intervention school, where being in pairs for the plaque exam and the children's questionnaire made the children feel more at ease.

The researcher or child read each of the questions aloud and then children were given time to answer before moving to the next question. As with the pilot, if the children required extra support with any of the questions, they were explained, being careful not to change the meaning.

Figure 6-5 Example of data collection set up for Children's questionnaire and plaque exam



6.6.2.2.3 Implementation of Children's D&W

The D&W sheets were prepared as in *study 1* using the revised statements (*section 5.4.2.2.2*) and distributed in class. It was explained to children that they were able to provide responses to statements by writing, drawing or using both methods. The statements were read aloud in turn to the children by the researcher and then they were allowed time to answer each question.

When necessary, children were provided with additional support from the researcher, but also if needed teachers, or teaching assistants. If children asked for support the relevant statement were re-read as it was written and then explained, without providing answers, to ensure it was the children's true views and opinions that were captured. For example, for statement 4 '*Draw & Write what you think it is like when we have problems with our teeth*' it would be explained to the children that we would like them to tell us what might happen to teeth if they go bad. If children wanted help with writing or to dictate a response support was

provided by the researcher, teacher or teaching assistant. This occurred during the completion of the D&W task with the child dictating what they were trying to write (either in conjunction with or instead of them writing) and the person supporting them with writing this. (*Figure 6-6* provides an example of support provided to a child).

Figure 6-6 Example of transcribing for children within the D&W once they have written their answers (Baseline - 03.1.073.3)

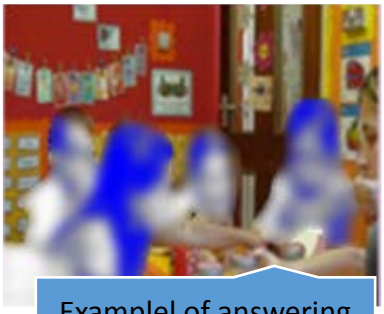
6.6.2.2.4 Implementation of Children's FGs

The FG methodology was implemented as per *study 1* (*section 5.4.2.2.3);* in a private space where children could be audio-visually recorded. Two mixed gender groups of 5-8 children were conducted each lasting up to 30-minutes (oral health (OH) and nutrition/sugar-snacking). As with *study 1*, teachers were asked to select a sub-set of children with consent that would provide a cross-section of developmental abilities and backgrounds within the class.

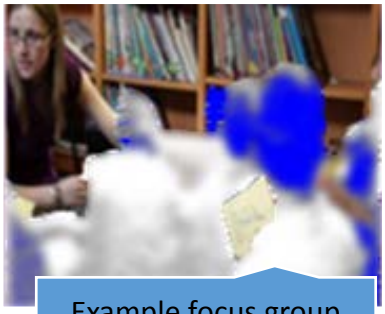
As with *study 1* (*Figure 5-2*) initially an ice breaker game was used to help the children feel at ease and ensure the FG was separated from a class exercise. This also aimed to reiterate that there were no right or wrong answers and they did not need to raise their hands as long as everyone was allowed to have a say. The revised questions from *study 1* (*Table 5-9 & 5-10)* were printed on A3 paper. As in *study 1* the questions were read aloud by the researcher, or if they wished by the children prior to each one being dsicussed.

Figure 6-7 Example of children's FG and interaction with props

Example of use of props



Examplel of answering sugar related questions



Example focus group with cards and props

6.6.2.2.5 Implementation of Parent's research tools – Parent questionnaire

The parent questionnaires were sent home via the children in individually coded envelopes. At baseline these were contained within the bags containing the children's home pack and the parent pack. At post-intervention and follow-up these were provided as named envelopes to take home. At the end of the school day, relating to each visit to carry out data collection, teachers were asked to give the envelopes to the children to take home to their parents. As parents were used to receiving forms to complete in this manner it was deemed a suitable delivery method compared to the researcher trying to deliver them to parents directly at the end or start of the school day.

At baseline, post-intervention and follow-up individually coded envelopes contained:

- A letter about the stage of the study (baseline, post-intervention or follow-up), and the questionnaire requirements (*Appendix 27, 30, 32, 34 & 35*).
- A copy of the questionnaire for completion - each questionnaire was pre-coded with a matching child code for comparison purposes.
- An envelope for returning the completed questionnaire to the school and a freepost envelope.

To ensure only parents of children present at each data collection point were sent questionnaires, parent questionnaires for those children who were not present on the day of data collection were not given to the teacher. This was designed to ensure only paired data would be collected from children and parents.

Completed questionnaires were returned either to teachers or via a freepost envelope directly to the research team. As with the children's questionnaires parents were advised support would be provided either in person or via the phone if required.

Additionally, as with teachers, parents were able to provide feedback via pre-set questions on the online blog (Appendix 29) with responses emailed to the researcher. Parents could also call the researcher to discuss their feedback, where notes where taken by the researcher during conversations.

For parents who did not return the questionnaire, within *study 2* it was not possible (or within the realms of working through the schools) to have children's home addresses to resend the questionnaires directly. For unreturned questionnaires teachers were asked to remind parents to return them. The importance of returning the questionnaires was also emphasised in the letters sent home for parents following visits to the schools (discussion in *section 6.8.2* and in *chapter 9*).

6.6.3 Method of data handling and summation of research tools

As outlined above, *study 2* was an exploratory matched cluster-control trial. Within this study there are differing data types (e.g. plaque is continuous data, the children's questionnaires are ordinal and the FG and D&W produced qualitative data analysed for themes), as such a number of different methods have been used to analyse the data.

Data is presented for the primary (change outcome), secondary (change outcome) and tertiary outcomes (which provide greater explanation of outcomes, qualitative measures) (see *p206* for details). The primary outcomes have been analysed to account for the clustering within the study. Due to the nature of the secondary outcomes it was not possible to conduct a multilevel analysis, so outcomes have been analysed descriptively, and using chi-squared to explore differences between the control and intervention groups. For the tertiary outcomes, analysis has been conducted to provide greater insight into the differences between intervention and control groups using primarily qualitative methods.

6.6.3.1 Method: Children's research tools

6.6.3.1.1 Data entry & summation of plaque measures (modified Silness & Löe)

At baseline, post-intervention and follow-up, individual plaque data was input into Excel 2010. To determine children's overall plaque scores, each score was added together and divided by the number of teeth examined to obtain an overall plaque index for each participant (Ramfjord, 1967). For example, scores of 0,1,1,0,1,0 the child's overall score would be 0.5 ((0+1+1+0+1+0)/6). If a child had missing teeth (99) these were not substituted so the overall score was only calculated for examined teeth (e.g. 0,2,99,1,99,1 overall plaque score would be 1 ((0+2+1+1)/4)).

The overall intervention effect (multilevel analysis) was calculated in SPSS 16.0 with support and guidance from a dental statistician (Burnside, personal communication); to ensure plaque data and clustering were accounted for correctly. Within the multilevel model the school was at level 2, with the children at level 1, using the plaque score at baseline as the covariate at child level.

6.6.3.1.2 Data entry & summation of Children's questionnaire

Children's questionnaires were coded into SPSS 16.0 using the children's unique identifiers. This allowed: tracking of responses throughout *study 2*, the ability to compare intervention and control groups, and where possible compare child and parent reporting. Data was evaluated descriptively and analysed to determine any significant changes in self-reporting between baseline, post-intervention and follow-up. As the data within the children's questionnaire was categorical (yes, no and don't know/sometimes) data was analysed in terms of frequency and percentages.

6.6.3.1.3 Data entry & summation of Children's D&W and transcription & process of analysis for Children's FGs

For Children's D&W analysis details see description in *study 1*, *section 5.4.2.3.2.* The Children's FGs were transcribed as in *study 1*, for details of the process for transcription and analysis see *section 5.4.2.3.3*.

6.6.3.2 Data entry & summation of parent research tool – Parent questionnaire

Parent questionnaires were coded into SPSS 16.0 using the parents' unique identifier. The mixture of question types enabled data to be analysed for frequencies/percentages and in some cases measured to understand the variance.

6.7 Results: *Study 2* clinical and behavioural outcomes

Sections 6.72-6.77 present results in relation to the following research questions, linked to thesis *aim 2*:

- How does toothbrushing and sugar-snacking behaviour change as a result of a SOHP (does the SOHP significantly increase reported toothbrushing and significantly decrease plaque levels and reported nighttime sugar-snacking behaviour)?
- How do levels of knowledge change in 6-7 year olds regarding toothbrushing and sugar-snacking as a result of a SOHP?
- How do reported habits, barriers, facilitators and home influences in relation to toothbrushing and sugar-snacking behaviours change in 6-7 year olds as a result of a SOHP?

6.7.1 Characteristics and flow of participants through the study

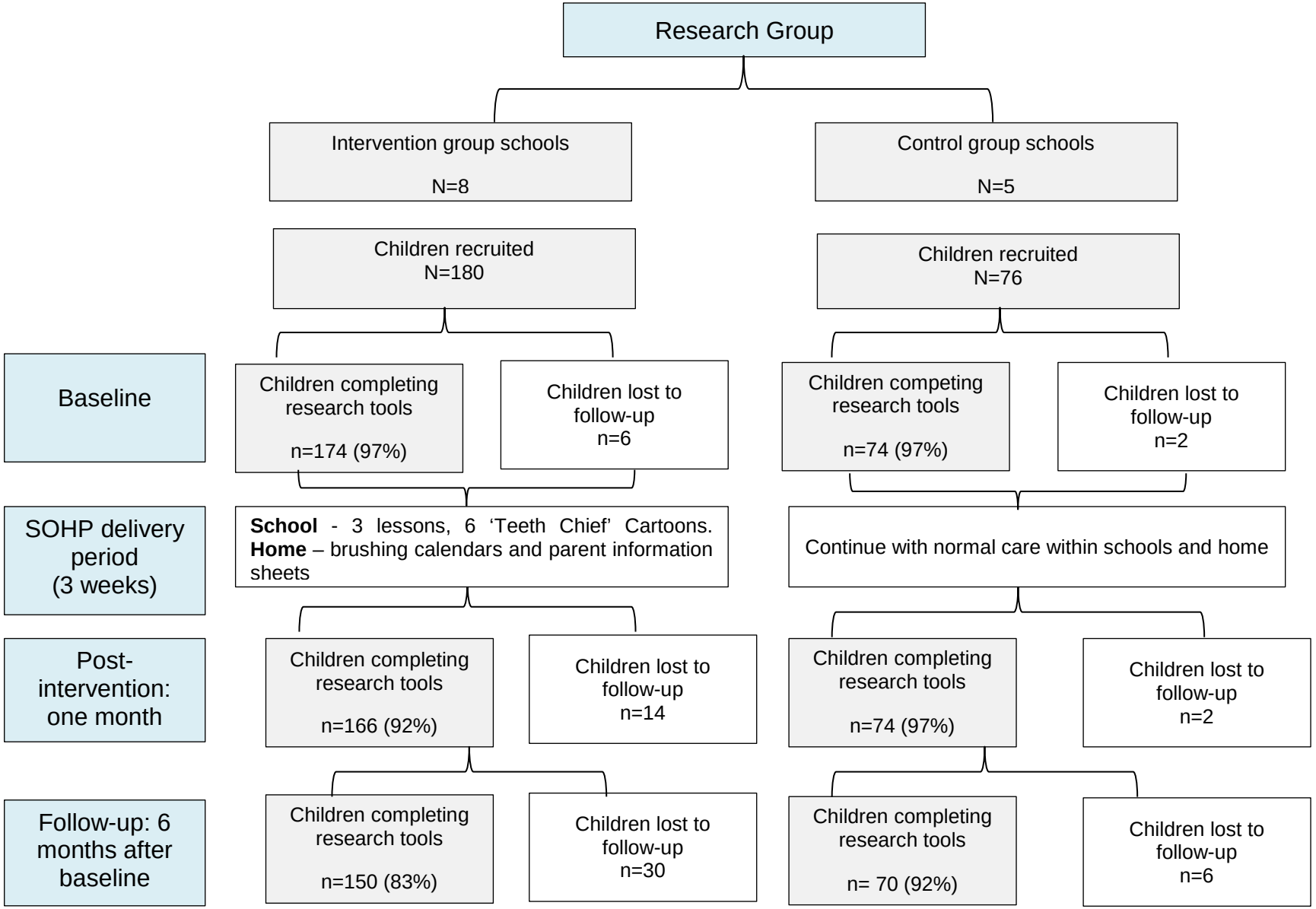
For **children** the achieved participant sample was a total of 13 classes from 13 schools (n=256 children). *Table 6-4* provides the baseline gender and age characteristics provided by the children, for both demographics there are some children who either did not provide this information or were missing for baseline measures.

Table 6-4 Breakdown of children in achieved sample with demographics provided using the baseline Children's questionnaire

	Schools/ classes (n=)	Children (n=)	Age in years		Gender	
			6	7	Boy	Girl
Intervention	8	180	n=31 (18.3%)	n=138 (81.7%)	n=82 (47.1%)	n=92 (52.9%)
Control	5	76	n=12 (16.7%)	n=60 (83.3%)	n=36 (49.3%)	n=37 (50.7%)

Figure 6-8 illustrates participant flow through the course of the study. As recommended by Eldridge & Kerry (2012) both the flow of individuals and clusters are included for clarity. Reductions were as a result of children leaving the school or being absent on the day of the data collection. The study ran from the start of the summer term 2010 to follow-up in December 2010.

Figure 6-8 Flow of children through each study phase



For the **parents** achieved sample overall the numbers of returned questionnaires were (*Note* - for discussion see *section 6.8.2)*:

- baseline n=93 (37.5%)
    - Intervention - n=43 (24.7%)
    - Control - n=50 (67.6%)
- post-intervention n=55 (22.9%)
    - Intervention - n=33 (19.9%)
    - Control - n=22 (29.7%)
- follow-up n=62 (28.2%)
    - Intervention - n=39 (26%)
    - Control - n=23 (32.9%)

In addition to returning the questionnaires, 3 intervention group parents provided information on the phone and via the blog.

Table 6-5 illustrates parents who completed the questionnaire at baseline, post-intervention and follow-up. In addition it highlights those who did not complete a baseline questionnaire but did complete one post-intervention. Finally, it shows those who returned a questionnaire at follow-up with this being: a) the first time they had sent one back, b) one's where there was no baseline completion (only post-intervention) and c) those who completed one at baseline but did not complete one post-intervention.

Table 6-5 Flow of completed Parent questionnaires across baseline, post-intervention and follow-up (*highlighted cells indicate those who completed questionnaires at all three time points*)

	Completed baseline	**Second completion post-intervention**	**Third completion follow-up**	New completions post-intervention (No baseline)	Completed post-intervention and follow-up	**Completed baseline and follow-up**	Lost data as no comparison point	
							Only complete post-intervention	Only completed follow-up
Intervention	N=43	N=16	N=10	N=16	N=7	N=8	N=9	N=15
Control	N=50	N=17	N=10	N=5	N=2	N=10	N=3	N=0

For those who returned the baseline questionnaire these were most often completed by mothers (although not always: 4 questionnaires were completed by different parents, e.g. mother (baseline) then father (follow-up)). *Table 6-6* (adapted from baseline characteristic reporting example in Campbell & Walters, 2014) presents baseline characteristics for returned baseline Parent questionnaires.

Table 6-6 Individual baseline characteristics of all parents who returned Parent questionnaires by intervention and control

	Intervention group			Control group		
	n	**Mean**	**SD**	***n***	**Mean**	**SD**
Parent's age	43	38.40	6.1	48	34.33	7.0
Number of children in the house	43	1.91	0.6	47	2.32	0.9

		Intervention group		Control group	
		n	**(%)**	***n***	**(%)**
What is your relationship status (missing n=3)	**Married**	32	(74.4)	31	(66.0)
	Single	1	(2.3)	8	(17.0)
	Divorced/separated	3	(7.0)	2	(4.3)
	Co-Habiting	6	(14.0)	3	(6.4)
	Other	1	(2.3)	3	(6.4)
Mother's education level (missing n=5)	**Primary school**	0	(0.0)	1	(2.2)
	Secondary school	17	(39.5)	16	(35.6)
	Further education	11	(25.6)	18	(40.0)
	Higher education	14	(32.6)	10	(22.2)
	No formal education	1	(2.3)	0	(0.0)
Father's educational level (missing n=6)	**Primary school**	0	(0.0)	1	(2.3)
	Secondary school	23	(53.5)	21	(47.7)
	Further education	9	(20.9)	16	(36.4)
	Higher education	11	(25.6)	4	(9.1)
	No formal education	0	(0.0)	2	(2.3)

From the baseline reporting it can be seen that within *study 2* parents who returned the questionnaire most frequently reported being married; with fathers most often being educated to secondary school level, whereas mothers education levels were reported as being more evenly distributed across secondary, further and higher education.

6.7.2 Results primary outcome measure: Presence of dental plaque - How does toothbrushing behaviour change as a result of a SOHP, home pack and supporting website?

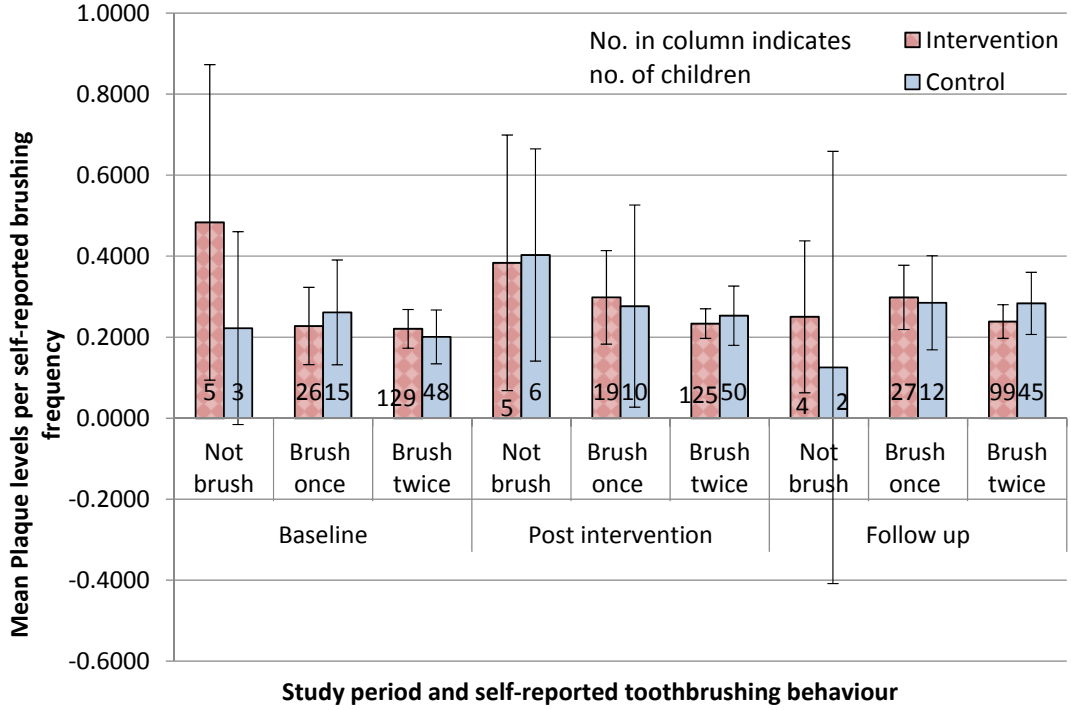
Through multilevel analysis overall there was no significant difference across each group at each time point (baseline, post-intervention and follow-up), indicating there was no overall intervention effect (Baseline-post-intervention $F(1,11.41) = 0.39$, $p=0.546$; Baseline-follow-up $F(1,14.44) = 0.63$, $p=0.439$, Post-intervention–follow-up $F(1,14.59) = 0.32$, $p=0.579$). The implication of this is that it is not possible to conclude that the evaluated SOHP had an impact on the presence of dental plaque.

Table 6-7 Overall children's mean plaque scores

	Intervention group	Control group
Baseline	0.174 (*SD* = 0.200) (n=174)	0.231 (*SD* = 0.222) (n=74)
Post-intervention	0.248 (*SD* = 0.213) (n=166)	0.315 (*SD* = 0.285) (n=74)
Follow-up	0.266 (*SD* = 0.210) (n=150)	0.306 (*SD* = 0.242) (n=70)

For those children who had both a plaque measure and self-reported toothbrushing behaviour the graph in *Figure 6-9* illustrates the impact of children's self-report brushing frequency at baseline, post-intervention and follow-up by group in relation to the mean plaque scores. At baseline and post-intervention those children in both the control and intervention group who did not brush had higher mean plaque levels compared to those who brushed once- or twice-daily, but this was not found at follow-up. At baseline within the intervention group the mean plaque scores of those who brushed once (mean 0.228) was very similar to those who brushed twice (mean 0.221); however, in the control group those who brushed twice (mean 0.201) had slightly lower mean plaque scores than those who brushed once (mean 0.261). For both groups, although not a significant difference, as can be seen in *Figure 6-9,* at post-intervention and follow-up the mean plaque scores for those brushing twice-daily (post-intervention – intervention group 0.233; control group 0.253; follow-up - intervention group 0.239; control group 0.283) were lower than the mean plaque levels for those who only brushed once-a-day (post-intervention – intervention group 0.298; control group 0.277; follow-up - intervention group 0.298; control group 0.285).

Figure 6-9 Intervention and control groups children's mean plaque scores versus self-report toothbrushing behaviour (with 95% confidence intervals for plaque scores)



6.7.3 Results Children's questionnaire: Secondary outcome measure - Behavioural outcome (Changes in children's self-report toothbrushing behaviour and reported night-time sugar-snacking behaviour)

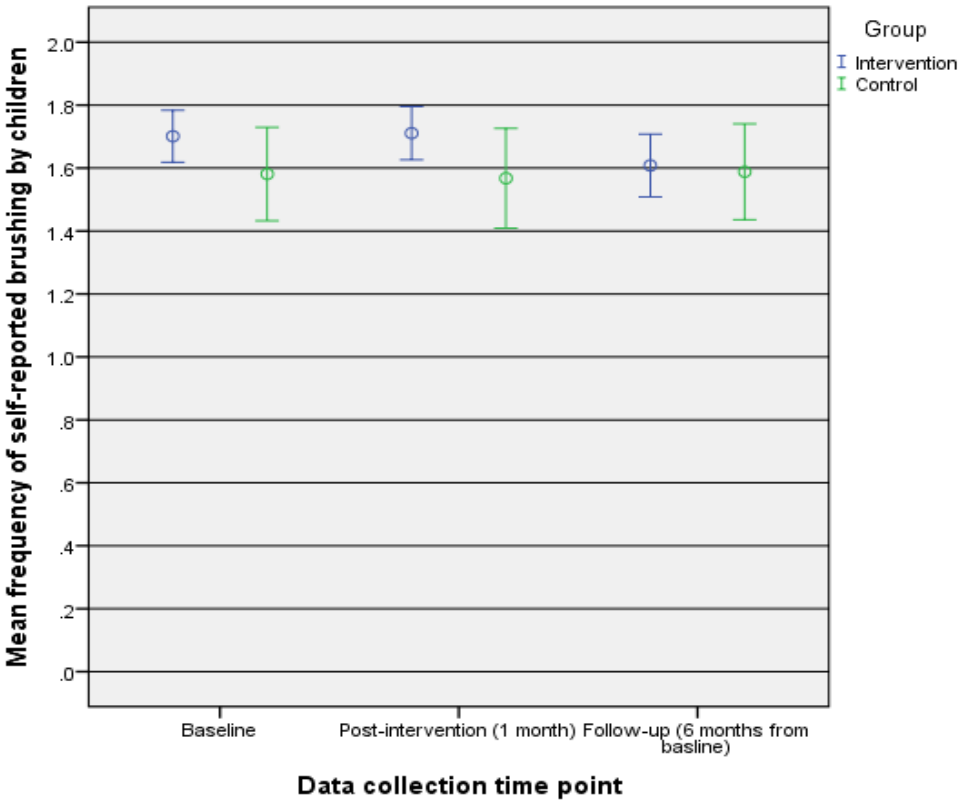
The Children's questionnaire, throughout *study 2*, showed relatively stable toothbrushing rates for both the intervention and control groups (*Table 6-8*). At baseline, post-intervention and follow-up there was no statistically significant association between reported brushing frequency and group, when calculated using chi-square. This supports the fact that although reported brushing levels changed for individuals, at a population level there was no significant change to reported toothbrushing levels (*Figure 6-10, p.236*) or plaque as a result of the SOHP. Within both the control and intervention group across each time point the highest proportion of children reported brushing twice-daily; however over-reporting must be accounted for.

Table 6-8 Children's overall self-reported brushing frequency using the Children's questionnaire

		Intervention group % (n)	Control group % (n)
Baseline	Not brush	4.6 (8)	6.8 (5)
	Brush once-a-day	20.7 (36)	26.0 (19)
	Brush twice-a-day	74.7 (130)	67.1 (49)
Post-intervention	Not brush	4.9 (8)	11.0 (8)
	Brush once-a-day	18.3 (30)	20.5 (15)
	Brush twice-a-day	76.8 (126)	68.5 (50)
Follow-up	Not brush	6.1 (9)	7.5 (5)
	Brush once-a-day	26.5 (39)	25.4 (17)
	Brush twice-a-day	67.3 (99)	67.2 (45)

For both intervention and control groups the mean frequency of reported baseline brushing was above 1.5, indicating overall the children in *study 2* already self-reported a high brushing frequency (*Figure 6-10*). Overall, as can be seen in *Figure 6-10* below the control groups' mean frequency of self-reported brushing was slightly lower than the intervention groups at baseline and following the SOHP; but was similar at follow-up.

Figure 6-10 Mean children's self-report daily brushing throughout *study 2* (using the Children's Questionnaire) with 95% confidence intervals



Throughout *study 2*, reported rates of toothbrushing for morning and at night for both the intervention and control groups remained relatively stable (*Table 6-9*), indicating the SOHP did not have a greater effect on one brushing period compared to the other.

Table 6-9 Children's overall self-report brushing frequency for morning and nighttime brushing from the Children's questionnaire

		Intervention group % (n)			Control group % (n)		
		Yes	**No**	**Don't Know**	**Yes**	**No**	**Don't Know**
Baseline	Brush in the morning	90%, (n=157)	8% (n=14)	2%, (n =3)	75%, (n=55)	19%, (n=14)	6%, (n =4)
	Brush at night	80%, (n=139)	14% (n=25)	6%, (n =10)	84%, (n=62)	12%, (n=9)	4%, (n =3)
Post-intervention	Brush in the morning	90%, (n=148)	8%, (n=13)	2%, (n=4)	80%, (n=59)	19%, (n=14)	1%, (n=1)
	Brush at night	82%, (n=136)	11%, (n=18)	7%, (n=11)	78%, (n=57)	15%, (n=11)	7%, (n=5)
Follow-up	Brush in the morning	87%, (n=128)	8%, (n=11)	5%, (n=8)	79%, (n=53)	15%, (n=10)	6%, (n=4)
	Brush at night	75%, (n=110)	18%, (n=26)	7%, (n=11)	81%, (n=55)	12%, (n=8)	7%, (n=5)

Although changes in self-reported behaviour at an individual level cannot be attributed to any intervention effects it is useful to examine movements in self-reported behaviour to understand any effects the intervention may have had both positively and negatively on individual children. *Table 6-10* reports the change of individual self-reported behaviour through *study 2* with respect to intervention and control groups for children where it was possible to link baseline, post-intervention and follow-up data.

Table 6-10 Intervention and control self-reported brushing behaviour changes throughout *study 2* (shaded squares = *decrease or increase in reported behaviour and white = no change*)

INTERVENTION

Children's self-reported daily brushing		Post-intervention				Follow-up						Follow-up			
		Not Brush % (n)	Brush once % (n)	Brush twice % (n)	Missing Data % (n)	Not Brush % (n)	Brush once % (n)	Brush twice % (n)	Missing Data % (n)			Not Brush % (n)	Brush once % (n)	Brush twice % (n)	Missing Data % (n)
Baseline	Not Brush (n=8)	37.5 (3)	**12.5 (1)**	**37.5 (3)**	12.5 (1)	25.0 (2)	**12.5 (1)**	**25.0 (2)**	37.5 (3)	**Post-Intervention**	Not Brush (n=8)	25.0 (2)	**25.0 (2)**	**25.0 (2)**	25.0 (2)
	Brush once (n=36)	**2.8 (1)**	36.1 (13)	**58.3 (21)**	2.8 (1)	**8.3 (3)**	44.4 (16)	**33.3 (12)**	13.9 (5)		Brush once (n=32)	**6.3 (2)**	37.5 (12)	**34.4 (11)**	21.9 (7)
	Brush twice (n=129)	**3.1 (4)**	**10.9 (14)**	76.7 (99)	9.3 (12)	**3.1 (4)**	**15.5 (20)**	64.3 (83)	17.8 (23)		Brush twice (n=126)	**4.8 (6)**	**17.5 (22)**	62.7 (79)	15.1 (19)
	Missing Data (n=6)	0.0 (0)	50.0 (3)	(3)	0.0 (0)	16.7 (1)	16.7 (1)	50.0 (3)	16.7 (1)		Missing Data (n=14)	0.0 (0)	14.3 (2)	57.1 (8)	28.6 (4)
	Totals	8	31	123	14	10	38	100	32			10	38	100	32

CONTROL

Children's self-reported daily brushing		Post-intervention				Follow-up						Follow-up			
		Not Brush % (n)	Brush once % (n)	Brush twice % (n)	Missing Data % (n)	Not Brush % (n)	Brush once % (n)	Brush twice % (n)	Missing Data % (n)			Not Brush % (n)	Brush once % (n)	Brush twice % (n)	Missing Data % (n)
Baseline	Not Brush (n=6)	66.7 (4)	**16.7 (1)**	**16.7 (1)**	0.0 (0)	33.3 (2)	**33.3 (2)**	**33.3 (2)**	0.0 (0)	**Post-intervention**	Not Brush (n=8)	12.5 (1)	**25.0 (2)**	**62.5 (5)**	0.0 (0)
	Brush once (n=19)	**10.5 (2)**	36.8 (7)	**52.6 (10)**	0.0 (0)	**5.3 (1)**	42.1 (8)	**47.4 (9)**	5.3 (1)		Brush once (n=16)	**0.0 (0)**	37.5 (6)	**37.5 (6)**	25.0 (4)
	Brush twice (n=49)	**4.1 (2)**	**14.23 (7)**	79.46 (39)	2.0 (1)	**4.1 (2)**	**16.3 (8)**	69.4 (34)	10.2 (5)		Brush twice (n=50)	**8. 0 (4)**	**18.0 (9)**	68.0 (34)	6.0 (3)
	Missing Data (n=1)	0.0 (0)	100 (1)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	100 (1)		Missing Data (n=1)	0.0 (0)	100 (1)	0.0 (0)	0.0 (0)
	Totals	8	16	50	1	5	18	45	7			5	18	45	7

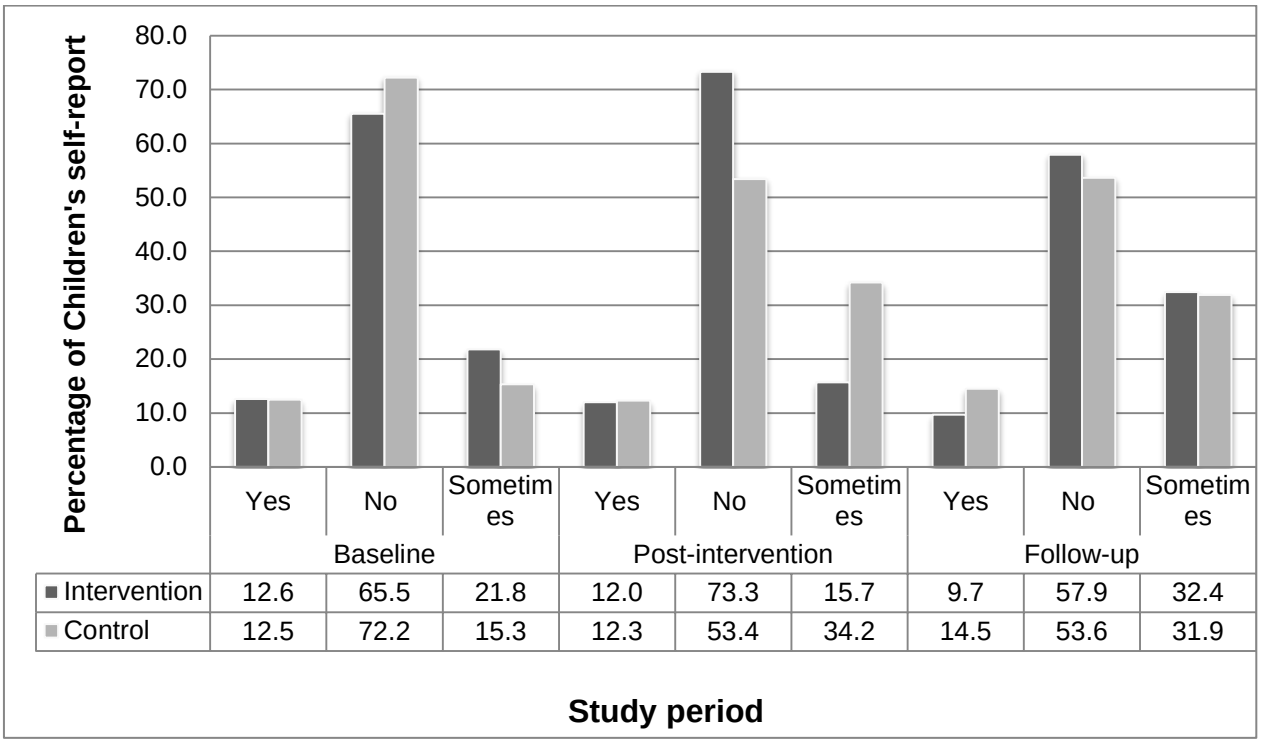
One of the influences on children's toothbrushing behaviour is parent support. Within the Children's questionnaire they were asked to indicate if they received support from either their mother or their father. As can be seen in *Table 6-11* across both the control and intervention schools at follow-up, as was seen post-intervention, there was a reduction in the number of children who said 'yes' to parents providing support. Which suggest the SOHP did not impact parents supporting behaviours.

Table 6-11 Reports by children using the Children's questionnaire in relation to Q6 & 7

Parent	Mum % (n)			Dad % (n)		
Self-report response around support	**Yes**	**No**	**Some-times**	**Yes**	**No**	**Some-times**
	Intervention group					
Baseline	12.7 (22)	67.1 (116)	20.2 (35)	7.5 (13)	80.9 (140)	11.6 (20)
Post-Intervention	5.4 (9)	74.1 (123)	20.5 (34)	3.6 (6)	85.5 (141)	10.9 (18)
Follow-up	4.1 (6)	72.6 (106)	23.3 (34)	3.5 (5)	81.9 (118)	14.6 (21)
	Control group					
Baseline	11.0 (8)	63.0 (46)	23.0 (19)	12.2 (9)	74.3 (55)	13.5 (10)
Post-Intervention	6.8 (5)	68.9 (51)	24.3 (18)	4.1 (3)	82.4 (61)	13.5 (10)
Follow-up	1.5 (1)	70.6 (48)	27.9 (19)	1.4 (1)	87.0 (60)	11.6 (8)

Finally, within the children's questionnaire Q12 asked about nighttime sugar-snacking, with self-reported nighttime sugar-snacking rates presented in *Figure 6-11.* Post-intervention there was a significant association between sugar-snacking behaviour and group $X^2(2) = 10.92$, $p < .004$. Indicating children in the intervention group were significantly less likely to reporting having, or sometimes have, sugary-snacks at night following the SOHP. At baseline and follow-up, there was no statistically significant association between sugar-snacking behaviour and group. This suggests the initial SOHP had a positive impact on children's reported sugar-snacking behaviour but this was not sustained.

Figure 6-11 Children's self-reported nighttime sugar-snacking behaviour using the Children's questionnaire



Finally, analysis was conducted to understand the relationship between children's self-reported toothbrushing behaviour using the children's questionnaire (Q3 & 4) and their reported sugar-snacking behaviour and if this changed for intervention children as a results of the SOHP (*Table 6-12*). Within this analysis answers were only used for children who said yes/no to each question and not children who were unsure or said sometime. Across both groups at each time point children most frequently children reported brushing twice-daily and not having any sugary-snacks at night.

Table 6-12 Relationship between reported toothbrushing and sugar-snacking (from Children's questionnaire)

		Self-reported toothbrushing behaviour using the children's questionnaire (Q3 & 4)					
		Baseline		Post-intervention		Follow-up	
		Once-daily brushing n (%)	Twice-daily brushing n (%)	Once-daily brushing n (%)	Twice-daily brushing n (%)	Once-daily brushing n (%)	Twice-daily brushing n (%)
		Intervention group					
Nighttime sugar-snacking	Yes	6 (4.8)	10 (8.1)	4 (3.2)	12 (9.7)	5 (5.9)	6 (7.1)
	No	11 (8.9)	97 (78.2)	9 (7.3)	99 (79.8)	10 (11.8)	64 (75.3)
		Control group					
	Yes	3 (5.8)	3 (5.8)	2 (5.1)	4 (10.3)	2 (5.1)	6 (15.4)
	No	7 (13.5)	39 (75.0)	5 (12.8)	28 (71.8)	5 (12.8)	26 (66.7)

6.7.4 Results: Tertiary outcomes – Knowledge relating to toothbrushing and OH

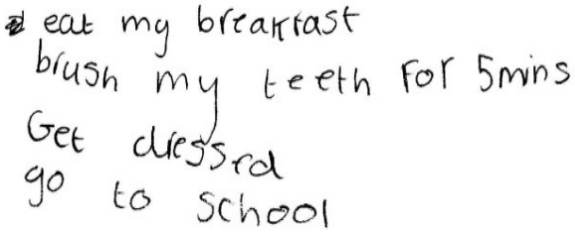
This section of the results aims to answer the research question – *How do levels of knowledge change in 6-7 year olds regarding toothbrushing as a result of a SOHP*?

6.7.4.1 Children's D&W results in relation to knowledge linked to toothbrushing, why we need to brush, knowing teeth are healthy, issues and problems

At baseline, post-intervention and follow-up few children in both the intervention and control groups used the D&W to explain how long they should brush for. When children were not depicting their routines (*section 6.7.6.1*), few children in both the intervention and control groups used the D&W to illustrate the need to brush twice-daily with fluoride toothpaste. However, at baseline, post-intervention and follow-up the intervention and control group children most commonly reported that brushing our teeth is how we can keep them healthy. Both groups of children showed understanding of the foods that were good or bad for us ('5 a-day'), and to some degree drinks, with there being limited changes in the complexity of reporting this in the intervention group as a result of the SOHP.

Differences were found between the intervention and control group around how we can tell our teeth are healthy. From baseline to follow-up there was an increase in intervention children who reported the cosmetic ways we know our teeth are healthy (e.g. white, good breath) and a reduction in drawing and writing about bad teeth (e.g. being black). In contrast to the intervention group, fewer control group children used the D&W to talk about cosmetic reasons for brushing. Through the D&W intervention group children more often specifically referenced a dentist as being able to help us know our teeth are healthy and what they are able to do. In comparison control group children were more likely to refer to parents as a source of support and only that a dentist can help but not what they do. Following the SOHP intervention children appeared to increase their knowledge around how and consequences of problems with our teeth. As well as children being able to demonstrate correct knowledge, there were also children who had misconceptions. Gaining an understanding of these is vital to be able to design SOHP to help target misconceptions and ensure children develop the correct understanding (e.g. around rinsing behaviour). Below are example illustrations and explanations relating to the D&W key findings:

Toothbrushing: Using the D&W for both groups there was limited reference to how often children brush and if for the intervention group the SOHP impacted behaviour. Post-intervention only one intervention group children used the D&W to refer to the length of time you should brush (which was longer than is recommended), despite this being a message in the SOHP. With no control children referencing brushing time.



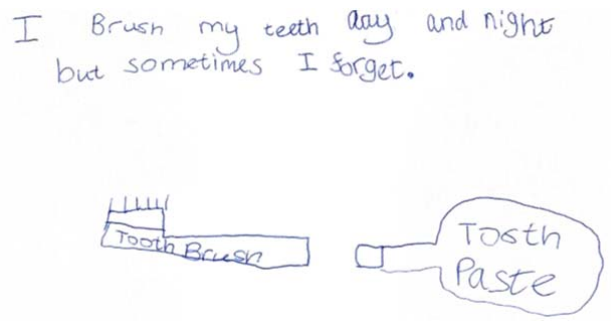
07.1.080.3

At follow-up a small number of contol and intervention children used the D&W to illustrate when you should brush and for how long but it was not clear if this refelected their behaviour :

I brush my teeth day & night, when I see them nice and white (01.1.031.3)

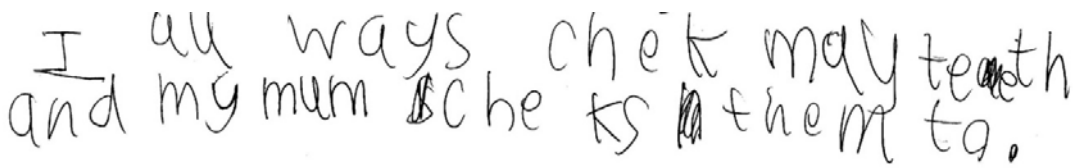
10.2.235.3

With only one control group child using the D&W to show the don't always brush twice-a day.



09.2.190.3

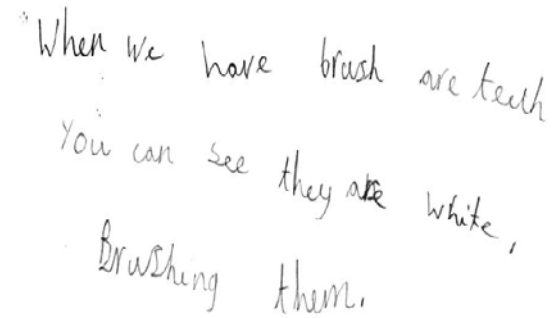
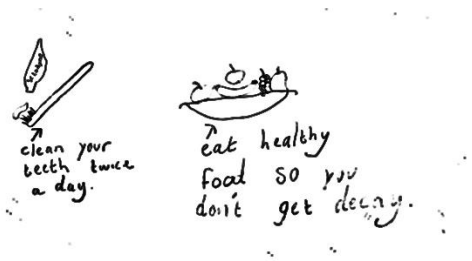
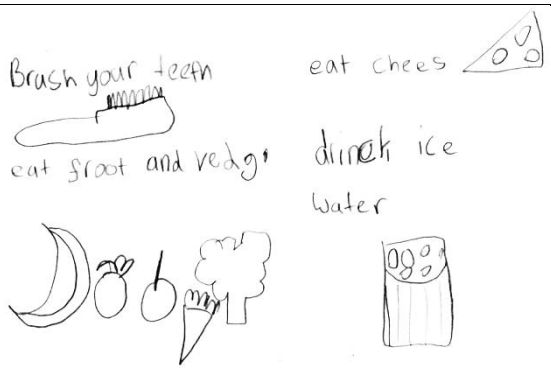
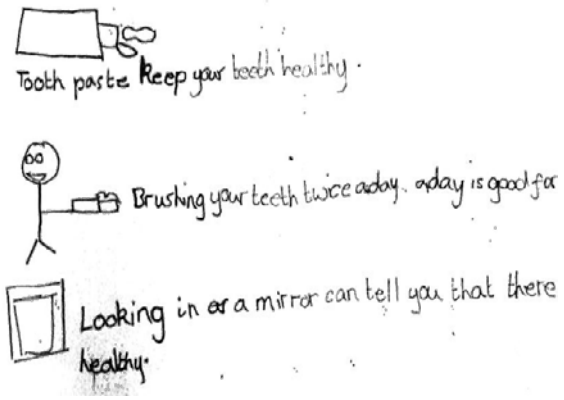
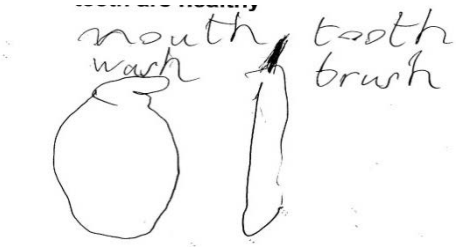
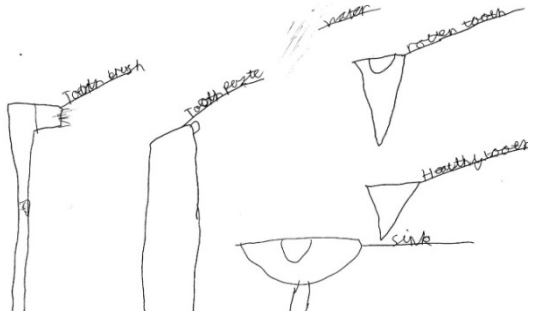
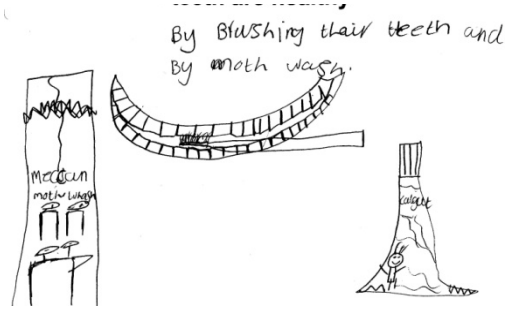
Across both the intervention and control group reference to support with brushing using the D&W was very limited at each point. Only one control group child wrote about the shared responsibility with their mum to check their teeth are healthy.

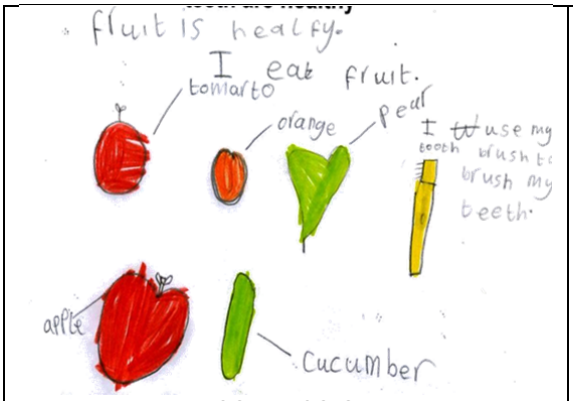


09.2.193.3

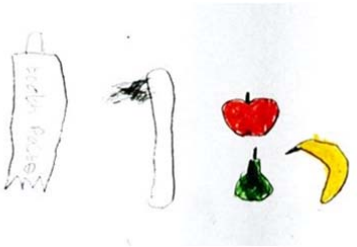
Why we need to brush and knowing teeth are healthy: Within the intervention group at baseline D&W responses relating keeping teeth healthy most commonly related to toothbrushing, toothpaste and '5 a-day'. Similarly to the intervention group, the control group children most commonly D&W about brushing your teeth

and ‘5 a-day. Following the SOHP there was still a focus on these behaviours within the intervention and control groups, with SOHP messages (e.g. reduced nighttime sugar-snacking) not be referred to by intervention group children.

Intervention group	Control group
 02.1.056.3	 11.2.300.3
 04.1.109.3	 10.2.230.3
 05.1.118.3	 09.2.197.3
 01.1.034.3	 10.2.223.3

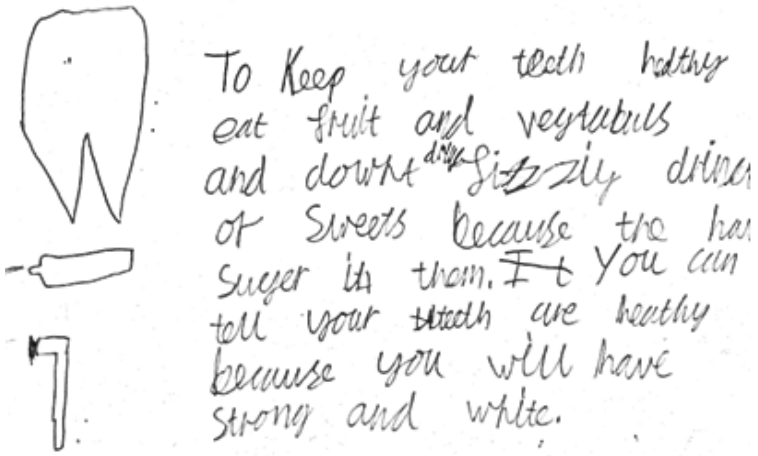
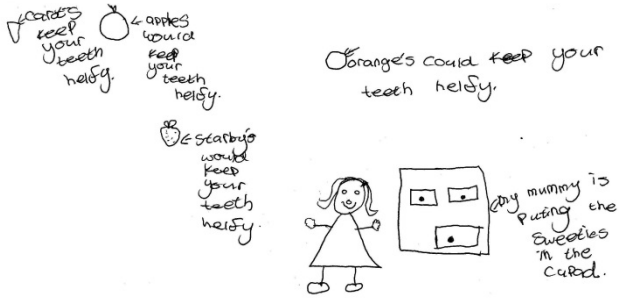
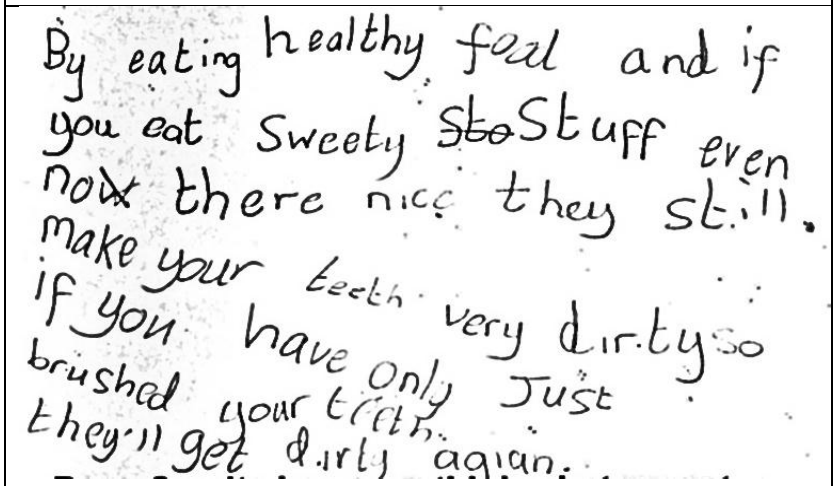
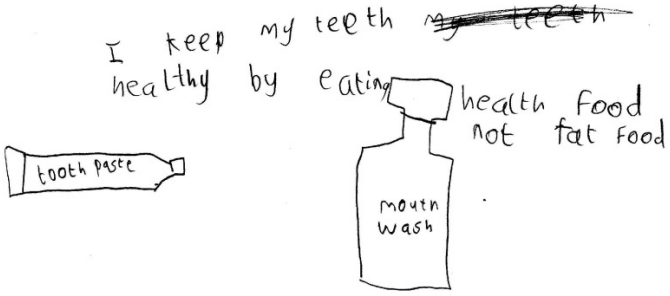


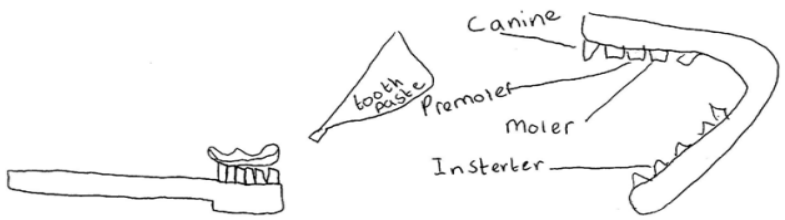
08.1.162.3



13.2.329.3

Within both the control and intervention group some children used the D&W to show a greater level of knowledge around explaining preventative behaviours, and how different behaviours impact our OH. Following the SOHP there did not appear to be a marked increase in the intervention group's knowledge in comparison to the control group in relation to more detailed responses.

Intervention		Control
 01.1.014.3	*"To keep your teeth healthy eat fruit and vegetables and don't drink dizzy drinks or sweets because they have sugar in them. You can tell your teeth are healthy because you will have strong and white."*	 11.2.313.3
 05.1.129.3	*"By eating healthy food and if you eat sweety stuff even no there nice they still make your teeth very dirty so if you have only just brushed your teeth they'll get dirty again."*	 09.2.191.3



04.1.109.3

10.2.226.3

Toothpaste if makes your teeth shiny and fresh.

06.1.145.3

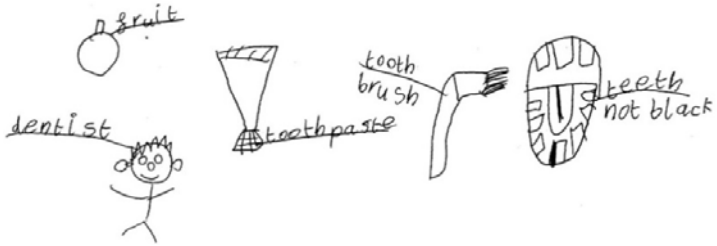
"Toothpaste if makes you teeth shiny and fresh"

10.2.229.3

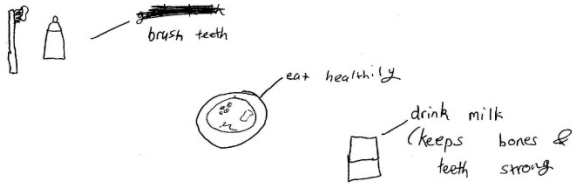
Draw & write what you think will keep your teeth healthy and how you can tell your teeth are healthy

milk keeps your teeth healthy because it has calcium

08.1.160.3



01.1.036.3



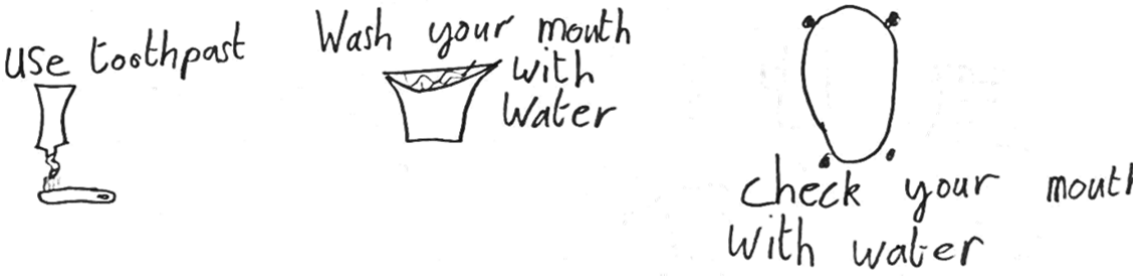
11.2.300.3

At baseline two intervention children illustrated misconceptions about water. These were not repeated following the SOHP, by these or other intervention children, but it is not known if their knowledge changed as a result of the SOHP.

04.1.103.3

04.1.096.3

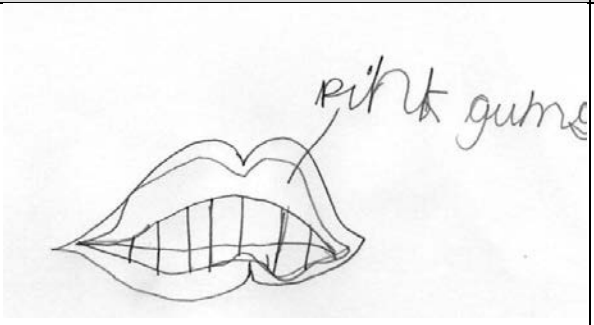
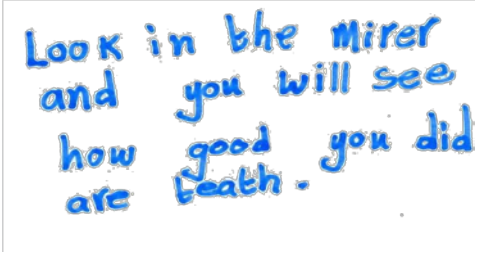
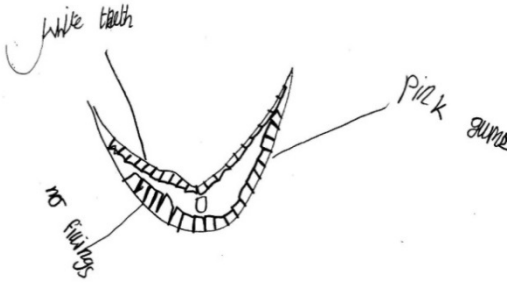
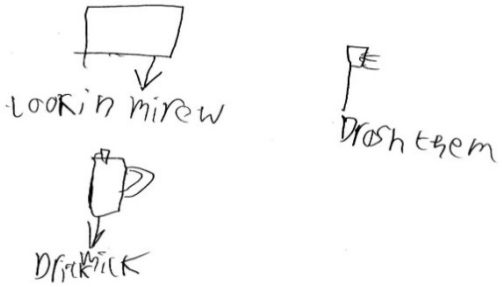
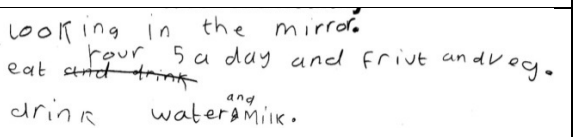
In addition although no reference was made by any children at baseline or post intervention, at follow-up one intervention child D&W about rinsing with water, rather than just spitting to ensure residual fluoride was not removed (rinsing behaviour is not addressed in current SOHP).



07.1.068.3

Along with understanding children's technique this is an area SOHPs can support good practice, to improve the effectiveness of children's toothbrushing with fluoride toothpaste.

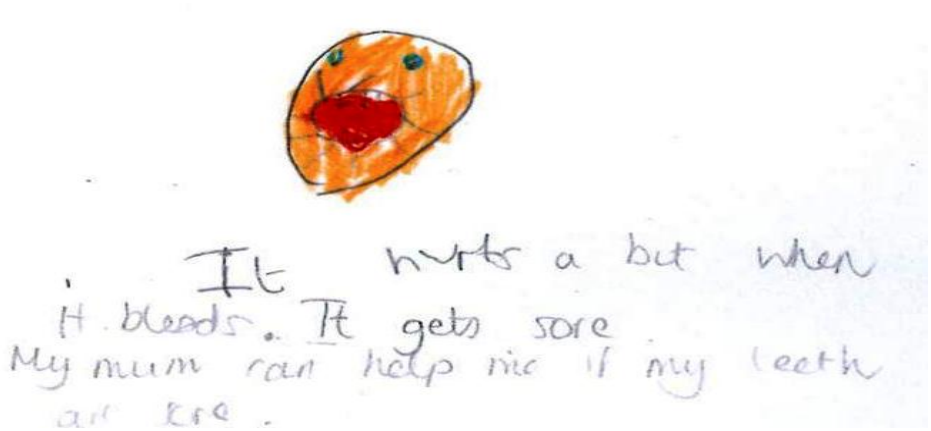
At baseline and post-intervention children in the intervention group reported being able to tell teeth are healthy through – brushing them, gums being pink, teeth being white and teeth being sparkly. Then knowing they were not healthy through them being black, rotten or falling out. However, within the control group, unlike the intervention group, there was no reference to gums being pink and less reference to white, sparkly or black teeth. Within both groups there was limited reference to mirrors being used to check teeth.

Intervention	Control
 02.1.046.3	 11.2.308.3
 02.1.051.3	 13.2.339.3
 01.1.029.3	 looking in the mirror. eat ~~and drink~~ your 5a day and friut and veg. drink water and milk. “*look in the mirror, eat your 5a day an dfruit and veg. drink water and milk*” 13.2.341.3

At follow-up the children had moved to year 3 and through the D&W within the intervention group there was an increase in reporting of cosmetic reasons for looking after teeth and knowing that they were healthy, with a mirror being seen as a way to spot if teeth are healthy. Within the control group there was still less reference to cosmetic reasons for looking after your teeth. However, as with the intervention group a mirror was seen as an aid to telling if your teeth were healthy. This begins to illustrate a transition to brushing teeth for preventative reasons to children brushing their teeth to meet social influences (e.g. white teeth and good breath). For intervention children who made greater reference to checking in mirrors, and cosmetic outcomes of brushing this may reflect the reporting of them taking greater responsibility for their own OH and checking the state of their OH, which may have been influenced by the increased awareness from the SOHP and

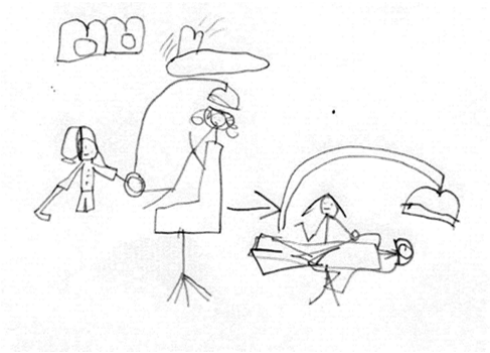
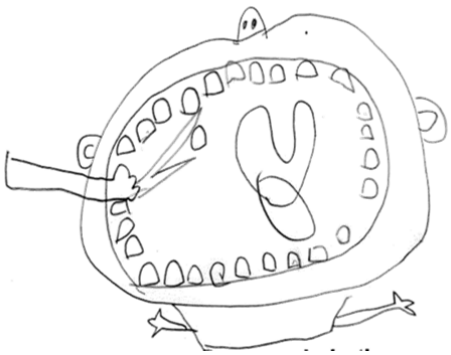
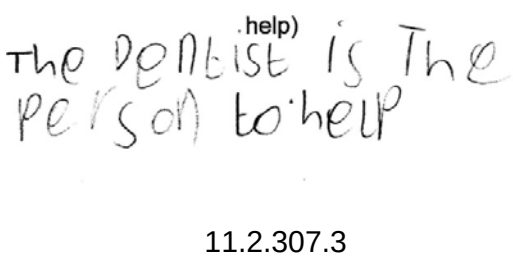
messages in the '*Teeth Chief's'* around how to keep teeth healthy (e.g. shinny superpowers).

People who are able to help if we have problems: Using the D&W children in the intervention group showed they understood that dentists were able to provide help, with only 1 child writing about mums as a source of help. Within the intervention group at baseline n=7 children drew & wrote about being able to go to the dentist or ask an adult to know they are healthy.

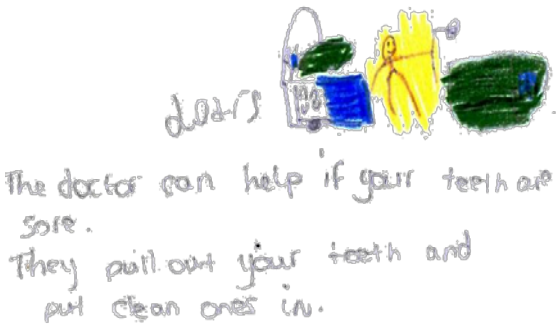


"*It hurts a bit when it bleeds. It gets sore. My mum can help me if my teeth are bad*" (03.1.073.3)

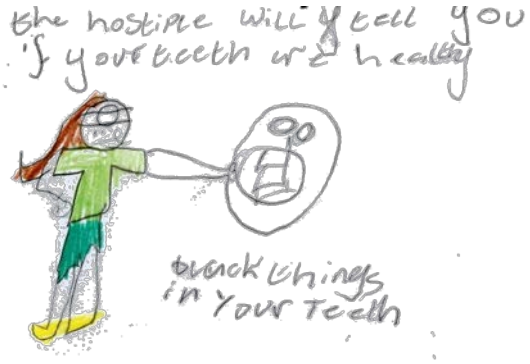
Similarly to the intervention group, it was clear at baseline that most children in the control group understood that dentists were able to help with problems with our teeth. There was a greater number of control group children who referenced parents being able to offer support, with n=5 children referencing 'mum' and three children 'dad'. Within the control group, two children within one school wrote 'clinic' on pictures of buildings, it is however unclear which health professionals they were referring to. Post-intervention using the D&W there was an increase in intervention children explaining the consequences of poor OH (relating to topics in the SOHP), and how dentists can help. This finding was supported by the FG, where children talked about false teeth (individual and sets), fillings and fluoride varnish (called coating by the children). However, post-intervention children within the control group were less likely to illustrate OH problems other than discoloured teeth (e.g. no reference to fillings) within their responses.

Intervention	Control
 02.1.057.3	 13.2.327.3
 03.1.083.3	 10.2.226.3
 02.1.050.3	 09.2.198.3
 01.1.014.3	 11.2.307.3

Within the intervention group at baseline there were also children who showed misconceptions around who can help if we have problems, with reference being made to doctors and hospitals.



Doctor - 03.1.072.3



Hospital - 04.1.098.3

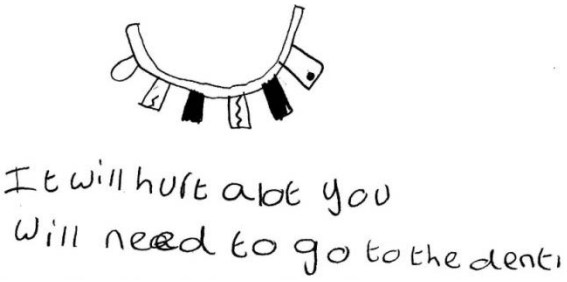
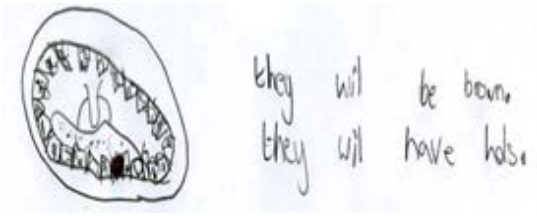
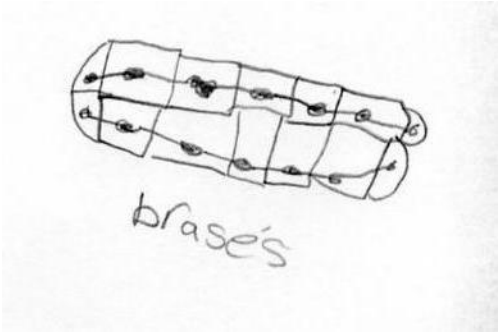
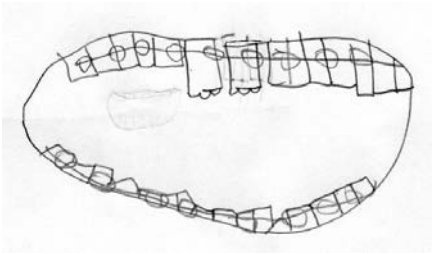
In addition an intervention group child at baseline D&W about a problem you can get with teeth, but through their explanation of the picture showed a misunderstanding about treatment.

03.1.077.3

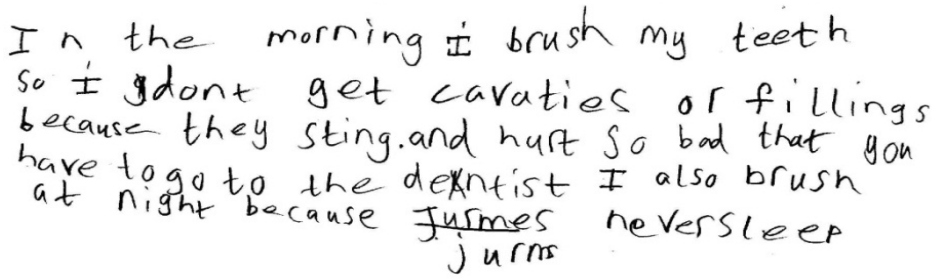
These misconceptions were not repeated by these of other intervention children following the SOHP, although it cannot be known if this was due to an increase in knowledge as a result of the SOHP.

Issues and problems with our teeth: Problems with our teeth were explained by children in the intervention group (at baseline) in terms of: dirty, wobbly or rotten teeth, and holes in our teeth. With solutions to OH problems around – brushing, having braces and having dental treatment. There was also reference to intervention children's past experiences of OH problems. Control group children drew & wrote in relation to problems with our teeth and solutions related to: teeth falling out (n=1); chipped tooth (n=7); pain (n=2); plaque (n=1); braces (n=2) and black/rotten teeth (n=20). Following the SOHP for both groups there was little

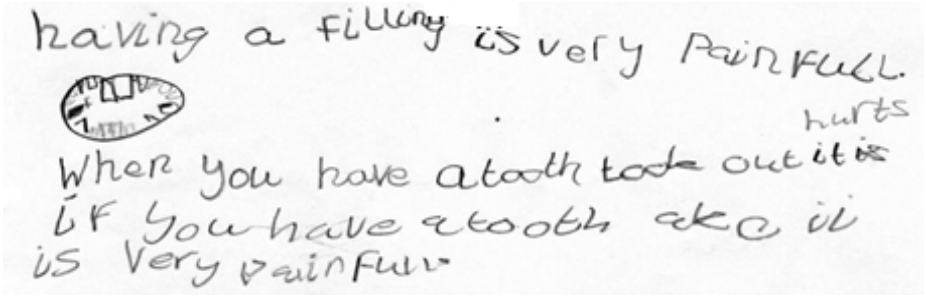
change in the baseline reporting, which reflected experiences, dirty/rotten teeth and holes.

Intervention	Control
 04.1.105.3	 10.2.228.3
 08.1.169.3	 09.2.198.3
 04.1.092.3	 13.2.327.3
 02.1.043.3	 11.2.302.3

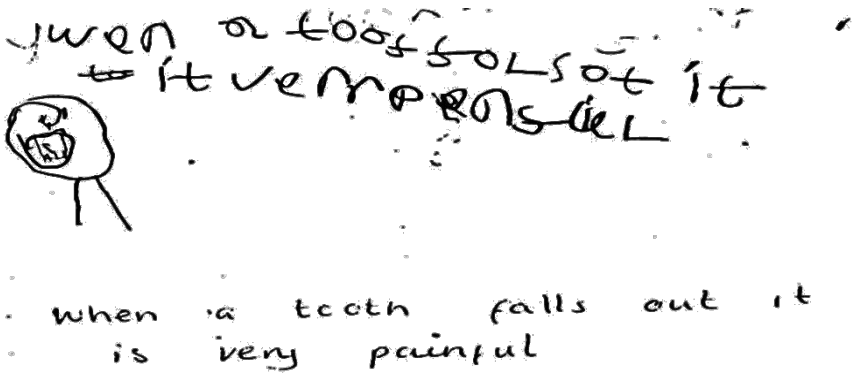
At follow-up as found at baseline and post-intervention children in the control group were less likely to include personal examples of OH problems and reference general ways teeth can be unhealthy (e.g. being black or falling out). In contrast to the control group through the D&W intervention children depicted and wrote about OH issues and concerns experienced (e.g. cavities, fillings and extractions). This may be a reflection of more children having past experience with OH issues but also may indicate a more developed knowledge than the control group around the negative impacts of poor OH, not brushing their teeth or having too many sweets.



08.1.161.3



05.1.119.3



04.1.099.3

6.7.4.2 Children's FGs results in relation to knowledge linked to toothbrushing, why we need to brush, knowing teeth are healthy, issues and problems

Overall through the FG it is possible to determine that children in both the intervention and control group understood that toothbrushing, toothpaste and mouthwash can help keep teeth healthy. In relation to **Children's reported behaviour linked to toothbrushing** at baseline, post-intervention and follow-up

through the FGs 24-hour recall most of the children reported brushing twice-daily. Upon completion of the SOHP in comparison to the control group, the intervention group children made greater reference to the need to brush twice-daily and that we should brush for 2 minutes (main messages in the SOHP). Although children appeared to understand toothbrushing was necessary to help maintain good OH, intervention group children appeared to have greater awareness of this post-intervention. Throughout *study 2* children talked about a number of barriers, facilitators and home influences, which largely due to the nature (e.g. toothpaste taste) did not change between baseline, post-interventions and follow-up for the intervention group in comparison to the control group.

When children in the intervention and control group were asked about germs few talked about them being an initial step in the development of problems with teeth (e.g. reference to plaque) with many equating germs to causing dental problems. Throughout the study both control and intervention children showed understanding that brushing was a way of removing germs. However, for both groups the 'how' around the impact of germs in relation to knowledge did not appear to develop across the study period (baseline, post-intervention and follow-up), suggesting limited impact of the SOHP in this area. Across both groups and the study period through the FG children showed awareness that dentist were able to help us, and also talked about their own experiences in relation to OH as well as wider families experiences. The example quotes and outcomes below are designed to help illustrate the main themes of the FGs (*Figure 6-12, p.275*).

Reasons related to toothbrushing: When children were asked about keeping our teeth healthy and how to keep them healthy; children indicated that toothbrushing was the most important behaviour.

> Control group baseline researcher-*…so what can we do to help our teeth when they go bad?*
> Girl 4- *go to the dentist…brush your teeth probably*
> Girl 2- *start brushing your teeth properly*

> Intervention group post-intervention researcher- *what are the most important things we can do to keep our teeth health?*

Boy 3- *brush every day and night*
Boy 2- *saliva* (Researcher– *yeah what does saliva do?*) *it helps to wash bad germs*
Girl 3– *Brushing that keep your white thing*
Boy 1- *you can drink lots of calcium*
Girl 3– *by drinking like water and milk and not having things with that much sugar in and eat fruit*
Boy 4- *I know how you can keep your teeth healthy, keep on brushing it every day and night*

Intervention group follow-up researcher– *what can we do to help our teeth if they go bad?*
Boy 4- *brush them*
Boy 1- *brush them more times in a day than twice*
Boy 2– *brush them for 2 minutes*
Girl 2- *brush them in the morning and at night*
Boy 3- *no brush them for an hour*

Some children (predominantly higher SES schools) in both the intervention and control groups understood that brushing is a way we can remove germs, with the SOHP showing limited impact on the level of this knowledge.

Control group baseline girl 1- *how do you think brushing our teeth helps them?*
Girl 3- *it gets them nice and clean and it can make them all white*
Girl 2- *its gets them healthy*
Researcher- *it makes them healthy; it makes your teeth white*
Girl 4- *and fresh*
Girl 1- *and you can smile with your teeth all white*

Control group baseline researcher- *how does brushing our teeth help them?*
Boy 3- *cos it can clean them*
Girl 3- *it gets all the germs out from your gums*
Girl 1- *it helps them stay healthy*

Boy 5- *it helps them stay healthy*
Boy 1- *it helps get the plaque out where you can reach it and it helps keep them clean*
Boy 2- *it helps stop your teeth go black*
Girl 4- *it stops your teeth getting mouldy*

Intervention group post-intervention researcher– *what are the most important things then to help our teeth?*
Girl 1– *toothpaste*
Girl 2– *day & night*
Boy 1– *cos it gets all the germs off*
Girl 3– *brushing them every day & night, making them really shinny*

Intervention group post-intervention researcher– *so what happens if we eat or drink once we have brushed our teeth?*
Boy 1- *it won't taste very nice*
Researcher– *do you think you would have to re-brush your teeth?*
(Children– *yeah*) *why would you have to do your teeth again?*
Boy 1- *cos you not give them a chance to work and kill the germs*
Girl 3- *if you brush your teeth and then have crisps and then you eat them sometimes my mum would say you have to brush your teeth after now*

Impact of previous experiences and tools for toothbrushing: A common barrier reported by children in both groups and throughout the study was the taste of the toothpaste; however others reported liking the mint taste as they liked the fresh feeling. Discomfort and difficulties with brushing were also reported to be a barrier for some. Following the SOHP there was greater reference to the length of time and when you should brush for the intervention children.

Intervention group baseline researcher– *what don't you like about brushing your teeth?*
Girls 3- *I hate it when you just like swallow a bit of toothpaste by accident (researcher– does it not taste nice?) no*

Boy 3– *I like swirling my mouth wash and I always spit it out and it's like green*
Boy 2– *I don't like cos my brush may squirm and I can feel it on my tongue and it doesn't feel nice*

Intervention group baseline researcher– *what do you like about brushing your teeth and what do you not like?*
Girl 3- *I like brushing my teeth, cos I have a chart and I put stars on my chart. And I got them all so I got a medal*
Girls 2- *I like brushing my teeth cos it shines my teeth*
Girl 1- *I like brushing my teeth cos the toothpaste tastes like chewing gum*

Control group baseline boy 1- *I don't like brushing them for a long time*
Boy 2- *she always says brush them for 3 minutes and then I do it for like 10 seconds*
Girl 3- *you got 5 minutes doing it*
Boy 2- *no cos what I do when she is in she is sometimes in the other bathroom doing her teeth so I always leave the tap on and she gets used to it then I just leave the tap on and don't do my teeth*
(Researcher- *ah I see so you trick her*?)*Yeah*
Girl 4- *what I do is I put toothpaste on my toothbrush sometimes and give quick brush and then it seems like I do*
Boy 2- *I just put toothpaste on my brush and little tidgy bit of water and then* (shows sweep across top and bottom) *done*

Intervention group post-intervention researcher– *so what do you like about brushing your teeth?*
Girl 3- *I like it because it's very good and of the feel you get*
Boy 1- *I like it because when you brush your teeth you can feel the plaque and sometimes and when you brush it you can feel that it's not there*
Girl 2– *I don't like it, it gets tiring*

Boy 4- *I like it because anytime you brush your teeth they won't fall out*

Control group follow-up researcher- *so what do you not like about brushing your teeth?*
Boy 3- *I don't like the taste of the mouthwash*
Girl 5- *I don't like it when it is sore in my mouth when teeth are coming through*

Intervention group follow-up researcher– *and what don't you like about brushing your teeth?*
Boy 1- *I don't like it doing it for 2 minutes*
Boy 2- *I just cut a second off, I always try and cut a second off*
Boy 3- *I don't like it cos it makes my arm ache*
Boy 4- *I don't like it when the toothpaste is too minty*
Girl 2- *when you go like that* (Researcher- *ah so it tiring to do your teeth is it*) *yeah*

Intervention group follow-up boy 6- *what do you like about brushing your teeth?*
Girl 3– *they look good*
Girl 4- *the exercises like that*
Boy 5- *getting them clean*
Boy 1- *your mouth smells all minty*
Girl 1- *I like it cos you get out my chores*
Girl 2- *it funny cos I know my teeth are shinny cos I rub them*
Boy 5– *I like it when I wash all my mouth out and I take all the toothpaste out of my mouth*

As found with the D&W, children in both the intervention and control groups talked about previous experiences of problems linked to their OH through extractions ("*I had two teeth that were there they were so you have to like take out*"), fillings *("I have 2 fillings in that one (at back) and they took that out and I have 1 filling in that one and I'm going to have 2 fillings in that one as I have an abscess and I have a filling in that one as well"*), decay and toothache ("*when you get plaque on your*

gum, and your tooth hurts"), and how this impacted behaviour. There were also a small number of intervention children who talked about issues that impacted on their brushing, but this was not found in the control group:

> Intervention group baseline girl 4- *sometimes I keep banging the back of my toothbrush against my check*
> Boy5- *sometimes I bang my gum on it and I don't like some flavours of the toothpaste*
> Boy 6- *sometimes I bend my gums and get some of my toothpaste*
> Girl 2- *I don't like it when my teeth always bleed when I brush* (Researcher- *yeah it's not very nice…is that wobbly ones as well*) *that one* (points to wobbly tooth in mouth)
> Boy5- *I don't like it when my gum bleed and it comes out in the sink and my mum shouts at me* (researcher- *why does she shout at you…cos it bleeding*?) *yeah*
> Boy5- *I don't like it when the toothbrush gets stuck in my gums*
> Girl 1- *I don't like it when my mum brushes my gums and it hurts*
> Girl 6- *I don't like it when the brush touches the bottom of my gums and it might hurt a bit*
> Boy4- *I don't like the taste of the mouth wash*
>
> Intervention group post-intervention researcher– *and what don't you like?*
> Boy 3- *getting your toothbrush at the back*
> Boy 1- *when I brush a sore bit in my mouth*
> Girl 3- *when I at the back because sometimes because it just tickles my gums*
> Girl 2– *when sometimes some of the prickles I swallow them accidently when I go to the back*

The SOHP impacted knowledge relating to the mechanics of toothbrushing, but had less of an impact knowledge around why and how in relation to germs and the process of OH problems developing.

Within the theme **Impact of previous experiences and tools for toothbrushing** there was a lot of overlap with the theme around **children's attitudes in relation**

to toothbrushing. As with the impact of previous experiences and tools, the children's attitude towards brushing twice-daily was influenced by toothbrushes, toothpaste, technique and frequency. Further to this at baseline in both groups children talked about the perceived importance they placed on the behaviour, how they found the behaviour and also other activities they could be doing.

> Intervention group baseline researcher– *what don't you like about brushing your teeth?*
> Girl 2– *I hate brushing my teeth cos its I rather not doing it*
> Girl 1– *I hate brushing my teeth cos every time I brush my teeth my arm just aches all the time*
> Boy 4– *I would rather let the toothbrush just do it and I just hold it in my mouth, and cos I have to go back upstairs when I'm done and I don't want too*

> Intervention group baseline Girl 3– *I don't really think about teeth.* (Researcher**-** *you don't think about teeth*?) *no* (researcher– *would you rather do something else than brush your teeth*?) *play*

> Control group baseline Boy 1- *I would forget and just go down stairs and watch TV for the rest of the time*
> Boy 2- *yeah that's what I would do*
> Researcher- *would you rather watch TV than brush your teeth?*
> Boy 1, 2, Girl 1- *yeah*
> Girl 2- *I would do both*

However, at subsequent stages there was only limited reference to '*getting bored'* or wanting to do other activities and a greater focus on the tools, the impact of these (e.g. taste, electric v manual toothbrushes) and brushing for cosmetic reasons. Through the SOHP attitude was not a target but is likely to be an important mediator in any behaviour change occurring and being sustained.

Knowledge and understanding linked to toothbrushing: Within the responses about how brushing helps it was evident within both the control and intervention groups that even at this age the cosmetic reasons for brushing matter. Intervention

group children were more prominent in their discussions around how toothbrushing removes plaque and makes your teeth (breath) smell nice at baseline.

> Intervention group baseline researcher– *how does brushing our teeth help them?*
> Boy 4– *takes the plaque off*
> Girl 3- *take all the food you have today out of your teeth and off your teeth*
> Boy 4– *it stops you having black teeth*
> Girl 3– *if you brush your teeth it gets all the plaque out*
> Girl 2– *if you don't brush your teeth all the plaque will stay in but you have to have a filling too*

> Intervention group baseline researcher- *does anyone know what brushing does to our teeth?*
> Boy 2- *with the toothpaste, it makes you teeth smell nice and minty*
> Boy 1– *because then your teeth grow stronger, and your be able to chew really really chewy things better*
> Girls 2- *it makes you teeth really clean, and if you keep on brushing your back one all the germs will get out and when you finished brushing your teeth you need to wash your mouth out*

Within the OH FG, children were asked about germs and their impact on OH. Within their answers children showed misconceptions (e.g. around germs being the cause of problems not an initial step in the development of dental issues – "*they get really really dirty and brown*" or "*they rot our teeth*"), used unique language in explanations (e.g. "*sugar is germ insects*") and also provided answers which demonstrated understanding (e.g. "*it when you got plaque on your teeth and you got too much on your teeth they can maybe damage your teeth and make them all black*"). From baseline, post-intervention to follow-up children's answers did not alter greatly, suggesting limited impact of the SOHP:

> Intervention group baseline researcher– *how do germs affect our teeth?*

Boy 3– *erm by going through your teeth*

Girl 3– *by sugar bugs* (researcher– *sugar bugs*?) *they make your teeth black*

Boy 1– *if you don't clean them*

Boy 2- *if you don't clean them they take over your teeth if you just leave them* (researcher– *and then what happens*?) *err….*

Boy 1- *you have a filling*

Girl 3- *you're have no teeth*

Intervention group baseline boy 1- *how can germs affect your teeth?*

Boy 1- *because they are strong*

Boy 2- *because they kill you*

Boy 3– *they drill through your teeth*

Girl 2– *they make like holes*

Boy 1– *they make our teeth go black*

Boy 2– *they make you be a German* (researcher– *why do they make you be a German*?) *cos you have germs*

Control group baseline researcher- *how do germs affect our teeth then?*

Girl 2- *it when you got plaque on your teeth and you got too much on your teeth they can maybe damage your teeth and make them all black and*

Girl 3- *you could get poorly*

Girl 3- *make our teeth smell*

Boy 2- *make it so you need chewing gum*

Researcher- *what happens if we don't brush our teeth?*

Girl 1- *you get plaque*

Girl 3- *you get smelly breath*

Boy 2- *you get dog breath*

Boy 1- *all your teeth fall out and then you can't really eat*

Girl 2- *if you get plaque will lead to decay and turn into decay*

Intervention group post-intervention researcher– *how do germs affect our teeth?*
Boy 1– *if you don't brush them loads of time they get wobbly*
Boy 3- *if you don't brush them when your asleep or if you don't brush them in the morning when you're at school they will just put this like sugar stuff on and make holes in your teeth*
Boy 3- *at night they all come out and um put holes in your teeth and the next day you get toothpaste and have to go to the dentist*

Intervention group follow-up boy 5 – *how can germs affect our teeth?*
Boy 6- *plaque'os*
Girl 4- *by making a hole in your teeth*
Researcher– *how are they making a hole in your teeth?*
Girl 4- *with the drills*
Boy 4– *with the saws*

Control group follow-*up researcher- how can germs affect our teeth?*
Girl 3- *by surrounding the teeth in our mouth and then they fall out*
Boy 1- *if you don't clean your teeth they can um...they can grow in your mouth*
Girl 3- *it starts with your teeth and your teeth go bad really slow*
Boy 4- *they can rot your teeth*

Children in both the control and intervention groups across baseline, post-intervention and follow-up were easily able to list things that we used our teeth for e.g. eating, drinking, talking, chewing and smiling. Following the SOHP intervention group children were asked if they could name the teeth. Post-intervention, intervention children in all schools, apart from those in the lower SES areas (who needed more assistance), were able to use the models to easily name the teeth and point to them. However, within the follow-up FGs the children took longer and required more support with this task. Within both the control and intervention groups, children had mixed feelings about the importance of primary

dentition, with the children understanding that if we lose our adult teeth "*that last pair of teeth you ever have in your life, if they fall out false teeth for you*". Across the study only a handful of children within each group explained why both sets were important:

> Control group baseline- *I think baby teeth are still important because you need to keep them white and erm keep them healthy because if um the top of your young tooth are um is rotten it could it could disease put a disease in into the older one*
>
> Intervention group follow-up researcher– *so do you think our milk teeth and our adult teeth are both important?*
> Children– *yes*
> Boy 2- *cos if one of your milk teeth falls out at not the right time you will just have a gap for ages until the big tooth starts growing*
> Boy 1- *like mine I lost them last year and it still not come through* (Researcher– *they still not come through does that make it hard to do things or does it annoy you*) *yes*
> Girl 2- *I tried to pull this tooth out and it managed to come out and it didn't come back for like a year and this one came out and I didn't have them two but now they started coming through* (Researcher- *so did it make it hard to eat?*) *a bit*
> Girl 2- *I lost that tooth two days ago and now it is harder to eat* (Researcher– *cos it hurts still?*) *yeah*

Influences on children's OH behaviour and routine: Within the FG although few children talked about support, they provided detail around what support was received in relation to reminders, brushing together or help with brushing:

> Control group baseline boy 8- *I don't like anything and when my mum helps me she always touches my gums and it hurts me and then she pushes me against the wall*
>
> Control group baseline girl 1- *my mum says my teeth are all precious as I still have quite a few milk teeth*

Boy 1- *I only do it in the mornings and I never do it in the night on Fridays*
Girl 3- *do you brush your teeth on your own or with someone else?*
Girl 3- *I sometimes brush it on my own and I sometimes get my mum to help; if I am struggling she sometimes brushes it for me.*
Girl 4- *this morning I did them myself cos my sister is not well*
Boy 1- *brush them on my own*
Girl 2- *brush them on my own*

Intervention group baseline researcher– *did anyone use to help you to brush your teeth?*
Girl 2- *my mum used to help me* (researcher– *has she stopped now cos you can do it yourself?*) *nods head*
Girls 2– my mum reminds me sometimes
Boy 1- *I can do it on my own* (researcher– d*o they sometimes remind you to brush your teeth?*) *no I always remember*
Boy 2- *I do mine on my own*
Boy 3- *I never get reminded*
Girl 3– *I don't need reminding cos when I get out of bed I always need to wake up by doing my teeth*

Intervention group Post-intervention Researcher- *so do you think it has helped you to brush your teeth at the same time every day?*
Boy 1- *I can't do it at the same time, I always have to take my dad to work so it hard as we always come back at different times*
Girl 2– *it's hard for me as I have to get up and take my dad to work, so I come back and brush my teeth and then I go to school*

Intervention group follow-up Girl 3- *my mum at the end of every month she brushes them*

Within the OH FG children showed both understanding and miss-understanding of the dentist's role and talked about previous visits to the dentist. Children described previous dental visits as both symptomatic (intervention follow-up "*I have been dentist to have the back ones taken out"*) and also regular visits (e.g. "*you have*

check-up and in case it's been like 3 month you come back and see like if your teeth are alright or if they are gone bad"). Across both groups and the study period there was no noticeable increase in knowledge about dentists, with answers being based on their own, or a family members' experience. Most commonly children reported the dentist to:

- do check-ups - Intervention follow-up "*my dentist in ... and all these one at the back taken out…3…2…2"*,
- give people fillings- control baseline "*they have to fill it put loads of things in your mouth and make it white"*
- take teeth out (extractions) - control baseline "*yeah...I don't like it (Researcher- what don't you like about it?) every time I have to have a tooth out (Researcher- and you don't like it) no, and the next one could be my big tooth*"
- put in false teeth.

Although many of the children talked about dentists and parents being able to help, a small number of children reported misconceptions (**Misconceptions related to toothbrushing**) around who is able to help with our teeth, which in relation to '*the hospital'* could be a reflection of past experience of a General Anaesthetic dental extraction:

> Intervention group baseline researcher– *so who do we go and see or who might be able to help us if our teeth go bad?*
> Boy 2– *dentist*
> Girl 2– *your mum and dad*
> Girl 3– *the hospital*
> Boy 3– *my sister* (Researcher– *she older than you*) *she's 10* (Researcher– *she reminds you, do you brush your teeth together?*) *yeah* (Researcher– *is that better than doing it on your own?*) *yeah*

Post-intervention, one intervention group child said "*maybe the doctors*". However, this was the only reference to doctors across all FG and both groups. Also following the SOHP one intervention group child responded '*the Teeth Chiefs*', showing they had taken the information from the SOHP but had confused it with people that can help if you have problems with your teeth.

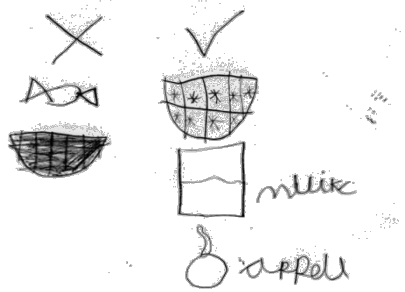
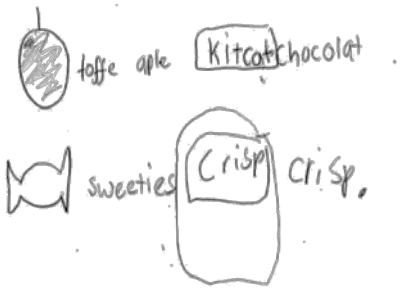
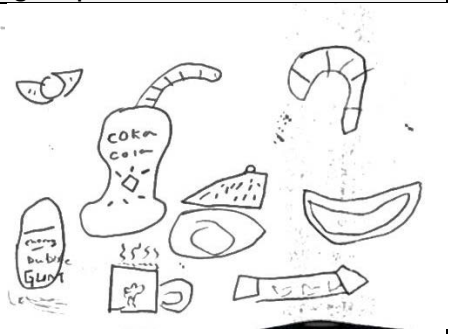
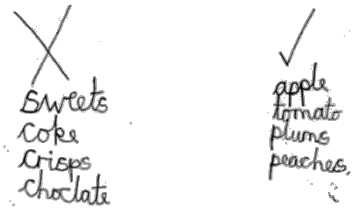
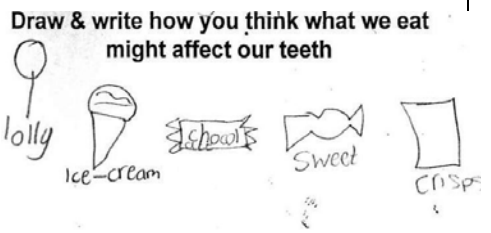
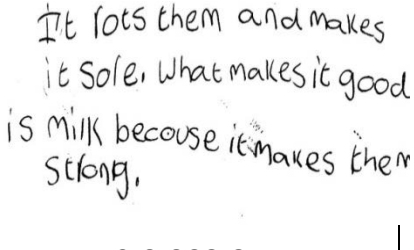
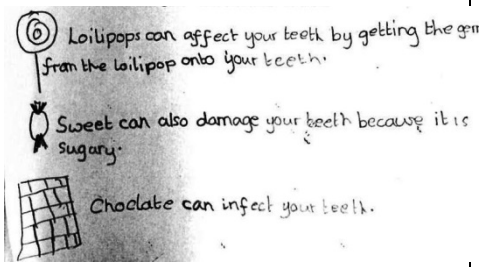
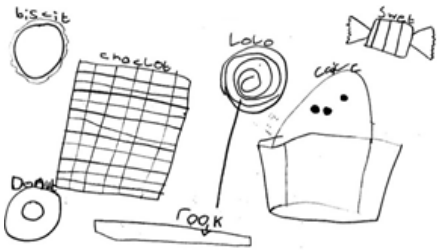
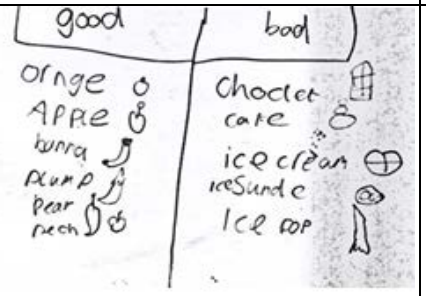
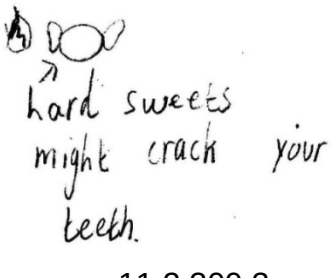
6.7.5 Results: Tertiary outcomes – Knowledge relating to sugar-snacking

This section aims to compare outcomes from intervention and control group to understand the impact of the SOHP on children's reporting on the question – *How do levels of knowledge change in 6-7 year olds regarding sugar-snacking as a result of a SOHP*?

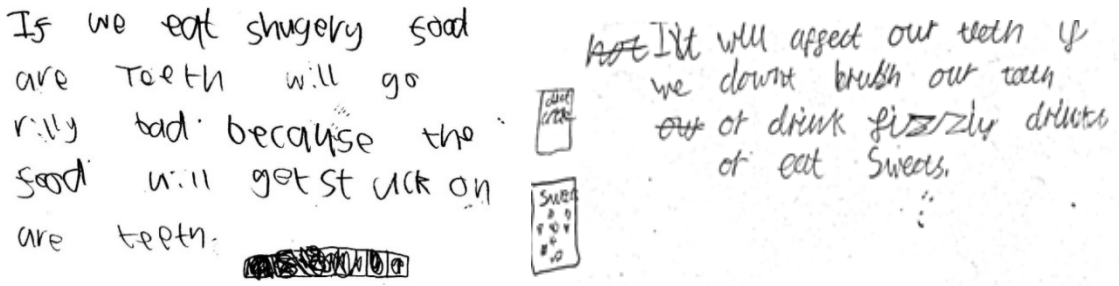
6.7.5.1 Children's D&W results in relation to knowledge linked to sugar-snacking

With the D&W one statement asked about children's knowledge of how what we eat might affect our teeth. Overall both the control and the intervention group children across the study period were able to talk about the importance of '5 a-day', but through the D&W did not show changes in their understanding of how sugar can impact our teeth. Children were able to provide examples of how sugar impacts our OH; in terms of what is good/bad for us to eat as lists. For both the control and intervention children responses were not linked to nighttime sugar-snacking, so through the D&W it is not possible to understand how the SOHP impacted knowledge in the intervention group compared to the control group.

Across the study period within the D&W when the children were asked how food can affect teeth, answers were often similar to those for keeping teeth healthy, in relation to fruit/vegetables ('5 a-day') being healthy/good and sweets/choc etc being unhealthy/bad in relation to OH. Throughout the study although both intervention and control group children showed understanding around how different food affects our teeth (see examples below), but it was not always clear they understood the details of why, with few mentioning sugar directly (only referring to food types) across the study period, with this knowledge showing little change as a result of the SOHP for the intervention group. For both the control and intervention groups as shown in the images below children did not always indicate if food/drink drawn or written about was good/bad for our teeth, making it difficult to fully determine their level of understanding, and any impact the SOHP had on intervention groups children's knowledge compared to the control group.

Intervention group		Control group	
 02.1.058.3	 04.1.109.3	 10.2.220.3	 13.2.334.3
 02.1.062.3	 05.1.129.3	 10.2.226.3	 10.2.228.3
 05.1.118.3	 08.1.169.3	 13.2.338.3	 11.2.300.3

Within the intervention group more complex answers around reasons sugar is bad for our OH was limited, with it not being possible through the D&W to determine any impact on knowledge of the intervention group compared to the control group relating to this as a result of the SOHP.



6.7.5.2 Children's FG results in relation to knowledge linked to sugar-snacking

Overall through the FG relating to sugar-snacking/nutrition children's knowledge around sugar reflected the less developed nature found for germs and for intervention children compared to control children showed limited progression throughout *study 2*. As reported through the D&W children clearly had an understanding of what is good and bad for us in relation to food and drinks but did not always report acting on this knowledge in terms of behaviour. Although it seems the SOHP had some impact on the children's knowledge around sugar and nighttime sugar-snacking, this was not universal across the intervention group. Some children understood that sugar leads to germs (e.g. "*it makes more baby germs*"), but there were also children who just reported sugar as causing the OH problems (e.g. "*rots your teeth*") throughout *study 2*. Within the FGs as found in the children's questionnaire, few children reported having sugary-snacks at night (**Children's reported behaviour linked to sugar-snacking**); with most children reporting drinking water in the night. Across both groups the children showed understanding of the need to re-brush teeth if you have sugary snacks at night; with reasons being to do with germs, sugar and the toothpaste being washed away. The quotes and outcomes below are designed to help illustrate the main themes of the FGs (theme map, *Figure 6-12*).

Within the FG there was very limited indication of **children's attitudes in relation to sugar-snacking**. There were a small number of children who talked about not

liking sweets and fizzy drinks and only one child across all the FGs who talked about liking sugar. As with talking about their attitude towards sugary foods, few children made reference to the frequency they have sugar-snacks either at night or during the day. Due to the limited reference to this theme it is not possible to know how the SOHP had an impact.

Knowledge and understanding linked to sugar-snacking: Through the FG many of the children taking part understood from baseline that if you eat anything following toothbrushing at night you should re-brush. This was often explained in relation to food sticking to teeth or needing to remove germs. Following the SOHP and over the follow-up period children still explained the need to re-brush but there was only limited evidence of increased knowledge around the reasons within the intervention group, with children in higher SES schools appearing to show the greatest increase in knowledge (but it is not being clear how much this knowledge was from the SOHP or other sources):

> Control group baseline researcher- *so if you have brushed your teeth and then you eat or drink something what do you think might happen, you know that one straight away?*
> Girl 1- *you will have to brush them again*
> Researcher- *yeah, do you know why?*
> Girl 2- *because it might stick to your teeth and if you don't brush it again more food can stick to it and it can all go…*
> Boy 3- *if you don't brush your teeth after you've had fizzy drinks or something like that you probably need to brush your teeth*
> Boy 1- *they can rot*

> Intervention group baseline researcher– *so what might happen if you eat or drink once you have brushed your teeth?*
> Boy 3– *your get more things on your teeth*
> Boy 1– *the fluoride will wash off your teeth* (researcher– *where does the fluoride come from*?) *toothpaste* (researcher– *who told you that*?) *I heard it*
> Boy 3– *I heard it on an advert*

Girl 4– *you have to clean your teeth again as you got things on it so you have to do it again.*
Girl 2– *someone I know just puts toothpaste in their mouth and just wipes them* (researcher– *do you think that will work?)* boys – *no*
Girl 2– *when you brush your teeth and you have something else, you're supposed to brush your teeth and then not have something else.*

Intervention group post-intervention researcher– *what happens if we eat or drink once we have brushed our teeth?*
Boy 1- *you have to do your teeth again*
Boy 2- *you have to do your teeth again and you have to do it when you do a bit more to 120*
Girl 2- *you have to if you keep drinking all the sugar, if you brush your teeth you're not allowed anything else to eat till the morning* (Boy 1- *expect water*) *because all the toothpaste if you have something to drink all the toothpaste that sticks to your teeth to make them clean it will just go away and you have to brush them again cos you need to keep the clean*
Boy 2- *it will wash all the fluoride out of your teeth*
Boy 1- *you can have it like in the middle of the night the water*

Intervention group follow-up researcher– *so what might happen if we eat or drink once we have brushed our teeth?*
Boy 1- *it might have sugar in and it can go into your teeth and it won't give a chance for you toothpaste to work, and if you have a drink and spat it out it could take some of the toothpaste away.*
Boy 3- *the toothpaste has fluoride in and when you drink some water even though it is good for you it can take the fluoride off*

At baseline, post-intervention and follow-up within the nutrition/sugar-snacking FG children showed a good knowledge of food and drink that were both good and bad for our teeth. Although children talked about '5 a-day' and the need to eat fruit and vegetables in order to help keep our teeth healthy there was no progression in the

explanations of why this type of food helps with our OH. When children were asked about how food can affect our teeth, children had a less developed knowledge, with discussion relating to this question being limited at baseline, post-intervention and follow-up. More complex answers to this question often related to food/sugar getting stuck to our teeth both physically, in relation to germs and eventually how sugar can lead to OH problems, but there was limited detail around the 'why'.

> Control group baseline researcher- *so how does food actually affect our teeth, what does food do to our teeth?*
> Boy 3- *if you if you have a lot of sugar you got to um um you they give you teeth plaque.*
> Boy 1- *if you eat too many unhealthy things they can turn black and fall out*
>
> Intervention group baseline researcher– *does anyone know how sugar affects our teeth?*
> Boy 1– *you get loads more germs*
> Boy 2- *sugar is germ insects*
> Girl 2– *because it can*
>
> Intervention group post-intervention researcher– *so how can food affect our teeth?*
> Boy 3- *cos if you don't brush them it will just keep sticking in your teeth and all the germs will come and they will pull all the food out and then there just start, just putting holes in your teeth*
> Girl 3- *because if you eat sugar things or something and all stuff will get inside your teeth and all it will go mouldy*
> Boy 2- *if you eat sugar stuff, they might like rot your teeth and if you don't brush them that night the germs will get them*
> Boy 4– *bad food has germs on*
>
> Control group follow-up researcher- *what does food do you your teeth?*

Boy 3- *if you eat unhealthy stuff your teeth could rot if you eat healthy stuff then it could still rot but like be not too bad*
Boy 1- *it can get stuck in awkward places*
Girl 3- *it can rot your teeth*

Intervention group follow-up researcher– *what happens if you eat sugar?*
Boy 2- *they can affect your teeth by drinking coke, lemonade, fizzy pop*
Boy 4- *cos it's too sweet*
Researcher– *and what does the sweetness do?*
Boy 4- *It makes more baby germs*
Boy 3- *no they split in half*
Researcher- *they split in half*
Boy 2- *and they attack your teeth*
Girl 3– *they make your teeth so they things or fizzy drinks are bad*

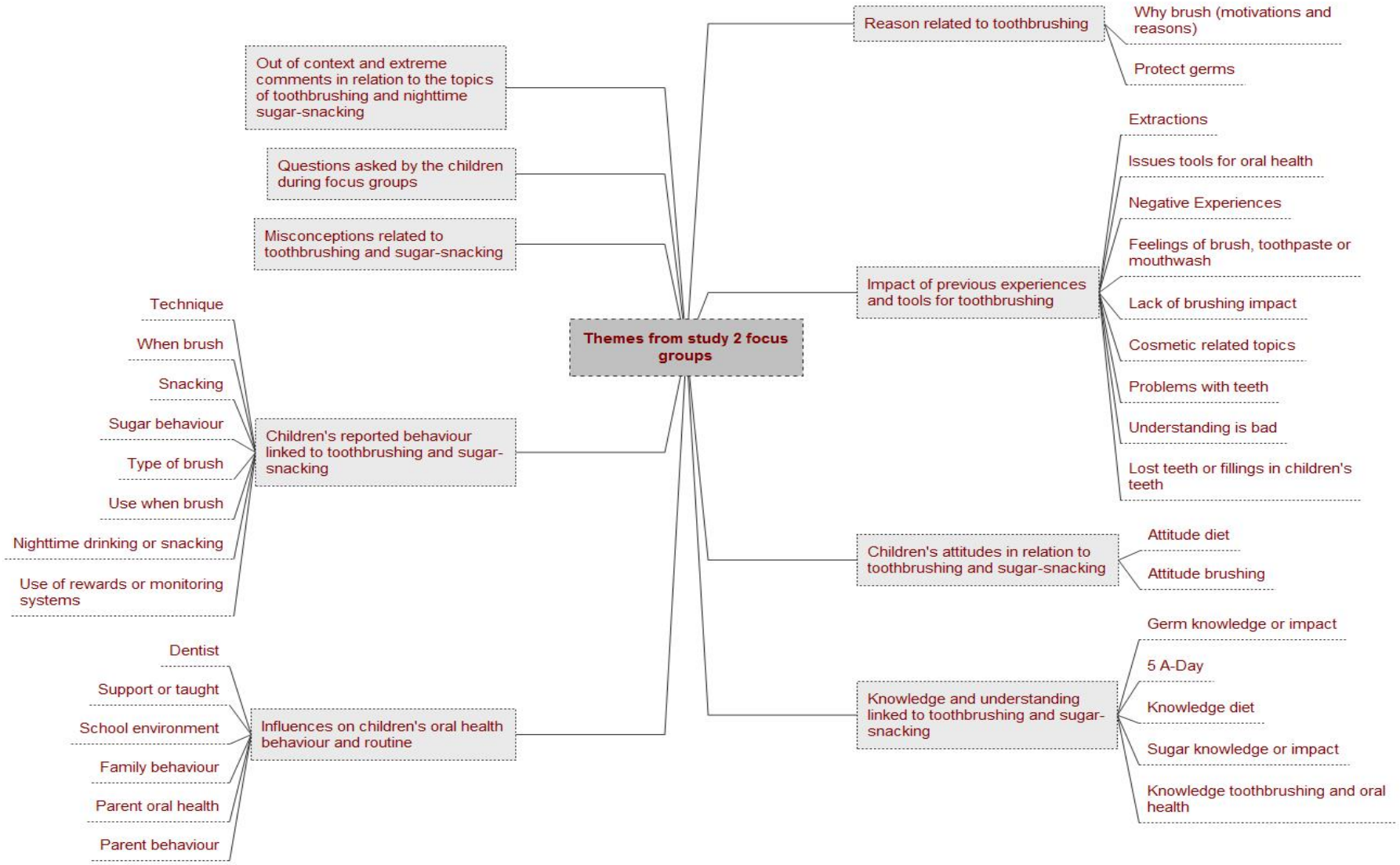
Misconceptions related to sugar-snacking in children's knowledge were found in relation to questions around '*how can sugar affect your teeth…what does sugar do to your teeth?'* as can be seen in the extract below:

Boy 2- *it makes your teeth go black*
Researcher- *yeah it makes your teeth go black…does anyone know why if makes your teeth go black?*
Boy 3- *If it it's got some things in it that makes your teeth go black*
Girl 2- *has it got calcium in it?*
Researcher- *no calcium is good for your teeth*

6.7.5.3 Theme map from the analysis of children's FG results

Having considered the findings from the FG across the study period the key themes that have come out of the FG have been mapped to illustrate the main themes and the sub-themes arising within them (*Figure 6-12*).

Figure 6-12 Theme map from analysis of children's FGs in *study 2*



6.7.6 Results: Tertiary outcomes – children's reporting of routines

Through comparing the intervention and control group this section aims to answer aspect of the research question – *How do reported habits, barriers, facilitators and home influences in relation to toothbrushing and sugar-snacking behaviours change in 6-7 year olds as a result of a SOHP?*

6.7.6.1 Children's D&W results in relation to routines

Within the D&W three of the statements focused on understanding general knowledge and reporting of their own and others behaviour, further one statement focused on a more complex level of understanding by asking children to think directly about their life and routines.

Table 6-13-6-15 (below) illustrates routines drawn by children within the intervention and control groups at baseline, post-intervention and follow-up. At baseline the majority of children in both groups drew single behaviours, with some not referencing toothbrushing. Post-intervention the complexity of both groups reporting increased for most children; but the intervention group children's reporting of their behaviour was overall more complex than the control group (including steps within a routine linked to toothbrushing), providing a greater insight into how toothbrushing fitted into morning and evening routines. From post-intervention to follow-up children's depiction of their routines remained the same in terms of complexity, with sequences of events showing where brushing occurred and also in a small number of instances if nighttime sugar-snacking occurred.

Table 6-13 Baseline D&W what you do in the mornings and to get ready for bed

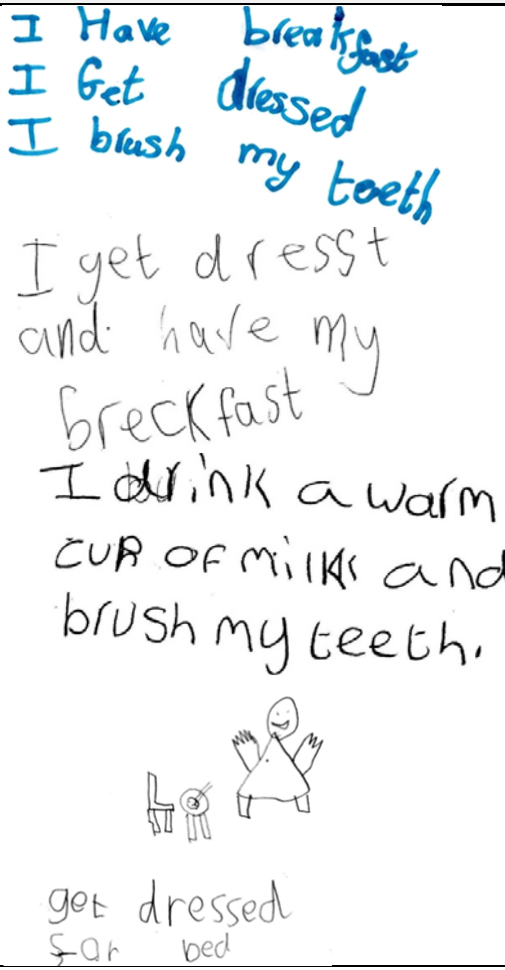
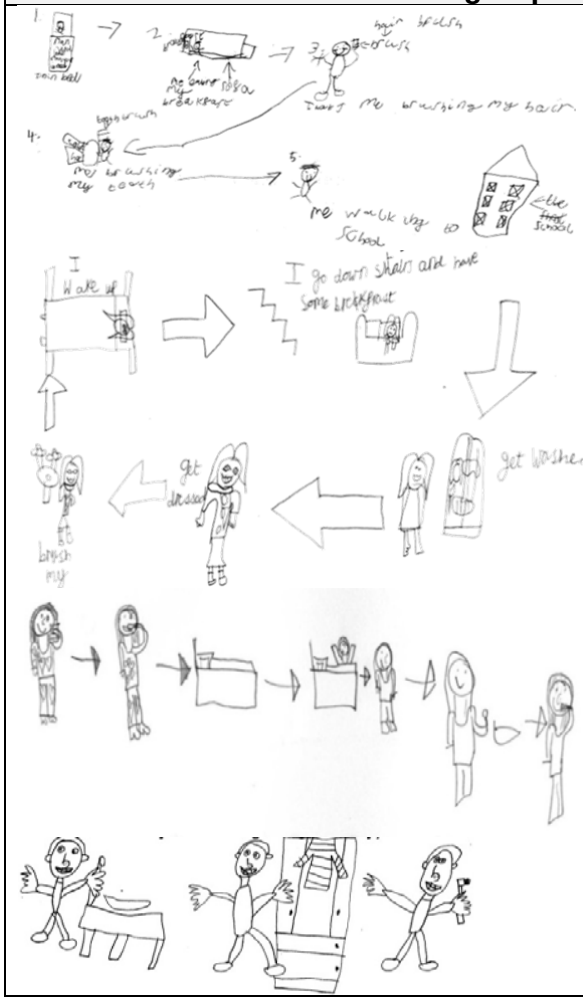
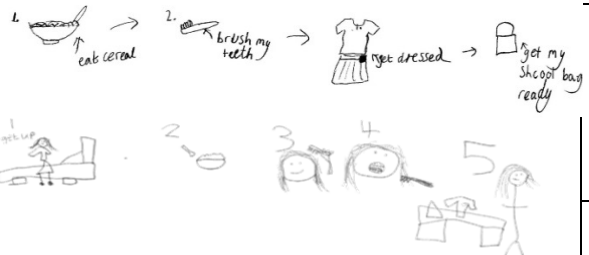
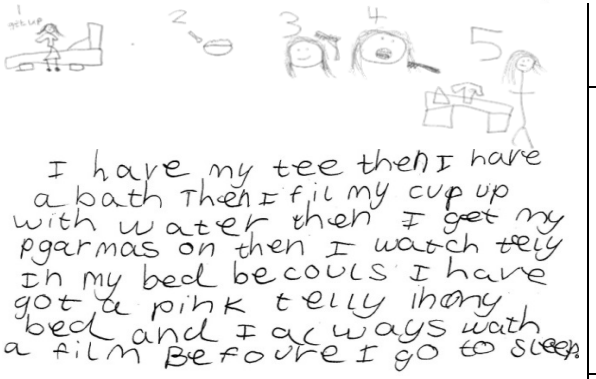
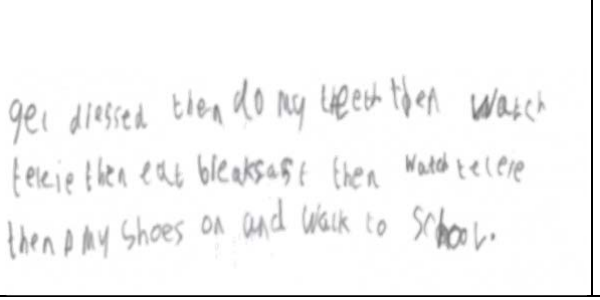
Intervention group		Control group	
	Wash my teeth		I have breakfast I get dressed I brush my teeth
			I get dressed and have my breakfast
	When I get up and go to bed my mum tells me to brush my teeth		I drink a warm cup of milk and brush my teeth
			Get dressed for bed

Table 6-14 Post-intervention D&W what you do in the mornings and to get ready for bed

Intervention group		Control group	
	Get up Eat breakfast on the sofa Brush hair Brush teeth Walk to school		Put toothpaste on brush, brush teeth, rinse brush
	I wake up Go down stairs and have breakfast Get washed Get dressed Brush teeth		Get breakfast Brush my teeth Get dressed Get my school bag ready
			I have my tea then I have a bath then I fill my cup up with water then I get my pyjamas on then I watch telly in my bed because I have got a pink telly in my bed and I always watch a film before I go to sleep
			Get dressed then do my teeth the watch telly then eat breakfast then watch telly then put my shoes on and walk to school

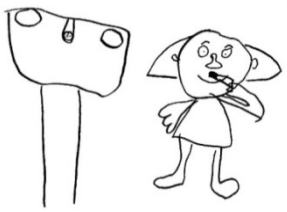
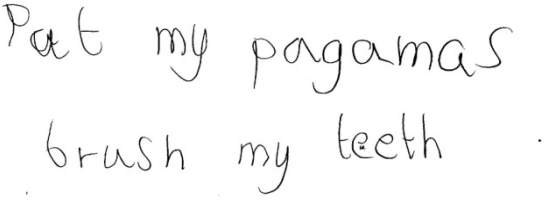
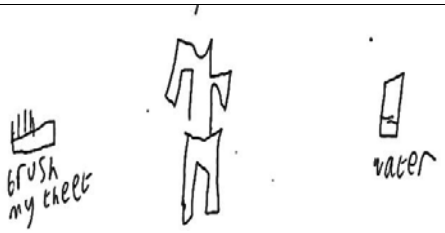
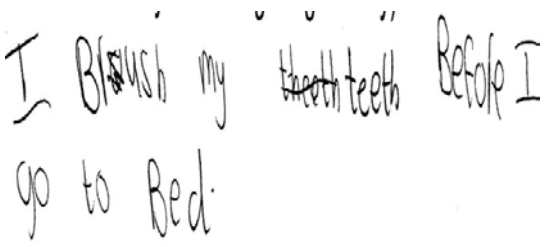
Within the intervention group, post-intervention although most children included pictures of toothbrushes within their routine this was not always the case, as shown in the two images below.

03.1.076.3

06.1.141.3

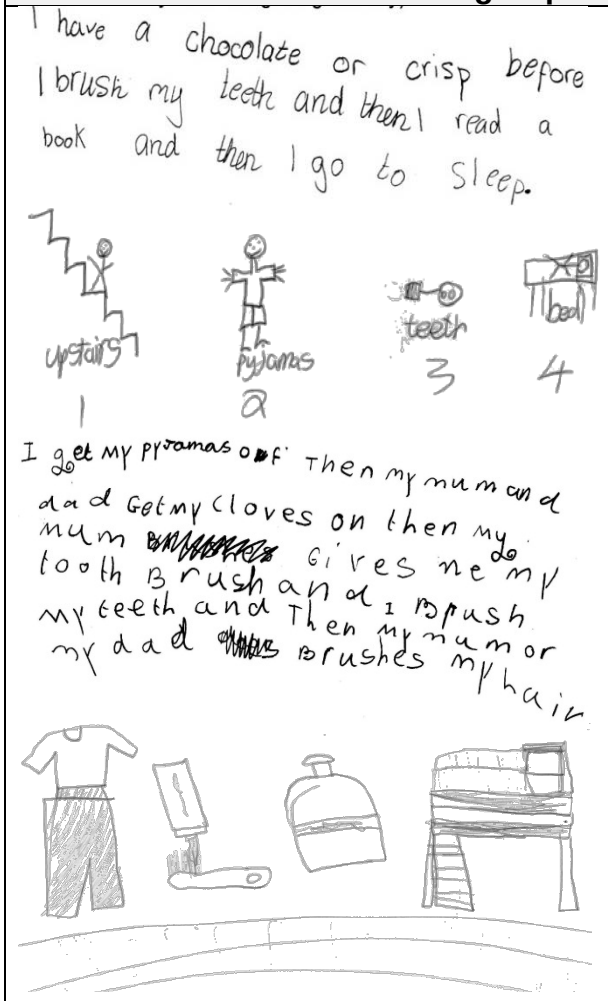
Post-intervention in addition to the more complex routines drawn, there were still control and intervention children (most commonly found with children in low SES schools) who only drew & wrote their responses as a singular behaviour around toothbrushing or only related it to being linked to one other behaviour (e.g. get dressed) (*Figure 6-13*).

Figure 6-13 Post-intervention examples of less complex routines from the D&W

Intervention group	Control group
 02.1.048.3	 09.2.192.3
 03.1.087.3	 10.2.226.3
 06.1.156.3	 13.2.342.3

Despite children moving up a school year which is likely to mean they have progressed developmentally, there was no additional level of complexity or detail added between post-intervention and follow-up. It is possible that children were not as focused on their OH routines as they were post-intervention due to the active part of the SOHP having ended. However, as the same levels of reporting of routines were found between control and intervention group children, it may be that just being part of a study around OH had an impact as well.

Table 6-15 Follow-up D&W what you do in the mornings and to get ready for bed

Intervention group		Control group	
	I have a chocolate or crisp before I brush my teeth and then I read a book and then I go to sleep I get my pajamas on then my mum and dad get my clothes on then my mum gives me my toothbrush and I brush my teeth and then my mum or my dad brushes my hair		I have some tea then have a bath then I brush my teeth and put my pajamas on and go down stairs and get some milk and go to bed.

6.7.6.2 Children's FGs results in relation to routines

Across both the intervention and control groups there was a limited amount of additional information in relation to routines during the FG. This was most frequently in relation to when the children brushed their teeth around meals ("*before supper*"; "*I do it after I have had my breakfast, cos if I brush my teeth then have my breakfast I would have to brush them again*"; "*because if you brush your teeth before breakfast it will be all minty and you get dirt on them*"). Those who provided a context mostly reported brushing after, with two children at follow-up reporting "*I brush my teeth before and then also after*"), other steps in the routine ("*when I'm dressed*") and before activities (e.g. "*I brush them half an hour before I go to bed*"; "*I do them last thing before I leave*"; "*I do it and then I go to bed*"). Post-intervention within one intervention FG three of the children also demonstrated their differing attitudes to brushing when providing information about when the brush:

> Boy 1- *I do it when I'm in the bath*
> Boy 2- *I used to do it in the bath, and I remember I used to spit it all out in the bath*
> Boy 4- *eugh all the germs that have come of you might go into it*

6.7.7 Parent questionnaire results relating to parents reporting of their own and their children's toothbrushing behaviour, sugar-snacking behaviour, knowledge and children's routines

In addition to the children's research tools the small number of returned parent questionnaires provided a baseline understanding of how these parents reported toothbrushing (their own and their children's), sugar-snacking (their child's) and routine behaviour (their child's). Parent response rates were very low, and therefore conclusions cannot be drawn from these results. Descriptive data is presented below for all returned baseline parent questionnaires to illustrate if the control and intervention arms were reported as similar (insufficient numbers of questionnaire were returned post-intervention and at follow-up by parents who had also completed a baseline questionnaire to allow data to be analysed, to show the impact of the SOHP). For completeness a description of the parent questionnaires that were able to be tracked across all three time points is included in *appendix 36*.

However, the results are not reported here due to the very small numbers and no conclusions can be made from these outcomes due to likely biases and the number.

6.7.7.1 Baseline Parent questionnaire results in relation to parents reporting of their own and their children's toothbrushing behaviour

Due to the low number of parent questionnaires returned the findings will not be representative and also likely be impacted by biases. *Table 6-16* compares parent reporting of their own and their child's behaviour at baseline. For those who returned the questionnaire, in both groups no parents reported they or their child brushed less than once-a-day, with control and intervention group parents most frequently reporting both themselves and their child brushing twice-daily.

Table 6-16 Baseline crosstab of parents reporting in the Parent questionnaire of their own and their child's toothbrushing frequency

Baseline reported behaviour by parents	Intervention group		Control group	
	Children % (n)	Parents % (n)	Children % (n)	Parents % (n)
Once-a-week or less	No responses			
Every other day	No responses			
Once-a-day	18.6 (8)	11.6 (5)	16.7 (8)	18.4 (9)
2 or more times a day	81.4 (35)	88.4 (38)	83.3 (40)	81.6 (40)
Missing	0	0	2	0

As well as being asked about toothbrushing behaviour parents were also asked about support. Although it will not be representative of the whole parent population, at baseline, n=26/43 intervention group parents reported their children brushing alone; whilst n=24/50 control group parents reported their children brushing alone. N=18/50 control group parents reported supporting (mostly mothers) their child's toothbrushing, with n=2 reporting brushing for their child. Whilst n=13/43 intervention group parents reported brushing together and only n=1/43 reported brushing for their child. Despite the limited level of support with toothbrushing reported by parents, *Table 6-17* (below) indicates that at baseline the small number who replied felt the most effective way to teach children about

health was to show them by practicing the skill, but this will not represent the cohort and is likely impacted by biases.

Table 6-17 Baseline reports by parents using the Parent questionnaire in relation to - What do you think is the best way to teach your child about health?

Method of teaching	Intervention group	Control group
	Baseline % (n)	Baseline % (n)
Explain without example	2.4 (1)	0 (0)
Explain using an example	14.6 (6)	25.0 (12)
Show your child by practicing the skill	82.9 (34)	75.0 (36)
Missing	2	1

6.7.7.2 Baseline Parent questionnaire results in relation to parents reporting of their children's sugar-snacking behaviour

Within the small sample of parent questionnaires, when they were asked about their children's sugar-snacking behaviour at baseline**,** n=36/43 parents in the intervention group reported their children did not have sugary-snacks at night (control n=45/50), with n=5/43 reporting children sometimes had snacks before bed (control n=1/50). Whilst this small number cannot be considered representative, as reported by children, if they needed a drink in the night n=10/43 intervention group parents reported children only had water (control n=16/50). Thirty three of the n=43 intervention parents reported their children liked the taste of sugar (control n=44/50), but n=24/43 said their children never had sugar added to food or drink (control n=21/50) or were only allowed a limited amount n=15/43 (Control n=20/50). Despite reporting sugar was not added to food and drinks n=15/43 intervention parents reported their child being allowed sweets or chocolate daily compared to n=12/50control; with n=22/43 saying they were only allowed them a couple of times a week (control n=22/50).

6.7.7.3 Baseline Parent questionnaire results in relation to knowledge around knowing teeth are healthy, issues and problems

Due to the low response rate, the findings in relation to parent's knowledge around knowing teeth are healthy, issue and problems cannot be considered representative of the whole parent population in the study and are likely impacted

by biases. As part of the parent questionnaire, parents were asked about their children's dental attendance and if they had been provided with any OH education at the dentist. At baseline, n=38/43 intervention group children were reported to be regular dental attendees by their parents compared to n=41/50 in the control group. Within the small sample, only one parent in the intervention group and two parents in the control group reported their children had never been to the dentist. Although it is unlikely to be representative of the whole parent population, at baseline only n=4/43 intervention group parents reported asking dentists to provide OH education to their children, with n=20/43 reporting not asking anyone for help with OH education, a similar level to the control group n=22/50. It is not known if general dental information was provided by the dentist during any of visits and how this may have impacted behaviour or knowledge.

6.7.7.4 Parent questionnaire results in relation to routines

In addition to children being asked about their routines parents completed the Child Routine Inventory (CRI) (Sytsma, Kelley & Wymer, 2001; Jordan, 2003). This aimed to provide insight into routines which connected aspects of the SOHP around toothbrushing and sugar-snacking. The CRI is constructed around 4 domains relating to routines in a child's life; *Table 6-18* outlines parent responses in relation to the domains at baseline. At baseline for the small sample who returned the questionnaire, intervention and control group parents reported similar levels of stability in relation to their children's routines.

Table 6-18 Baseline Parent questionnaire factor outcomes for 'Child routine inventory' (Jordan, 2003)

Questionnaire factor	Intervention group(n=43)		Control group (n=48)	
	Mean	SD	Mean	SD
Daily living routine (11 items)	50.7	3.52	50.9	3.22
Household routine (9 items)	27.4	5.57	30.0	4.91
Discipline routine (11 items)	42.3	6.23	45.3	6.28
Homework routine (5 items)	18.0	1.65	18.4	2.48
CRI total score	137.5	11.56	145.3	12.20

At baseline, when exploring specific items within each domain, when parents were asked "*my child does the same things each night before bed*" (part of daily living routine) n=13 intervention group parents said this was the case often (control n=16), with only one saying this occurred sometimes (control n=2), With one control parent also saying this was rarely the case. However, when parents were asked "*my child eats breakfast at about the same time and place each morning*" (part of daily living routine). Parent's reporting of "*my child brushes teeth before bed*" (part of daily living routine) produced similar levels of reporting for the intervention and control group as those from the parent questionnaire. Part of the '*Brush Day & Night*' programme relied on the use of rewards for the correct brushing behaviour, at baseline as part of the discipline routine factor parents who returned the questionnaire in both groups reported the children are rewarded or given privileges for specific good behaviours.

6.8 Discussion relating to the clinical and behavioural outcomes, the sample and the research tools

6.8.1 Discussion of outcomes relating to the study design, *study 2* clinical and behavioural findings and research questions

When considering the design of the trial, health interventions delivered in schools, evaluated via cluster studies, provide an opportunity to answer certain questions, research effectively with groups, and implement an intervention where individual randomisation may not be feasible, or as suitable (Keogh-Brown et al., 2007).

Within schools children are grouped into classes, which means that behavioural interventions with a whole class component cannot be confined to an individual (unlike for example, the way a fluoride varnish trial could be). Moreover, for behavioural interventions where a component is delivered at the whole class level or where aspects will be discussed in the classroom, between children and/or parents, it is not appropriate to individually randomise children within a class. Randomising at an individual level for these types of behavioural interventions would make any estimations of effect inaccurate; therefore there is a need to group the children in classes which requires a cluster design (Hayes & Bennett, 1999). Further factors that mitigate against randomising at the individual level for school based behavioural interventions include: increased risk of contamination

(Hardman et al., 2007; Keogh-Brown et al., 2007; Ford et al., 2012); additional logistical problems for teachers and greater ethical issues if only delivering the intervention to part of a class (Sadler et al., 2007; Hemming et al., 2011). Previous examples of cluster-controlled trials in school OH intervention research include Redmond et al. (1999) and Worthington et al. (2001).

In relation to research Q1 using the child self-report measure of daily toothbrushing frequency and plaque measures *study 2* was found to have a non-significant impact on plaque outcomes and toothbrushing rates. However, individual intervention group children reported changes in toothbrushing behaviour as a result of the SOHP. These slight changes in reported behaviour could be due to reported shifts in self-regulation (through recording of brushing on the provided toothbrushing charts), reinforcement of key messages, and greater awareness of routines. Post-intervention the intervention group children who could correctly remember the message around when you should brush (day & night) where more likely to report twice-daily toothbrushing. Although it may not be representative of the whole study population, for the small sample of parents who returned the parent questionnaire many also reported children brushing twice-daily. This highlights a challenge within intervention research to support both those who feel they already have good habits and may need support to improve other aspects (e.g. time spent brushing) and also families that may need support in just establishing the habit of toothbrushing.

Three key factors may have influenced the clinical and behavioural findings. Firstly, baseline self-reported brushing was already high (over 1.5 times a day), this makes it more difficult for interventions to detect a change in behaviour but it cannot be known fully if this was an issue with the sample selected, or how much over-reporting occurred. Secondly, behavioural self-report has a tendency to be inaccurate (e.g. due to reporting bias, Peat, 2002). Finally, at baseline 34% of intervention (n=59) and 24% of control (n=18) children had teeth free from plaque, with overall average plaque levels being low. These outcomes highlight a challenge within intervention research to understand how an intervention works and impacts on a target population's health, which through national data is reported as poor (i.e. OH within Salford is amongst the worst in the North West (NW) of England with higher disease levels than the English average (*chapter 2*)),

but through self-report and low plaque levels, it can appear that the correct behaviour is being carried out.

Furthermore in relation to research Q1 post-intervention the SOHP had a statistically significant impact on reported nighttime sugar-snacking behaviour of children in the intervention group compared to those in the control group, but that this was not sustained at follow-up. Although this suggests the SOHP had some impact on children's nighttime sugar-snacking behaviour, greater reinforcement appears to be needed after the initial SOHP to sustain any changes. When toothbrushing and nighttime sugar-snacking were explored together, those who reported good routines also reported less sugar-snacking behaviour.

In addition to the quantitative outcomes (plaque and children's questionnaire) qualitative outcomes are able to illuminate the findings in relation to exploring children's knowledge (research Q2). Using the qualitative research tools children showed they understood that we should brush our teeth to keep them healthy. Children's knowledge around the mechanisms of how OH issues form did not appear to be impacted by the SOHP. Using the qualitative research tools intervention group children showed an improved understanding post-intervention around the need to '*Brush Day & Night*' and how long you should brush your teeth for, compared to control children.

For germs and sugar children were able to explain that they are bad, but there was limited progression in both the intervention and control group of knowledge around 'how' and 'why' they impact the state of our OH. Messages around '5 a-day' and what food and drinks are good and bad for our teeth appear to be understood by the children. Through the qualitative methods although both groups of children understood that sugar intake should be limited, for intervention group children following the SOHP there was limited reference to nighttime sugar-snacking, the need to minimise this and reasons why. Through the qualitative outcomes the SOHP appeared to impact intervention children's knowledge in relation to aspects relating to sugar, germs and OH but had limited impact on the more complex aspects relating to these.

Within the intervention group from baseline to post-intervention spikes in reporting were seen around reported nighttime sugar-snacking and to a small degree in relation to toothbrushing support. Within *study 2*, intervention children were provided with brushing calendars that allowed parents to engage with their children which may have increased support provided (and interest/change in views relating to good toothbrushing routines) from baseline to post-intervention, In contrast reporting by control group children was more consistent around these two areas. For the concept of '5 a-day' there is was a more consistent pattern of reporting across the intervention and control groups, which may be a reflection of the fact this is more widely reinforced by a number of sources and a common message in schools for both groups (not linked to the SOHP). The spike in reporting found for the intervention group from baseline to post-intervention and the consistency in reporting across the control and intervention groups for '5 a-day' illustrate the importance of reinforcement to help messages be understood by the children.

For research Q3 across all research tools children reported infrequently receiving support with brushing, which is still recommended for children of this age, and could impact the development of the correct behaviour. When children reported receiving support this related to reminders (e.g. when they were tired) and in a small number of cases re-brushing and checking. Through the FG the children reported feeling they did not need help with brushing and at follow-up that they were old enough to not need support. Understanding how children define and describe support is useful for future SOHP to aid the development of tools to support children and parents. Within the SOHP parents were targeted in relation to supporting their children with the brushing calendar and providing rewards for the correct behaviour on the supporting website and through additional stickers. As children often reported not receiving support this may reflect why parents did not appear to be as engaged with *study 2*. Tiredness and boredom were cited by children in the FG as barriers to brushing. Future SOHP could look at ways to help make brushing more fun, in addition to a brushing calendar, for instance the '*Brush Day & Night*' programme website had a space for people to upload videos of brushing but this feature was not used.

Although due to the small number it is not reflective of the whole study population, control and intervention group parents at baseline reported routines being relatively stable, however there appeared to be less stability of reporting routines in the evening and eating breakfast. Post-intervention and at follow-up many of the intervention group children were able to depict more complex routines around morning and evening brushing, but some children still only drew single/paired behaviours. Toothbrushing occurs as part of a wider hygiene routine so gaining an understanding of routines helps SOHP understand how to develop programmes that can target the behaviour to develop the correct contextual cues. It is clear that for some children the SOHP impacted their toothbrushing behaviour, their attitude towards the need to brush and limit sugar and their OH knowledge but this was not sustained for all or universal across the intervention group.

6.8.2 Discussion around consent rates and response rates for children and parents and geographical split for sampling

Within *study 2* control group schools had a lower overall initial parental consent rates for their children to take part (43.7%), compared to intervention group schools (72.3%). When talking to teachers during the consent process many intervention school teachers said they actively engaged parents to improve consent rates. Within one control school the teacher was very surprised they had received such a poor parental response given their perceived importance of the topic, but they had been less active in trying to gain a higher consent rate. Despite the fact control schools, parents and children would be provided with the materials for the SOHP and home following completion of the follow-up (wait-list control) it may be as the consenting process took place post-randomisation there was a lack of perceived benefit by the parents of taking part in research where no immediate active delivery of the SOHP happened. Although the same numbers of schools were invited to take part, fewer control group schools accepted. This can lead to some additional bias occurring (e.g. imbalances in the matching process), with the likelihood of these biases having an impact being proportionate to the size of the difference between the two clusters (Kerry, & Bland, 2001; Guittet, Ravaud, & Giraudeau, 2006). Finally, it is recognised that difference in cluster sizes can lead to a loss of power, which is variable depending on the size of the imbalance (Guittet, Ravaud & Giraudeau, 2006).

Within *study 2* the main focus in relation to the outcomes measures related to the children's research tools, which enabled conclusions to be made about the effectiveness of the '*Brush Day & Night*' SOHP. Children's response rates were high:

- Intervention group children - baseline 97% (n=174); post-intervention 92% (n=166), and follow-up 83% (n=150),
- Control group children - baseline 97% (n=74); post-intervention 97% (n=74) and follow-up 92% (n=70).

The high response rates for children can thus have a mitigating effect on the poor parental response rates. A limitation of this research is the ability to use the data from the parent questionnaire to complement the children's data due to the poor response rates (*section 6.7.1*). Further to this the baseline parent questionnaires were sent home with the children on the day the baseline children's research tools were conducted. This means that the parents' awareness of the study and the topic (OH and sugar-snacking) may have led to a potential confounder through sequencing issues and raised awareness of the topic area as a result of discussion with their children after school. Where parents only returned the post-intervention or follow-up questionnaires this data was not used within the analysis as it would not be possible to compare it to a second time point (e.g. baseline). Within *study 2*, at each of the three time points the questionnaire was only sent out once, with teachers being asked to remind parents to return questionnaires and letters explaining the study and the importance of returning the questionnaire (*section 6.6.2.2.5*). Although this is recognised as a limitation and likely contributing factor to the low response rate, as outlined in *section 6.6.2.2.5* using additional methods (e.g. incentives or sending the questionnaires directly to houses if they were not returned) was not possible, because parent's names, addresses, etc., were not available to the researchers. Given the length of the time between baseline and post-intervention (4 weeks) sending unreturned questionnaires out multiple times would also have likely impacted them reflecting a baseline and allowing time to show any post-intervention change.

The use of surveys often attracts a certain amount of non-responders, and obtaining a satisfactory percentage of returned surveys is becoming increasingly

challenging for researchers (Galea & Tracy, 2007; Bryman, 2012). Previous studies (e.g. a trial looking at questionnaire length, whether personalisation mattered and difference in reminder types) using a similar style of delivery (postal instead of supplied through their children) and length of questionnaire reported average response rates of 17% (Sahlqvist et al., 2011). They also reported that shortening the questionnaire from 24–15 pages significantly increased the response. Within this study the questionnaire was only n=12 pages (number of questions 48 plus 37 items in the child routine inventory). As such the number of pages should not have been a factor impacting the low response rate, but it is not known if the number or types of questions impacted the response rate. Nationally within the UK, it has been found that postal survey response rates are continuing to fall. For instance within Bolton (an area within Greater Manchester) the Health and Wellbeing survey in 2010 had a response rate of 30%, compared to 68% in 2001. Although the parent questionnaire was not a traditional postal survey the level of response was similar to that seen within Bolton in 2010 (30%). In contrast to challenges of engaging parents, discussed further in *chapter 7,* teachers within the lower SES schools appeared (through discussion) to place more value on the need for the SOHP to support children and families, highlighting a potential contrast between levels of parent and teacher engagement.

Hansen et al. (2014) looked at the impact of non-responders on a health and lifestyle questionnaire as part of an intervention with 20-40 year olds with multiple psychological and lifestyle problems. By calling people who had not responded they achieved an extra 10% of questionnaires returned, however they reported the increase in response rate "*did not change the estimates of the interventions effects on different health resources and lifestyle outcomes*" (p.5) but the study gained strength. Linked to this, Galea & Tracy (2007) explored the declining trends in participation rates within epidemiology studies over the past 30 years. Through this Galea & Tracy (2007) concluded that a low participation rate is not always an indicator of high levels of bias, and that it is the characteristics of the differences between those who responded and did not responded which can introduce bias. Galea & Tracy (2007) propose that there are many different elements to what may be defined as 'participation rate' so one figure is not likely reflective of the complexities of studies (e.g. in *study 2* child engagement (which was always face-

to-face) was high compared to parent engagement (all via written communication)). For the returned parent questionnaires the highest proportion of parents reported being married, but education level did not appear to be an indicator of responding.

Within *study 2* the geographical split between control and intervention was pre-defined, meaning schools were randomised prior to the consent process (*section 6.4*). Although ideally schools are randomised following consenting to reduce the possibility of consenting bias (Eldridge, & Kerry, 2012), for *study 2* as the intervention group was to be located in Salford and a matched control found through benchmarking it was not possible to allocate schools following consenting. The rationale for using a geographical split for sampling was to reduce the risk of contamination (Torgerson, 2001; Howe et al., 2007; Keogh-Brown et al., 2007) through schools sharing information (Ridgers, Fairclough & Stratton, 2010). Contamination of control schools from intervention schools has been found to occur in other areas of public health research where geographical separation had not occurred (e.g. Howe et al., 2007 & Ridgers, Fairclough & Stratton, 2010). As with many methods of allocating participants, this process has both strengths (e.g. using objectively derived data tables to help match key characteristics of schools) and weakness (e.g. it is difficult to find schools that will be exactly the same due to the many outside impacts, such as parental engagement).

6.8.3 Discussion around sample size and power in relation to the children and parents within each group

For this study the sample size was calculated using the primary outcome (plaque) (*section 6.4*). However, although a relatively good sample size was obtain for statistical analysis; in this study the desired sample size was not reached. The achieved sample was n=13 schools giving a sample of n=256 children (intervention n=8 clusters (n=180 children) and control n=5 clusters (n=76 children)). Within the intervention arm the desired number were recruited, but this was not the case in the control arm. Not reaching the required sample size within this study means the outcomes should be read with caution. However, it is important to note that this study was an exploratory cluster-control trial, therefore careful interpretation of outcomes relating to differences in intervention and control

groups should still lead to appropriate conclusions being able to be drawn. In conjunction with this Lenth (2001) reported that issues relating to sample size are "*context-dependent*" (p192) and that this is only one way a study can be judged.

Within cluster-control trials the importance and necessity for an adequate sample size links to both the ability to be able to generalise from the outcomes and ensuring the study has adequate power to be able to confidently draw conclusions (Peat, 2002). Lenth (2001) outlines the need for the correct sample size for both practical reasons relating to running the study and also ethical reasons (e.g. unnecessary number of people being involved).

Eng (2003) asserts that "*the accuracy of sample size calculations obviously depends on the accuracy of the estimates of the parameters used in the calculations*" (p312). As such there is a need to be able to find similar studies within which it is possible to use outcomes within your calculations. Within SOHP research there are limited numbers of previous studies that could have been drawn on, which have used the same/similar design, similar type of intervention, the same age group.

From the outcomes of this study in relation to recruitment and consent rates (average of 20 per 30 child class) *study 2* can help produce new sample size calculations which can inform larger studies. This study provides an estimate of standard deviation for the primary outcome (plaque) of 0.3, an estimate 0.06 for the intra-class correlation coefficient. As such the research in this study can inform future research with this calculation producing a sample size of 24 schools (assuming 20 children per class), giving 240 children per study arm to detect a 0.12 difference in the primary outcome between groups with an 80% power and 5% significance level (Burnside, personal communication).

6.8.4 Discussion in relation to the research tools with children linked to clinical and behavioural outcomes in *study 2*

Within *study 2* detailed analyses by SES was not conducted as the study was not powered sufficiently (Peat, 2002).

Plaque assessment: provides an objective clinical outcome to understand the children's level of oral cleanliness (to complement self-report brushing data) and is

less complex, quicker to administer and requires a shorter follow-up period than dmft. Moreover only a dental hygienist rather than a dentist is required, making it more practical to carry out during an exploratory study in a school setting (McCracken et al., 2006).

Limitations with plaque measures are caused (in parts) by the dynamic nature of the substance than can vary in amount throughout the day (Dige, Schlafer & Nyvad, 2012). Fluctuations can be caused by a person eating and drinking through the day and their dental hygiene levels, such that teeth brushed in the morning will increase plaque growth over the day. Therefore, a key aspect of ensuring consistency in repeated plaque measures is to undertake the repeated measure at around the same time of day as any previous comparative measure. Measures are standardised and clinicians should be trained and calibrated, however scores are still, to an extent, subjective (McCracken et al., 2006). Plaque is removed by a person's toothbrushing, so is frequently used in SOHP evaluations (e.g. Redmond et al., 1999; Worthington, 2001; Pine, 2007) as an objective proxy measure for a person's toothbrushing behaviour (Hickman et al., 2002). With children (and adults), it is also possible that issues with incorrect technique can affect effective plaque removal. For instance, if only the top section of the teeth are brushed, so gums lines are not brushed effectively there will be limited plaque removal at the site of measurement. Within *study 2* all exams at baseline, post-intervention and follow-up were carried out by the same dental hygienist, and where possible at the same time; thus enhancing validity and eliminating inter-observer bias.

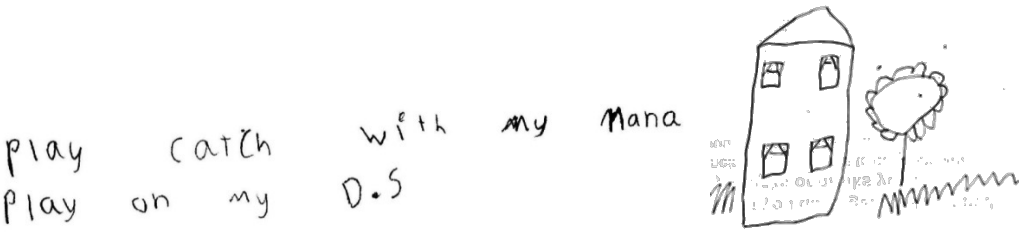
In relation to the plaque exam within *study 2* it is not possible to know how children's technique impacted on the non-significant result or the fluctuations in mean plaque scores. In addition, there may have been experimenter effects of the children knowing they were going to have a dental exam. Additionally the plaque exam caused a handful of children anxiety, which led to them not consenting to this research tool (number not consenting across both groups - baseline n=3; post-intervention n=4; follow-up n=1). These children were allowed to complete the other research tools despite this meaning a small number of data sets were incomplete, the children's wellbeing was paramount and missing data was accounted for during the data analysis phase with the impact minimised due to the clustering (Shaw et al., 2011).

In addition to the discussion around **FGs** in *section 5.6.1* there were some additional consideration following *study 2*. One of the reasons for using FGs over interviews was in part due to the nature of them allowing interactions between participants during the conversation and to ensure children were with peers (Smithson, 2000). As in *study 1*, at times one of the challenges was the limited interactions that appeared to occur. Additionally, through the analysis there appeared to be some evidence of 'groupthink' occurring with children giving singular responses (e.g. to toothbrushing behaviour relating to when they brushed), which has been found to be an issue were people may adjust their responses to conform or censor them in relation to the group (Carey & Smith, 1994). Although it may be that all of the children had brushed their teeth at a given time, it also should be considered that there is likely to be 'group effects' in relation to peer influences and wanting to do well (Farnsworth & Boon, 2010; de Leeuw, 2011). Within the FGs children were allowed to read the questions aloud for the others to hear and also suggest when to move on, which was only done if the researcher felt it appropriate. Allowing them this control, while ensuring questions were answered and followed-up again reinforced how central they were to the research.

Whilst it is recognised that the **children's questionnaire** used in *study 2* has not yet been validated using a more robust test-retest study, through *study 1* the face validity and usability of the questionnaire was checked (*section 5.5.2, discussion 5.6.1 & 5.7.2*). In addition a more robust test-retest study against an objective measure of toothbrushing was designed as part of the programme of research in this thesis (*study 3*). As a result of the lack of test-retest on the questionnaire at this stage the outcomes should be interpreted with caution as it is not known how valid and reliable the questionnaire was and how it was impacted by issues of inaccuracies with self-report. However, the use of a package of research tools with the children aims to mitigate some of this impact by allowing children to expand on answers provided in other methods.

For the **D&W** as outlined in *chapter 5* the initial 5 steps of Prosser (1998) steps relating to D&W studies were considered (*section 5.5.3.1*); following the completion of *study 2* the remaining 5 steps are discussed below (adapted from Prosser, 1998, p281):

- "*Sample selection*" the sample for children who took part in the D&W within *study 2* is described in *section 6.4*, with children using the D&W in different ways (e.g. drawing, writing & labelling).
- "*Analysis*" the analysis for *study 2* was based on that of *study 1*, with both the pictures and the writing used (*section 5.4.2.3.2*). As some children only draw or wrote this ensured all children's responses were used. Care needs to be taken when using the images to ensure they are not interpreted as something they may not be and only used if it was obvious what they depicted.
- "*Reviewing the data*" - *Figure 6-14* & *6-17* illustrate the tools accessibility for 6-7 year olds and the varied responses provided. These figures also show how the children used the tool to suit them through writing, drawing or using both methods. In respect of *'lessons learnt'*, within the D&W it was found that some children did not answer all questions and some of the responses may be seen by some as lacking depth. Through the D&W process children were not provided with prompts. Even though asking the children to think about their answers in relation to OH would have provided answers on topic, children may have altered their responses to fit this requirement, rather than provided their own reflections of current knowledge and behaviour. For future SOHP development it is important to capture where children are in their behaviour, beliefs and attitudes that the SOHP seeks to change and then be able to understand how a SOHP impacts on the children initially and during a follow-up period. A small number of answers provided information about children's behaviour at home but were not related to the topic of interest.



(Post-intervention – 03.1.084.3 and 07.1.084.3)

- "*Dissemination*" – as part of this research, the D&W in relation to routines has been presented as a poster at the European Association of Dental Public Health conference.

- “*Curriculum development*” In relation to future curriculum development the outcomes can inform intervention developers of misconceptions and areas where knowledge is more and less well developed. From *study 2* it would be suggested children needed more support around germs, nighttime sugar-snacking and the impact of sugar on their teeth but overall they understood about what affect not brushing can have on our teeth and foods that are good and bad for us.

Figure 6-14 Example of intervention group D&W

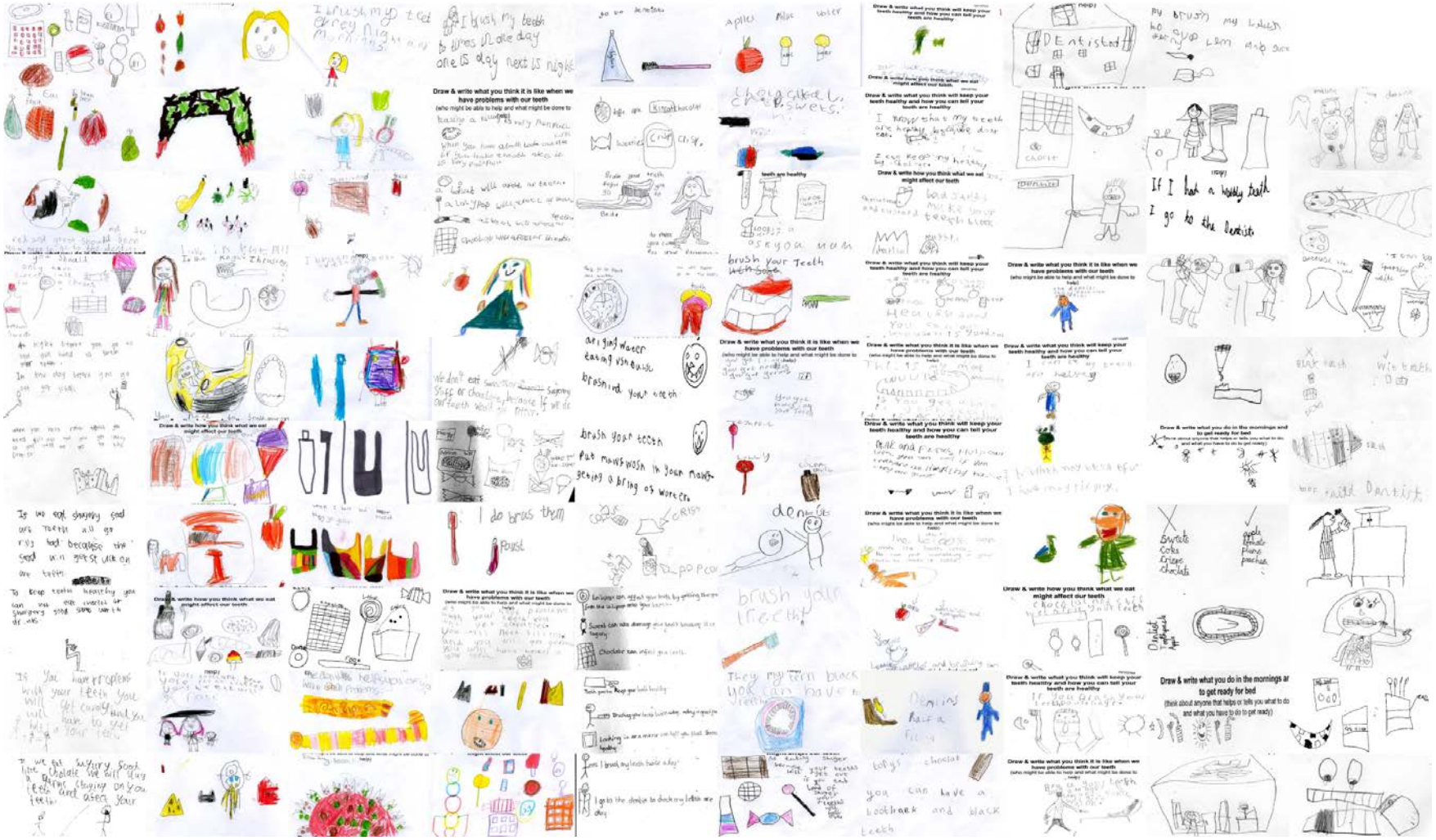


Figure 6-15 Example of Control group D&W

6.8.5 Discussion regarding the mixed-methodology used throughout *study 2*

The use of mixed-methods offers different perspectives on a topic and people's knowledge, attitude and behaviour. However, ultimately all of the research tools relate to exploring the same topic. Within *study 2* there were times when the different research tools produced differing results, illustrating the worth of mixed-methods in gaining a full picture of what children report. For example, within the children's questionnaire (and the D&W) few reported (or referenced) receiving support from their mum or dad, however within the FGs children talked about being reminded but this was not seen as support and within the follow-up FGs some talked about being old enough to do it themselves. Gaining this perspective can help future SOHPs in terms of understanding the terminology children use around 'support' with toothbrushing and how they perceive the need for support over time. Moffatt et al. (2006) in their article about mixed-methods in health service research write:

> *"…it is not wholly surprising that each method came up with divergent findings since each asked different, but related questions, and both are based on fundamentally different theoretical paradigms"* (p.6)

Although a deeper level of analysis is possible when both quantitative and qualitative methods are used, the differences in their underpinning and the slight differences in how they are asking the same questions must be recognised (Moffatt et al., 2006). For instance within *study 2* children's toothbrushing frequency was measured as a proxy through plaque, through Q3 & 4 of the children's questionnaire obtaining self-reported toothbrushing behaviour, through asking about brushing routines in the D&W and the FGs using both 24-hour recall and more detailed questions. Through the children's depiction of their routines it is possible to gain a greater insight into how the '*Brush Day & Night*' programme may integrate into the home and how any revisions could account for ways routines are depicted (e.g. more support in the evenings when routines seems less set than in the mornings).

In relation to considering some potential conflicts around the epistemology and ontology of the different stances Bryman (2012) writes "*in fact, research methods are much more 'free-floating' in terms of epistemology and ontology than is often supposed*" (p619). This can be taken to mean that all of the methods used contain assumptions relating to a person's knowledge and their reality and these need to be recognised but not taken as completely deterministic. Within this research a more pragmatic stance was taken in relation to the epistemology, reducing the conflict between different epistemological stances associated with qualitative and quantitative methods. Within the use of mixed-methods there is a need to ensure credibility is given to the differences between qualitative and quantitative research (e.g. '*static vs process*' orientated outcomes, '*structured vs unstructured*' examination of concepts and in relation to peoples reporting '*behaviour vs meaning*', Bryman, 2012, p408) and similarities (e.g. concerned with: answering a set of research questions and uncovering/understanding variation and recognising any impact of errors) (Bryman, 2012). Moreover, Onwuegbuzie & Leech (2004) explain how mixed-methods allow a researcher to look further into a dataset and begin to understand meaning as well as verifying findings with the other methods (for greater discussion of mixed-methods, and the difference between qualitative and quantitative data see *chapter 4*).

The qualitative methods revealed details around the routines reported by the children (*section 6.7.6*), which would not have been detected as comprehensively using only quantitative methods. In relation to *study 2*, the information with regards to routines helps with understanding how a programme like '*Brush Day & Night'* can be integrated into the home and how toothbrushing fits into the wider context. Presently there is a dearth of literature around this area, so these outcomes can provide suggestions around how to better incorporate the home part into the wider determinates of an OH routine.

A further example of the additional richness that can be gained through the use of mixed-methods can be seen from one child and their reporting within the children's questionnaire and FG. Within the intervention group the intervention appeared to raise children's awareness of the impact of sugar-snacking, e.g. when completing the questionnaire they explained they had recorded '*sometimes*' although this was not the case normally as the previous night was '*family night*' so after getting ready

for bed and brushing their teeth, the children were allowed to have fizzy drinks and sugary-snacks while watching a film. In the FG they elaborated on this to explain:

> Girl 3– *"last night I drank coke (*Researcher– *you drank coke before you went to bed, before or after you brushed your teeth?) after, (*Researcher– *why that bad then?) because I was having a family night and I drank coke (*Researcher– *why it bad you drank coke after you brushed your teeth, what does the coke do?) make them go mouldy. Its only one time though"*

This child showed in both instances that they were aware, as a result of the SOHP; they should not have carried out this behaviour once they had brushed their teeth or they should have brushed again (which during completing the questionnaire they explained did not occur due to tiredness). This is also an illustration how children can receive mixed-messages around health topics from different sources (in this case the SOHP and parents) and this can lead to children perhaps acting on what they know is not right in some instances.

6.8.6 Recommendations from the clinical and behavioural outcomes of *study 2*

From the outcomes of *study 2* it is suggested that different reinforcement methods, in relation to frequency, length of brushing time and messages are likely to be required for different groups of children. However, further research would be needed to fully understand behaviour patterns (e.g. using an objective measure) and develop materials within a larger study.

The main primary and secondary outcomes within *study 2* related to children's clinical and self-report outcomes. It was also intended that parent questionnaires would provide complementary outcomes around knowledge and behaviour. However, there was a poor response rate from parents which meant this was not possible. It is recommended that future studies should consider ways to improve the return rate of the parent questionnaire, in order to improve the ability to utilise the data in comparison to the children's data (discussed further in *chapter 9*).

Within this study children were asked if they received support with toothbrushing and parents were asked if support was provided. It is suggested, due to the age of

the children where support appears to be uncommon that within future research, information from children and parents is sought around whether parents used to provide support for toothbrushing and at what age this stopped. This could help with understanding the changing nature of toothbrushing support in the home, and how recommendations are being adhered to around support; thus providing context for the development of materials to support the home routine. Also as shown through the qualitative outcomes some of the children had misconceptions in relation to toothbrushing and sugar-snacking. Through understanding these issues future SOHP can develop materials to help children understand these areas correctly (e.g. around rinsing behaviour).

Future studies needs to consider methods for enhancing consent rates in control schools and school engagement to ensure sufficient numbers of clusters are recruited. Although the sample in this study allowed conclusions to be drawn, they need to be considered with caution, and future studies should consider larger sample sizes to allow greater exploration across SES and ensure the desired power is obtained.

Within this study a new combination of research tools to engage children within dental public health research were used. These were shown to be acceptable to the children and suitable for the research. D&W was used for the first time in a community SOHP study and was found to be an effective way of capturing the children's voices, alongside the FG, to provide greater depth of understanding around their views of SOHPs. Within *study 2* children took on the role of 'assistant' within the plaque exam using a child friendly tool, demonstrating how they can play an active part in the research process. Further recommendations as a result of the process evaluation are made within *chapter 7* (*section 7.6*) and in *chapter 9*.

6.9 Overall chapter summary for *study 2* exploratory matched cluster-controlled trial: clinical and behavioural outcomes in relation to an

This chapter presents the clinical and behavioural findings from *study 2* to explore the impact of a new SOHP ('*Brush Day & Night'*) on behaviour, knowledge and attitudes. The chapter summary presents the main conclusion in relation to the research questions answered through *study 2* for the clinical and behavioural outcomes:

1. How does toothbrushing and sugar-snacking behaviour change as a result of a SOHP (does the SOHP significantly increase reported toothbrushing and significantly decrease plaque levels and reported nighttime sugar-snacking behaviour)?

The current '*Brush Day & Night*' SOHP produced a non-significant effect on the plaque scores of the intervention group (mean plaque scores - baseline 0.174, post-intervention 0.248, follow-up 0.266), compared to the control group (mean plaque scores - baseline 0.231, post-intervention 0.315, follow-up 0.306).

At baseline children in both groups within *study 2* had a mean frequency of reported brushing above 1.5; this high baseline reported brushing rate makes it more challenging to detect a change in behaviour. However, there are known issues with over-reporting in other areas using self-report. Sub-sets of the intervention group children reported an increase in their toothbrushing behaviour that was sustained over the 6-month follow-up period. The slight changes seen in the intervention group at follow-up could be due to reported shifts in the self-regulation of the behaviour or reinforcement of key messages.

Post-intervention a significant association was found between sugar-snacking behaviour and group in favour of the intervention (x^2 (2) = 10.92, $p < .004$); but no significant association was found at follow-up.

2. How do levels of knowledge change in 6-7 year olds regarding toothbrushing and sugar-snacking as a result of a SOHP?

Following the intervention the children were able to report when you should brush and many could explain why you should brush. Overall the children in the intervention group showed an increase in their knowledge in certain areas (e.g. how long you should brush for) following the intervention compared to the control group, but increases in knowledge were often not sustained at follow-up. In support of previous research the children struggled with how germs and sugar impacts our teeth, other than they can make holes or your teeth may be dirty. For more complex concepts, there was limited progression in knowledge for the intervention group compared to the control group.

3. How do reported habits, barriers, facilitators and home influences in relation to toothbrushing and sugar-snacking behaviours change in 6-7 year olds as a result of a SOHP?

Within *study 2* children most frequently reported not being supported with toothbrushing. It was also not possible through the current study to determine if supported brushing occurred when children were younger, but had stopped by the age of children in the sample.

Although there was no-significant impact on the children's plaque, some children' reported both positive and negative changes in their self-report behaviour. This illustrates the complexities of understanding the impact of a programme on children individually and as a part of a group, with qualitative outcomes providing some explanations of the changes in behaviour seen in sub-sets of children. At baseline using the D&W when asked what they do in the morning and evening children most frequently only drew images that related to just them brushing. From baseline to post-intervention the complexity in the routines presented increased (to a greater extent in the intervention group) to illustrate when brushing occurred as part of larger morning and nighttime routines, but there was limited further increases in complexity at follow-up. Improving understanding around routines can help inform future interventions through beginning to learn how to integrate brushing into larger routines.

6.9.1 Chapter conclusion

Overall this chapter presented the clinical and behavioural outcomes for the evaluation of the '*Brush Day & Night*' programme, with the process outcomes being presented within chapter 7. Although no overall intervention effect was found relating to children's plaque outcomes and self-reported brushing rates, there were individual children who changed their behaviour and many facilitators as well as barriers that were evident in the SOHP. Post-intervention the intervention showed a significant association between sugar-snacking behaviour and group in favour of the intervention group, although this was not sustained at follow-up.

This chapter strengthens the literature around children's own reported behaviour, knowledge and attitudes towards OH and sugar-snacking; through focusing the

research tools in *study 2* to capturing the child perspective. Further, this study adds to the literature around the use of mixed-methods within OH and the use of qualitative methods alongside clinical and quantitative research tools to help provide greater context to the outcomes. It has also begun to provide an insight into children's routines in the home through D&W (and FGs); something which has been previously under explored within the dental public health literature from the children's perspective. Finally, this study provides details for the calculation of sample size for future clinical studies evaluating this type of SOHP using plaque as an outcome measure.

Chapter 7 Study 2 - Conducting a child-centred evaluation of a complex school oral health programme – An exploratory matched cluster-controlled trial: process evaluation

7.1 Chapter Overview

This chapter presents the outcomes of the process evaluation part of *Study 2* which was designed to understand how the programme was reported in terms of acceptability and usability for intervention children, parents and teachers. This chapter is designed to:

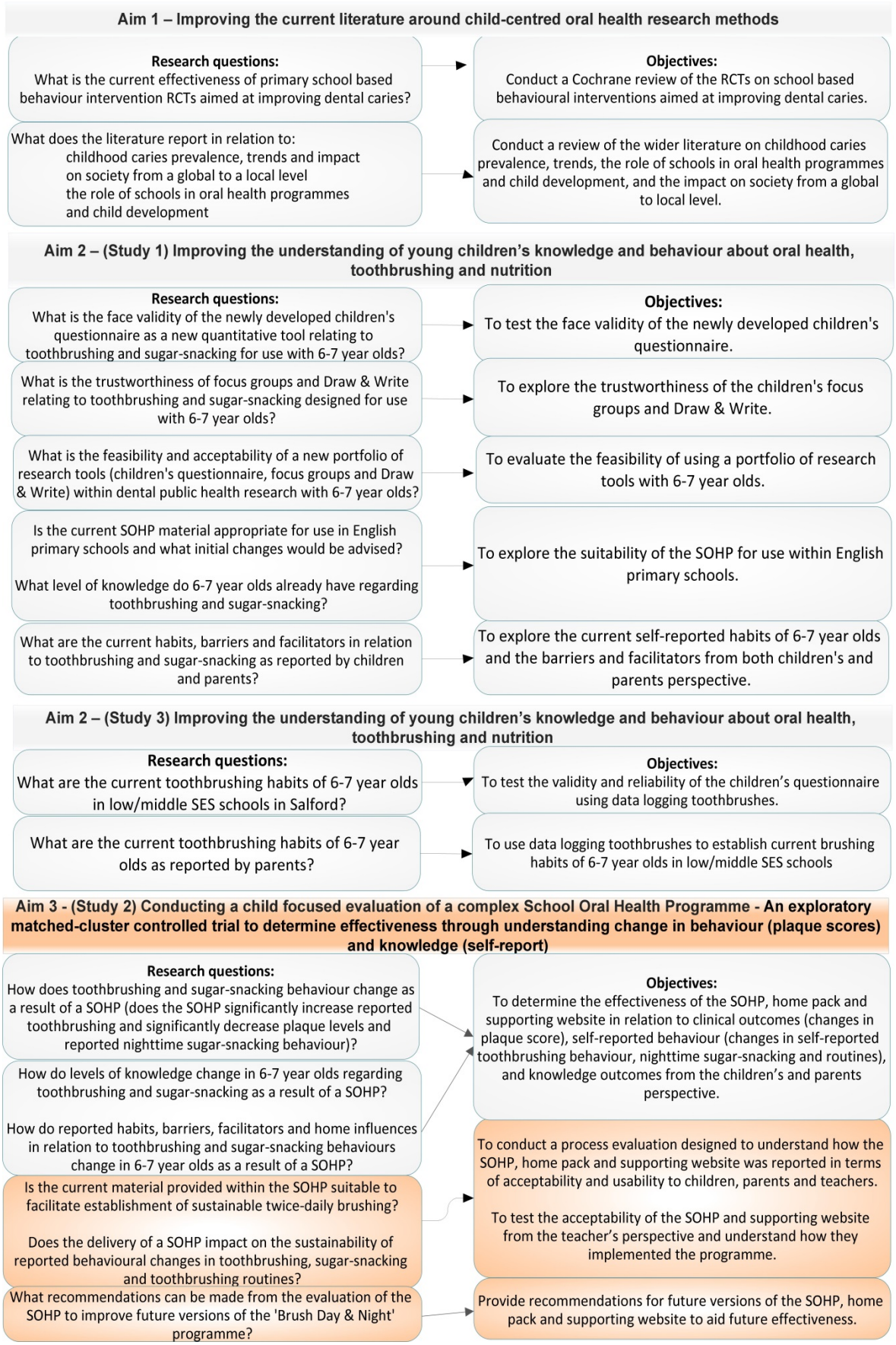
- Outline the design, implementation, methods of data entry and summation for the process evaluation research tools.
- Provide the outcomes of the process evaluation component of *study 2.*
- Test the acceptability of the '*Brush Day & Night'* school oral health programme (SOHP) from teachers' perspectives and understand how they implemented the programme (treatment fidelity).
- Make recommendations for revisions to the '*Brush Day & Night*' SOHP to aid future effectiveness.

7.2 Research Questions

Study 2 aims to answer questions related to aim 3[69] of the thesis (highlighted boxes, *Figure 2-1 below*).

[69] Conducting a child focused evaluation of a complex School Oral Health Programme – An exploratory matched-cluster controlled trial to determine effectiveness through understanding change in behaviour (plaque scores) and knowledge (self-report)

Figure 2-1 The research framework for this thesis (Aim 3)



The objectives, designed to answer the research questions (highlighted boxes, *figure 2-1)*, were answered using a variety of research tools as outlined in *Figure 7-1* (p. 311) (remaining research questions under aim 3 answered in *chapter 6*)

The interpretation of the results was aided by non-evaluated tools: children's worksheets and brushing calendars (*Appendix 12*). Due to the nature of these tools they were not suitable to be used for detailed evaluations, as it was not possible to deliver them in a controlled manner (e.g. the brushing calendar was designed to be encouraged to be used in the home as part of the intervention and was not an enforced tool).

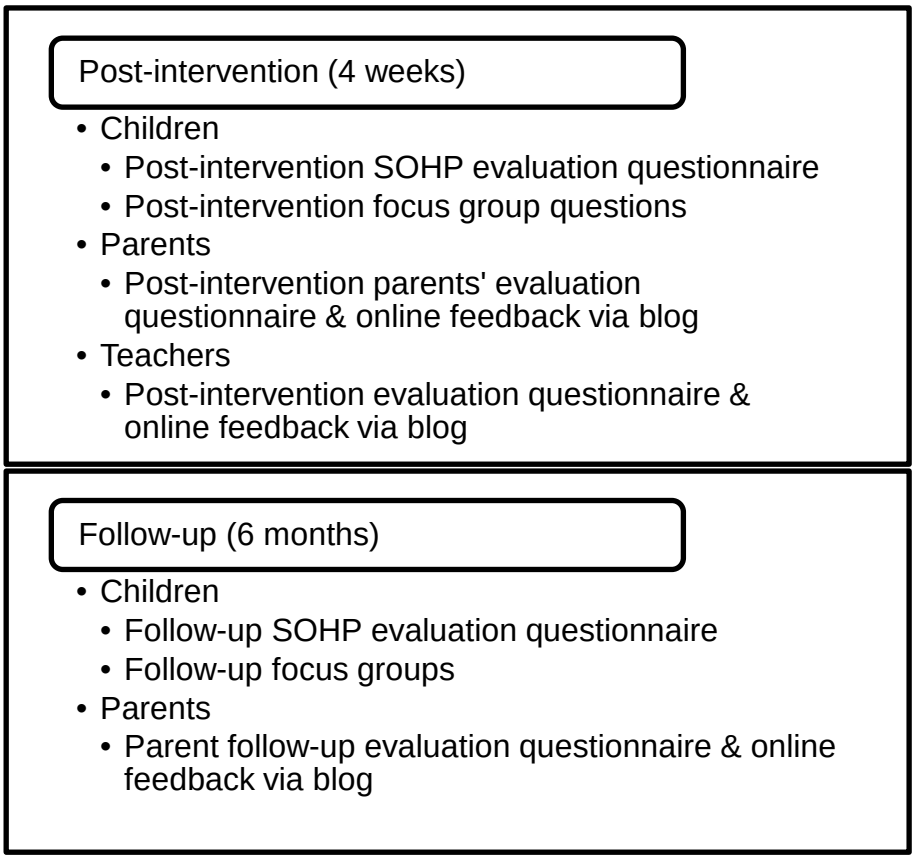
7.3 Sample

Details of the sampling, recruitment and consenting processes relating to schools (teachers), parents and children for *study 2* have previously been described in *chapter 6*, *section 6.4*.

7.3.1 Process evaluation methodology – design, implementation and data entry and summation of children's and parents research tools

In addition to the research tools reported in *chapter 6*, specific research tools (*Figure 7-1*) were used as part of the process evaluation to improve understanding around how the SOHP was implemented and received by the intervention group (*Figure 7-1*). Data was gathered retrospectively from intervention children, parents and teachers.

Figure 7-1 Outline of process evaluation research tools used within *study 2*



7.3.2 Method: Design of research tools for children, parents and teachers

The following sections outline the additional tools designed as part of the process evaluation for children, parents and teachers. All evaluation questionnaires and additional focus group (FG) questions were designed specifically for this research study.

7.3.2.1 Method: Children's research tools

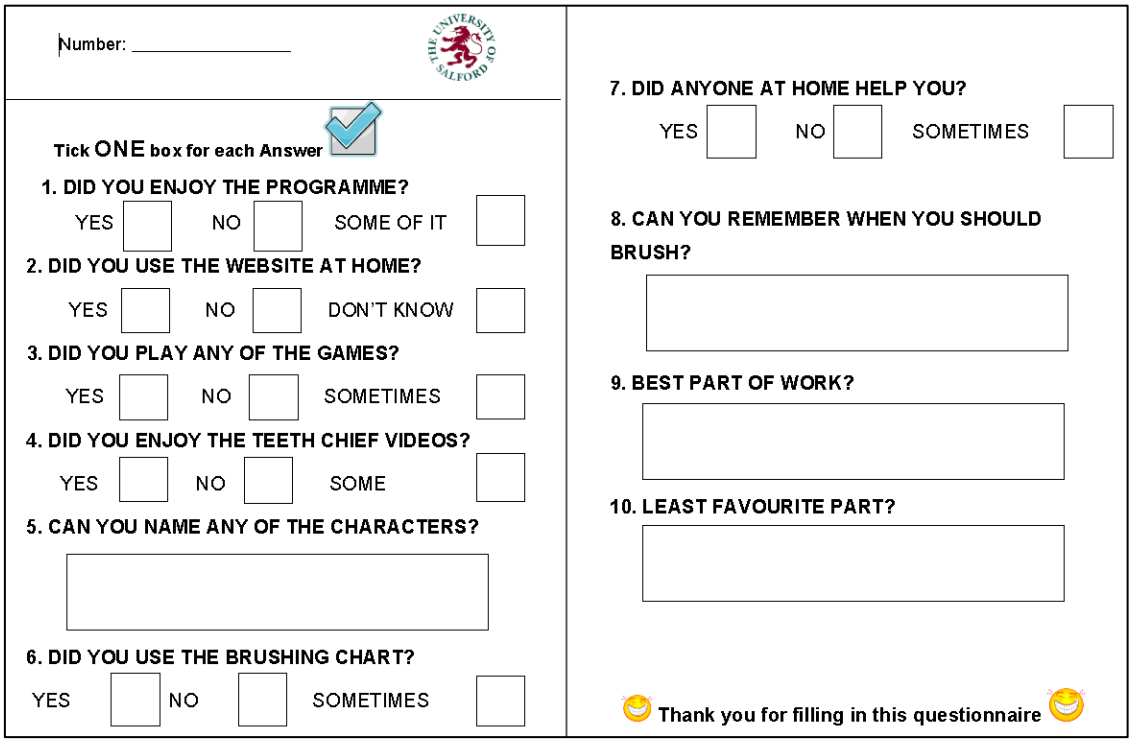
7.3.2.1.1 Design of children's post-intervention SOHP evaluation questionnaire

All intervention group children with parental consent were asked to complete a questionnaire designed to evaluate the use of the programme components and whether they liked the programme overall (*Figure 7-2*). This reflected the style and layout of the children's questionnaire so it was in a familiar format. Unlike the main children's questionnaire the children's post-intervention evaluation questionnaire contained both open (free-text response) and closed (tick-box) questions. This was designed to allow all of the intervention group children to provide more detail

to certain questions, in addition to the subset of children who provided more detail in the FG.

The questionnaire (*Figure 7-2*) consisted of 10 questions. Questions 2, 3, 6, and 7 were intended to understand how the children used the materials at home (children's brushing calendar and website). Question 8 aimed to determine if children were able to recall the key SOHP message; with details relating to the *'Teeth Chiefs'* being asked in Q4 & Q5. Finally the questionnaire aimed to gain an insight into the children's favourite (Q9) and least favourite parts (Q10) of the SOHP.

Figure 7-2 Children's post-intervention SOHP evaluation questionnaire



Number: _____

Tick ONE box for each Answer

1. DID YOU ENJOY THE PROGRAMME?
YES ☐ NO ☐ SOME OF IT ☐

2. DID YOU USE THE WEBSITE AT HOME?
YES ☐ NO ☐ DON'T KNOW ☐

3. DID YOU PLAY ANY OF THE GAMES?
YES ☐ NO ☐ SOMETIMES ☐

4. DID YOU ENJOY THE TEETH CHIEF VIDEOS?
YES ☐ NO ☐ SOME ☐

5. CAN YOU NAME ANY OF THE CHARACTERS?

6. DID YOU USE THE BRUSHING CHART?
YES ☐ NO ☐ SOMETIMES ☐

7. DID ANYONE AT HOME HELP YOU?
YES ☐ NO ☐ SOMETIMES ☐

8. CAN YOU REMEMBER WHEN YOU SHOULD BRUSH?

9. BEST PART OF WORK?

10. LEAST FAVOURITE PART?

Thank you for filling in this questionnaire

7.3.2.1.2 Design of children's post-intervention FGs

In addition to the previously outlined FG (*section 6.6.1.1.2*); additional questions were added around key components of the intervention. This was designed to provide a platform for children to provide more detailed feedback. The additional questions were:

- What do you think of the lessons you have just done on teeth?
- What do you remember from the lessons?
- What were the best and worst parts of the programme/lessons?

- What do you think of the *'Teeth Chiefs'*?
- Did you use the website? What did you do on the website?
- Have the lessons helped you to '*Brush Day & Night'* and at the same time?
- Did you use the sticker book/calendar?
- Has anyone else in your family used any of it?
- Have your parents helped you?

7.3.2.1.3 Design of children's follow-up SOHP evaluation questionnaire

During the 6-month follow-up visit children completed a further follow-up SOHP evaluation questionnaire, designed to help determine children's longer-term perceptions of the SOHP. This again reflected the style of the children's questionnaires (*Figure 7-3*). Question 1, 2 and 3 were intended to understand if messages taught in the SOHP had been retained. Any information around the continued use of the materials in the home was aimed to be gained through Q4 & 5. As with the children's post-intervention SOHP evaluation questionnaire the children's follow-up SOHP evaluation questionnaire contained a mix of open (free-text answers) and closed (tick-box) questions to allow all intervention group children to provide greater detail to certain key aspects.

Figure 7-3 Children's follow-up SOHP evaluation questionnaire

Number: _____

Tick **ONE** box for each Answer

1. CAN YOU REMEMBER WHEN YOU SHOULD BRUSH YOUR TEETH?

2. CAN YOU NAME ANY OF YOUR TEETH?

3. CAN YOU NAME ANY OF THE TEETH CHIEFS?

4. HAVE YOU STILL BEEN USING THE BRUSHING CHART?

YES NO SOMETIMES

5. DID ANYONE AT HOME HELP YOU?

YES NO SOMETIMES

Thank you for filling in this questionnaire

7.3.2.1.4 Design of children's follow-up FGs

As with the post-intervention FG, in addition to the questions used throughout *study 2*, additional questions were added specific to the follow-up period of the evaluation. These were designed to understand what children remembered about the SOHP and any continued effect. The additional questions were:

- Do you remember the lessons in year 2 around teeth? What do you remember from the lessons?
- What do you remember as the best and worst parts of the lessons?
- Have you been using the supporting website? What have you looked at?
- Have you still been using your brushing calendar/sticker book?
- Has anyone else in your family used any of the pack?
- Have your parents helped you?
- Do you remember the *'Teeth Chiefs'*? Can you tell me about them?

- Do you remember when you should brush your teeth and for how long?

7.3.2.2 Methods: Parent's evaluation research tools

7.3.2.2.1 Design of post-intervention parent's evaluation questionnaire

In conjunction with the SOHP parents were provided with a parent pack. Within this evaluation the home parts (*section 3.4.3.3*) of the intervention were not monitored. Therefore in addition to the children's feedback, intervention parent's responses were sought.

The post-intervention parent's evaluation questionnaire (*Figure 7-4*) was split into 5 sections: the parent's pack, their child's engagement, child's use of resources, their experience of the *'Brush Day & Night'* programme and any other comments. Answers to the questionnaire included free-text responses, as well as closed responses.

Figure 7-4 Parent's post-Intervention evalution questionnaire

School Oral Health Programme
Primary Caregiver Evaluation

Thank you for agreeing to let your child take part in this school oral health programme evaluation study designed to improve the tooth brushing behaviour of year two children. Now the lessons have finished I would be grateful if you would complete a short evaluation questionnaire. In this questionnaire there are no right or wrong answers – we are just trying to understand more about the programme.

All information given in this questionnaire will be treated confidentially.

General Information

School name: .....

Childs name: .....

Section A

The first set of questions are about the parent pack that was sent home

1. **Did you receive a parent pack?** Yes ☐1 No ☐2 Not sure ☐3
2. **Did you find the information easy to read?** Yes ☐1 No ☐2 Did not read ☐3
3. **Did you think the information was useful?** Yes ☐1 No ☐2 Did not read ☐3
4. **Did you learn something new?** Yes ☐1 No ☐2 N/A ☐3
5. **Was there anything additional you would have liked included?** Yes ☐1 No ☐2

Please explain:

Section B

The next set of questions are about the your child's engagement with the programme

1. **Did your child enjoy the programme?** Yes ☐1 No ☐2
2. **Do your child use the brushing chart?** Yes ☐1 No ☐2
3. **Did you use the routine chart?** Yes ☐1 No ☐2
4. **Do you think it has improved your child's brushing behaviour?** Yes ☐1 No ☐2

Please explain:

5. **My child now brushes twice a day – morning and evening?** Yes ☐1 No ☐2
6. **Did your children go on the website?** Yes ☐1 No ☐2
7. **Did you use the website?** Yes ☐1 No ☐2
8. **Which aspects did you use? (e.g. games, information)**

Section D

The following questions are related to your experiences of the programme

1. **Did you find it useful?** Yes ☐1 No ☐2
2. **Do you feel a benefit from the programme?** Yes ☐1 No ☐2
3. **Will you continue to use the brushing chart with your child?** Yes ☐1 No ☐2 Some ☐3
4. **Have you felt the programme helped you with tooth brushing routines?** Yes ☐1 No ☐2

Please explain?

Section E

Finally if there are any other comments both positive and negative these would be appreciated:

Please take a moment to ensure that you have answered all the questions.

Thank you very much for your help.

7.3.2.2.2 Design of parents follow-up evaluation questionnaire

As with the school programme, there were no set activities in the home during the follow-up period. Continued reinforcement was the responsibility of parents through the calendar, website and providing encouragement. The parent's follow-up evaluation questionnaire (*Figure 7-5*) was designed to determine how the programme was still functioning in the home, children's engagement, parents' experience of the programme and any other comments. Answers to the questionnaire included free-text responses, as well as closed responses.

Figure 7-5 Parent follow-up evaluation questionnaire

School Oral Health Programme - Primary Caregiver Evaluation

We are completing the 6 month follow up and would be greatful of you would complete a short continued evaluation questionnaire. In this questionnaire there are no right or wrong answers – we are just trying to understand more about the programme. All information given in this questionnaire will be treated confidentially.

General Information

School name: .....

Childs name: .....

Section A

This set of questions are about your child's continued engagement with the programme

1. **Does your child still use the brushing chart?** Yes ☐ No ☐
2. **Do you think it has continued to improved your child's brushing behaviour?** Yes ☐ No ☐

Please explain:

3. **My child now brushes twice a day – morning and evening?** Yes ☐ No ☐
4. **Has your child been on the website?** Yes ☐ No ☐
5. **Have you used the website?** Yes ☐ No ☐
6. **Which aspects did you use? (e.g. games, information)**

Section B

The following questions are related to <u>your</u> experiences of the programme

1. **Have you felt a continued benefit from the programme?** Yes ☐ No ☐
2. **Will you continue to use the brushing chart with your child?** Yes ☐ No ☐ Maybe ☐
3. **Have you felt the programme continued to help with the tooth brushing routine?** Yes ☐ No ☐

Please explain?

Section E

Finally if there are any other comments both positive and negative these would be appreciated feel free to add on the other side

Thank you very much for your help.

7.3.2.2.3 Online feedback via blog

In addition to the questionnaires parents were able to use an online blog with set open-ended questions to feedback their experiences at any time (*Appendix 29*). The online blog: also contained information about the study, links to useful resources and separate open-ended question feedback pages for teachers (*section 7.3.2.3*).

7.3.2.3 Method: Design of Teachers' – post-intervention evaluation questionnaire & online feedback via blog

7.3.2.3.1 Post-intervention evaluation questionnaire

In order to evaluate the SOHP from the teachers perspective they were asked to complete a post-intervention evaluation questionnaire comprising both open (free-text responses) and closed questions split into six sections (*Appendix 31*). The first three sections related to:

- The lessons – aimed to understand what they thought about the lessons, worksheets and supporting materials.
- The '*Teeth Chief*' cartoons – aimed to determine what teachers thought about the cartoons which were designed to support the lessons.
- The '*Brush Day & Night*' supporting website – aimed to understand if the teachers had used the website and what they thought of it.

The final three sections of the questionnaire aimed to determine each teacher's view of the SOHP, and its impact:

- Their experiences of the intervention
- Their perceptions of parents and children's response to the intervention
- Any other positive or negative comments about the SOHP.

7.3.2.3.2 Online feedback via blog

In addition to the questionnaire teachers were able to use an online blog with set questions during the delivery of the SOHP. This was set-up because teachers felt it would be easier to provide feedback during the evaluation period electronically, rather than having to write and keep hold of paper feedback.

Further, during the study period emails were frequently sent to each intervention school teacher to enquire how they were getting on with delivering the SOHP, if they had questions or needed help, and if they had any intermediary comments.

7.3.3 Method: implementation of children's research tools

7.3.3.1 Implementation of children's post-intervention and follow-up SOHP evaluation questionnaire

For both of the children's evaluation questionnaires the same method for completion and delivery was used. Children were asked to complete the questionnaire while they waited for their plaque exam (outlined in *section 6.6.2.2.1*) and completed the main children's questionnaire (outlined in *section 6.6.2.2.2*), helping to ensure the children where familiar with the process.

If necessary clarity was provided ensuring meaning was not altered. For Question 5, 8, 9 and 10 that asked for written responses, if required children's answers were scribed verbatim by the researcher.

7.3.3.2 Implementation of post-intervention and follow-up FGs

The same method of implementation was used for both the post-intervention and follow-up children's FGs, as outlined in *chapter 6* (*section 6.6.2.2.4*), As with the main FG additional questions were typed onto A3 sheets to allow the children to have a record of the question and so they could read them aloud.

7.3.3.3 Method: Implementation of Parents' - post-intervention and follow-up parents' evaluation questionnaires and online feedback via the blog

The same method of implementation was used for both the post-intervention and follow-up parent evaluation questionnaires. Questionnaires were sent home via the intervention group children. The envelope contained a letter explaining to intervention group parents about the additional questionnaire and how this was important for them to complete to enable us to understand how they, and their children had experienced the SOHP and home packs.

As with the main parent questionnaire this was returned in a sealed envelope to teachers or returned using a pre-paid envelope directly to the researcher.

Teachers were asked to prompt parents and remind them of the importance of returning the questionnaires.

At the start of the SOHP evaluation parents were told the address for the online blog and that this could be used at any stage of the research from baseline to follow-up to send feedback directly to the researcher using a set of open-ended questions.

7.3.3.4 Method: Implementation of Teachers – post-intervention evaluation questionnaire & online feedback via blog

7.3.3.4.1 Post-intervention evaluation questionnaire

At the beginning of the post-intervention school visit teachers were provided with the evaluation questionnaire to complete during or following the visit (returned via a free-post envelope).

7.3.3.4.2 Online feedback via blog

During the delivery of the SOHP teachers could use the online pre-set questions contained within the blog to feedback, with responses automatically being emailed to the researcher.

7.3.4 Method of data handling and summation of children's research tools

7.3.4.1 Data entry & summation of children's post-intervention and follow-up SOHP evaluation questionnaire

As with the children's questionnaire data was coded into SPSS 16.0. Categories for responses were created for Q5, 8, 9 and 10 to allow descriptive analysis of the free text responses (e.g. Q5 – 1 – Name one (Teeth Chief); 2 – Name 2; 3 – Name 3; 4 – Name 4; 5 – Name four and bad ones; 6 – no; 7 – Pablo; 8 – Oliver and 9 – Pablo & Oliver). Free text responses were coded into Microsoft Excel and grouped for common themes to provide greater context to the quantitative analysis.

7.3.4.2 Transcription & process of analysis of children's post-intervention and follow-up FGs

The transcripts of the audio files from the FGs were analysed as described in *section 5.4.2.3.3*. Where possible the answers were coded to each child, aided through the video recordings.

7.3.4.3 Method: Data entry & summation of parents'- post-intervention and follow-up parents' evaluation questionnaires and online blog

In both instances returned questionnaires were coded into SPSS 16.0 and analysed descriptively. Any qualitative answers from the questionnaire and blog were collated into an excel spreadsheet against the parent's codes to allow them to be grouped into themes.

7.3.4.4 Method: Data entry & Summation Teachers' - post-intervention evaluation questionnaire & online blog

The answers to the quantitative aspects of the teacher's questionnaire were coded into SPSS 16.0 and analysed descriptively. The qualitative responses from the blog, questionnaire and emails were compiled into an excel sheets across all schools allowing the main themes to be extracted and to provide greater details in relation to individual teachers responses.

7.4 Results: *Study 2* SOHP process outcomes for children and parents

The children and parents result *sections 7.4.2* & *7.4.4* are designed to illustrate answers to the following research questions:

a. Is the current material provided within the SOHP (School programme, Children and parent's home pack and supporting website) suitable to facilitate establishment of sustainable twice-daily brushing?
b. Does the delivery of a SOHP impact on the sustainability of reported behavioural changes in toothbrushing, sugar-snacking and toothbrushing routines?

7.4.1 Characteristics of participants

N=8 female teachers (within n=8 intervention schools) delivered the SOHP and provided feedback during and post-intervention. N=5 teachers helped facilitate the visits to control schools. Details of the children's sample size has been previously described in *section 6.7.1.*

7.4.2 Result post-intervention

7.4.2.1 Outcomes from the children's post-intervention SOHP evaluation questionnaire

Looking at the key message provided within the SOHP, post-intervention over 80% (n=141) of the children could correctly answer when brushing should occur (day & night or morning & night, *Table 7-1*). With 54.8% (n=91) correctly recalling the main message (and name) of the SOHP to brush '*Day & Night*'.

Table 7-1 Children's post-intervention SOHP evaluation questionnaire - Q8

"*Can you remember when you should brush?*"	Childrens self-reporting % (n)
Day & Night	54.8 (91)
Morning & Night	30.1 (50)
Everday	2.4 (4)
No/not brush	2.4 (4)
Only once in day time	1.2 (2)
Referred to brushing after meal times	6.6 (11)
Other	2.4 (4)
Total	166 (missing n=14)

In order to begin to understand if the current material is suitable to facilitate establishment of twice-daily toothbrushing *Table 7-2* shows how remembering the timing of toothbrushing was associated with children's self-reported brushing behaviour. Through this comparison it can be seen that in 75% of cases where intervention group children correctly reported when you should brush they also reported twice-daily toothbrushing.

Table 7-2 Crosstabulation of Can you remember when you should brush? v's children's self-reported toothbrushing behaviour

			Self-reported toothbrushing behaviour using the children's questionnaire (Q3 & 4)				Total
			Brush once	Brush twice	Not brush	Unable to transform	
Can you remember when you should brush?	Day & Night	% (n)	9.9 (9)	75.8 (69)	3.3 (3)	11.0 (10)	100 (91)
	Morning & Night	% (n)	14.0 (7)	76.0 (38)	2.0 (1)	8.0 (4)	100 (50)
Total % (n)			11.3 (16)	75.9 (106)	2.8 (4)	9.9 (14)	140 (missing n=1)

As part of understanding if the delivery and materials of the SOHP impacted on any reported behaviour changes the impact of the '*Brush Day & Night*' supporting website was investigated. Through this it was found only 35% (n=58) of children reported accessing the website at home, most commonly to play the games (40%, n=59). The children's reasons around using and not using the website were similar to the parents (discussed in *section 7.4.3.3*), with key reasons being: access to a computer with internet; being permitted to use the website; and being aware of the website. One child who did access the website explained they "*lost sticker chart after a few times but got new one from site*" (06/1/146/3). However, two children who wanted to use the website but struggled wrote "*could not find games on site*" (06/1/150/3) and "*did not know was website*" (01/1/026/3). Within the website children were able to upload their own videos of toothbrushing experience; however none were uploaded during the study period.

As part of the current SOHP '*Teeth Chief*' cartoons were designed to help children learn the key messages. Within the children's post-intervention SOHP evaluation questionnaire children reported enjoying the cartoons (72%, n=113), which was supported through teacher's feedback (*section 7.4.4*). For some children when the plaque'os were winning in making the town dirty (representation of the mouth), this was their least favourite part ("*germs being nasty on videos*", 05/1/134/3 and "*on the videos the people beating the 'Teeth Chiefs'*, 01/1/030/3). Indicating understanding this was bad and the '*Teeth Chief*' had not been carrying out the correct brushing behaviour. However, despite their reported popularity there was large variation in the children remembering the characters names (*Table 7-3*).

Table 7-3 Children's post-intervention SOHP evaluation questionnaire - Q5

Number of names remembered from the cartoons	Childrens self-reporting % (n)
Name one	9.8 (11)
Name two	8.0 (9)
Name three	12.5 (14)
Name four	15.2 (17)
Name four and the plaque'os	2.7 (3)
Pablo	0.9 (1)
Oliver	2.7 (3)
Pablo & Oliver	18.8 (21)
Not able to name any characters	28.6 (32)
Total	112 (missing n=68)

Within the children's home pack the brushing calendar was a key tool to help facilitate establishment of twice-daily brushing. Post-intervention 82% (n=137) of children reported using the calendars, while 8% (n=14) indicated intermittent use. However, from this it is not known if they helped improve behaviour. Further, the calendars were designed to allow parents to be involved in supporting their children, however, only 19% (n=31) of the children indicated receiving support with the calendars, with some reporting this was from older siblings and 10% (n=17) having help '*some of the time*'. The remaining 70% (n=115) indicated not receiving help with the calendar; due to either not using the calendars or not feeling support was required.

Within the free-text answers around children's favourite and least favourite part of the SOHP greater understanding was provided around how the current home materials were aiding the programme to change behaviour:

> *"Mum put sticker chart somewhere"* (06/1/155/3),
> *"Getting all stuff out bag and mum told put all back"* (06/1/145/3),
> *"Mum forgot stickers but not me!"* (06/1/154/3),
> *"Dad help[s] with stickers"* (05/1/129/3),
> *"Mum look after sticker chart"* (02/1/041/3).

For children, brushing their teeth can be a complex set of processes. The in-consistency in the behaviour compared to knowledge was shown by one child through their favourite part being "*like work at home";* but their least favourite part being "*had to brush*" (06/1/157/3). For some brushing can also mean they are taken away from preferred activities "*sometimes miss films at night*" (07/1/074/3).

As part of the study children were provided with toothbrushes and toothpaste. Within the evaluation FGs some children explained that when the "*toothbrush tickles* [their] *mouth*" (07/1/078/3) this was their favourite part compared to others that saw "*when brush tickles* [my] *gums*" (06/1/140/3) as a deterrent. By age six years, children should be using the family fluoride toothpaste (1400ppm fluoride content) but as expressed in the free text for some the taste can deter them:

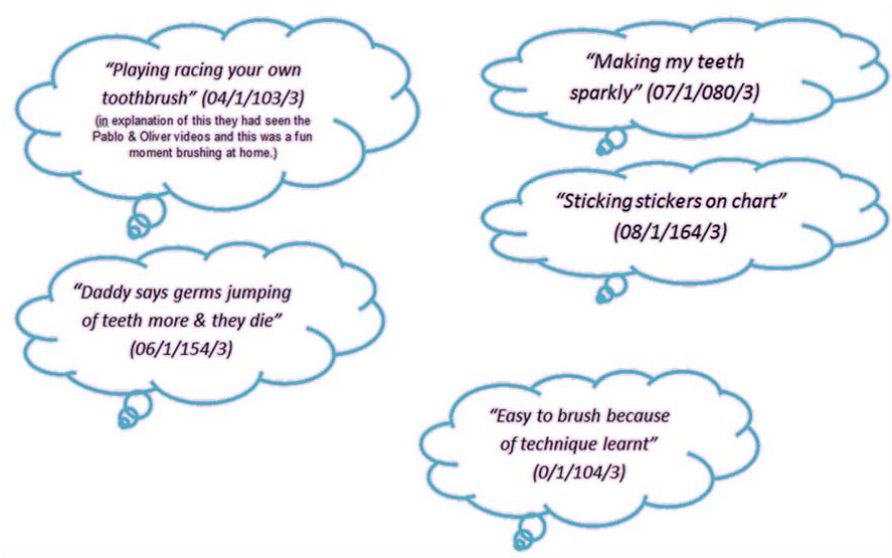
> *"Toothpaste* [was] *too minty"* (02/1/054/3),
> *"Toothpaste – don't like flavour"* (07/1/082/3),

"Putting the toothpaste on [brush]*"* (08/1/169/3).

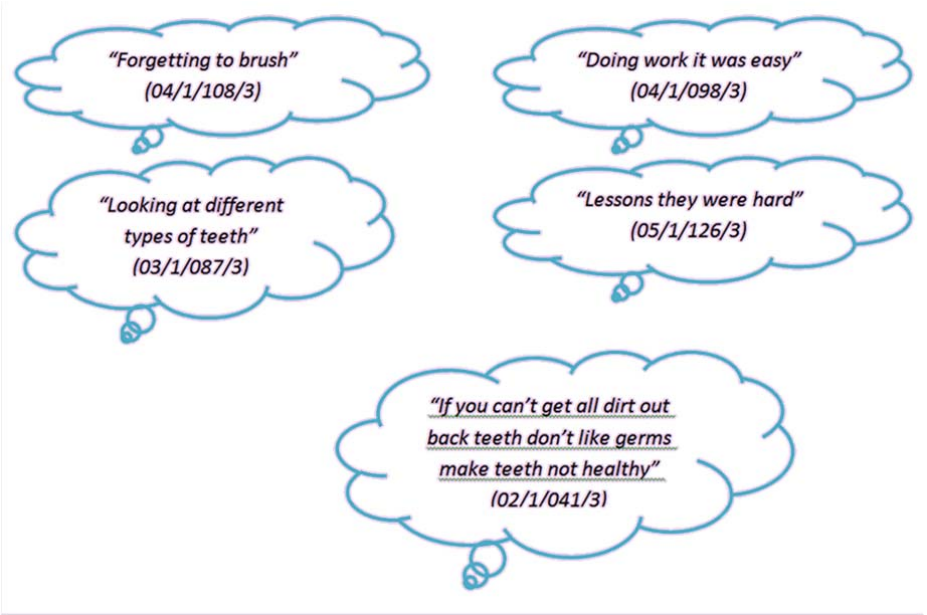
But for other children that use the family fluoride toothpaste this can facilitate brushing:

> *"When you put the toothpaste in your mouth it all goes fizzy"* (08/1/177/3),
> *"Spitting it out, because I don't want the minty taste to go away"* (06/1/141/3).

The children's overall perception of the SOHP was positive with only 4.2% (n=7) saying they did not enjoy it and 4.8% (n=8) saying they only enjoyed parts (Q1). This suggested they were engaged with the current materials and the delivery of the SOHP, but some aspects of it may have been less effective than others at helping facilitate behaviour change. The teacher's echoed this finding (*section 7.4.4*) and felt the children had enjoyed the SOHP. Children provided a great deal of variation in their reasons for liking and not liking aspects of the materials and tools. Some examples of the best part of the SOHP from Q9 of the children's post-intervention evaluation questionnaire were:



When children reported their least favourite part of the SOHP, there was a mix of children reporting that the lessons and worksheets were easy and others who reported them as being hard. Below are some examples of children's feedback in relation to their least favourite part of the SOHP (Q10):



In relation to the current materials and the delivery, in school (05/1) where the teacher felt it was necessary to add more activities (in addition to delivering all the core elements of the programme as they were prescribed), some children also reflected the need for changes "*only a bit fun, need more activities*" (05/1/119/3), "*lesson boring, not enough games*" (05/1/133/3). However, this view was not shared by all, with one child writing "*lesson they were hard*" (05/1/126/3).

7.4.2.2 Children's post-intervention FG results relating to the SOHP process evaluation

Through the FGs greater understanding was gained around if the delivery and materials of the SOHP impacted the SOHP effectiveness.

One topic of questions related to the '*Brush Day & Night*' supporting website, and as reported by children using the questionnaire, few children within the FGs talked about accessing the website with most only using it to show it to family members:

> Researcher- *did you go on it at home?*
> Girl 1- *I didn't*
> Researcher– *what did you use it for?*
> Boy 1- *to show my cousin, cos he is only 3* (Researcher– *you were teaching him were you?*) *yeah*

Boy 2– *I was showing my mum* (Researcher- *what did she think of it?*) *she said, she said she didn't know that*

Boy 1- *I think it's better when you know more than adults*

Researcher– *you been on it then?*

Boy 1- *I not been on it recently, but I'm either on club penguin but I show my dad about it*

Girl 1– *I showed my dad cos he didn't know much about it*

Researcher– *so you taught him things as well*

Girl 2- *I always go on … and Dr Who so I don't have time*

Children also provided further detail around the '*Teeth Chiefs'*. The cartoons were reported as being successful in helping many of the children learn and remember you should brush for 2 minutes:

03.1 Researcher– *so what did you think of the teeth chiefs?*

Boy 1- *brilliant*

Girl 1- *brilliant*

Boy 2- *one of them is called my name* (Researcher– *ah maybe you are a secret teeth chief*)

Researcher- *so do you remember the stories?*

Boy 1- *um I can remember the last one were Oliver was riding on the toothfairies back and the other city getting attached by the plaque'os and loads of people drowned*

Girl 2- *I don't remember some, but I know they got a song that is 2 minute song*

Researcher– *can you remember the song?*

Boy 3- *brush 2 minutes long to keep your teeth super strong, brush 2 minutes long to keep them plaque'os out of site*

Boy 2- *Ollie*

Researcher- *so what were there other names?*

Girl 2- *fang*

Boy 1- *minty*

Girl 3- *sparkly*

Boy 2- *mo*

05.1 Researcher– *what did you think of the teeth chiefs?*

Boy 2- *it was brilliant*

Boy 1- *it was fantastic*

Boy 3- *I liked it because, when the girl put like the shiny stuff on the germs and made them all go through the floor*

Boy 4- *I liked it when the girls turned them into ice and then put the leaves on*

Girl 1– *I liked it because they were all funny*

One of the central features of the children's home pack was the brushing calendar. Within the FG children were asked whether this had helped facilitate any behaviour change and how/if it was being used. Within the children's FGs there were mixed feelings as to the impact of the brushing calendar in aiding children to brush twice-daily. Some children felt having the visual reminder of when they needed to brush was supportive to build the routine, whereas others felt they didn't need the reminder. There were also instances of children reporting losing the calendar (impacted the likelihood of the home programme helping behaviour change) and differencing levels of support with the use of the calendar:

Researcher- *Did you sticker book help you remember when to brush your teeth?*

Girl 1– *yes*

B1– *yes I did them all by myself*

Girl 3– *I did*

Girl 4– *my mum put the big sticker on you know when you finished, but my mum put it in 1st but you're not allowed to do that*

Researcher– *so do you think it helped you remember to brush them, when do you brush them?*

Girl 1– *day & night*

Boy 1– *day & night*

Researcher– *did anyone miss any stickers?*

Girl 1– *no*

Boy 1– *nearly all of them* (Researcher– *is that because you forgot to brush your teeth or you forgot to do the stickers?*) *– forgot to do the stickers*

Researcher– *has it helped you brush more often, do you think you are brushing your teeth more than you did before?*
Girl 1– *yeah*
Boy 1– *no*
Girl 3– *yeah*

Researcher– *did you use your sticker books?*
Children – *yeah*
Researcher – *do you think they helped you remember to brush your teeth?*
Boy 3- *no*
Other children– *yeah*
Researcher– *you don't think it helped, did you still forget?*
Boy 3- *no I just did it at the time I wanted too*
Boy 2- *I remembered cos when I went in the bathroom I saw it was there and then I remembered to brush my teeth*
Researcher– *so has it changed when you brush your teeth, do you think it has helped you to brush your teeth more?*
Children– *yeah*
Researcher– *why has it helped you and not helped you?*
Boy 3– *it helped you to get used to it and helped your teeth to get strong*
Researcher– *why don't you think it helped you, did you already brushed your teeth?*
Boy 1– *I already brushed my teeth, I didn't need it*

Researcher– *did anyone get any help with their sticker books?*
Boy 2- *I don't think I did, I don't like the writing one though*
Boy 4- *my mum keeps finding it and then I lose it again*
Researcher–*So have any of you started brushing your teeth more because of this?*
Boy 1- *no*
Researcher– *has it helped any of you with remembering to brush your teeth?*

Girl 2- *I used to brush them not that long and know I do it longer*
Girl 3- *I do it for 60 seconds and now I do it for 10 second longer*

During the FG children also provided their views of the SOHP as whole, expressing both positive and negative views, which provided greater detail to their evaluation questionnaire responses. The main positive themes discussed by the children related to:

- Learning, although some answers related to aspects of the FGs and materials,

03.1 Researcher– *so what did you think of the lesson you have just done on teeth then?*
Girl 1- *brilliant*
Researcher– *why brilliant?*
Girl 1- *because um it helps your teeth*
Girl 2- *I liked them because we learnt different stuff about your teeth and stuff, and it is great to learn about different things?* (Researcher– *can you tell me something that you learnt*?) *I liked when you learnt about how much sugar was in coke*
Boy 1- *I like it when um we was seeing how much sugar was in coke and um and that cos I liked it cos you was like testing us.*
Researcher– *what about the lessons you got taught in class?*
Boy 2- *I liked it cos we got to watch the teeth chief videos*

Researcher– *so you know the work you have been doing what did you think of the lessons you have just been doing?*
Boy 1- *amazing*
Girl 1- *fun because I get to learn about teeth*
Girl 2- *ok* (Researcher– *why just ok*?) *because I wasn't here half the time* (Researcher– *ah so you missed some of it*)
Boy 2- *fantastic (*Researcher– *what did you learn*?) *because you are teaching us some things*
Girl 3- *fantastic*
Girl 2– *it was good because we, because I got a bit of plaque on my teeth and I get to learn about it*

Boy 4- *don't you dare say no!*
Boy 3– *don't really mind*

05.1 Researcher– *and what did you think about the lessons you have just done on teeth*
Boy 2- *alright…it was alright* (Researcher– *why was it alright*?) *because you had to um know what our teeth were doing and what we can do better to make our teeth more shinny*
Researcher – *and what about you?*
Boy 2– *were you said about the sugar* (Researcher– y*ou learnt more about that*?) *yeah we done that in the lesson*, (Researcher– *what did you learn*?) *don't eat too much sweets or chocolate or your teeth will rot*

Researcher– *What was the best bit of the lesson that the teacher taught you?*
Boy 3- *that she showed us that adults have 32 teeth and kids have 20*
Boy 1- *she showed us that bag where you put on the sticker day and night*

- and the 'Teeth Chiefs'

01.1 Boy 3– *good because I like teeth chiefs*
Boy 4– *I like the plaque'os*

03.1 Girl 4- *I think it was amazing cos you get to watch some little cartoons*

05.1 Boy 2- *she showed us the little clips of the teeth chiefs*

02.1 Boy 2– *because we learned all about teeth, and the films were good.*

Two main themes emerged for the negative responses.

- the toothbrushing:

  01.1 Researcher– *what don't you like?*
  Boy 1– *a bit boring*
  Boy 2– *a waste of time*
  Boy 2– *don't want to do at bedtime*

  03.1 Girl 1– *cos I know when to and, my dad keeps saying have you brushed your teeth and its gets annoying* (Researcher– *so you know to do it but then they are nagging you because of this*?) *yeah*
  Boy 1- *and I'm always tired* (Researcher- *and you're always tired so you don't want to brush your teeth when you're tired*?) *yeah*

- the school work- around the writing and worksheets:

  02.1 Researcher– *so what did you think of the lessons that you did with* [teacher name]*?*
  Girl 1– *they were a bit easy for us*
  Boy 1– *some of them were easy some [of] them were hard*
  Researcher– *what things where easy?*
  Girl 1– *the sheets*
  Researcher– *the worksheets so the worksheets were easy?*
  Children– *yes*
  Researcher– *so which bit were hard?*
  Girl 1– *remembering the names of the teeth, having to colour the names of the teeth*
  Boy 1– *I don't like the colouring*

  03.1 Boy 1- *the worst bit is not doing work on it*
  Girl 1- *some of it wasn't kind of that good for me cos we didn't do most of the time we were doing the lesson were you didn't learn stuff*

  05.1 Researcher– *and was there anything you didn't like about the lessons?*

Boy 3- *where we colour in the ones that we've got but I didn't like the bit where you don't colour in the ones that you haven't got*
Boy 2- *nothing*
Researcher- *is there anything you haven't enjoyed*
Boy 3- *when you have to do hard words that you can't spell*

The FG also provided an opportunity to learn more about the additional components that were delivered in some schools, to begin to understand their impact on the establishment of twice-daily toothbrushing and the SOHP evaluation outcomes. Within *school 03/1* the teacher asked children to design their own '*Teeth Chiefs'*. From the children's FGs (*see extracts below*) and the children's SOHP evaluation questionnaire it appears the addition had an impact (favourite part "*making own* '*Teeth Chiefs*', 03/1/071/3). Through the FG findings, the ability of the children to design their own '*Teeth Chiefs'* suggests this activity had increased their ability to translate what they had learned into practical understanding. This was demonstrated through the incorporation of what powers they would need to help to protect their teeth and how to achieve these powers.

Girl 2- *I liked it because we get to do like, you got to draw your own teeth chief and you got to bring your own toothbrush in and the person who is next to you, you got to show them how to brush your teeth* (Researcher- *and what was your 'Teeth Chief' called*?) *'Teeth Chief' toothpaste* (Researcher– *and what superpower did they have*?) t*hat when um the breath when he goes ahhh you just like faint*
Researcher– *what was your teeth chief called?*
Girl 1– *super shiny* (Researcher– *and what was the special power*?) *toothpaste laser brush*
Boy 1- *mine was mint breath* (Researcher– *ah so just minty breath just all over the plaques*?)
Boy 2- *mine was teeth chief milk, who spits milk and one of my friends his was teeth chief disclosure tablets that let you help see the plaque'os*

Girl 3- *we learnt about the teeth chiefs*

Boy 1- *when we made our own teeth chiefs on a poster*

Researcher– *you made your own teeth chiefs what were you characters?*

Boy 3- *spike teeth* (Researcher– *and what power did that have*?) *um could fight the plaque'os away*

Boy 1– *disclosing tablet* (Researcher– *so it could disclose the plaques away was it*?) *yeah*

Boy 2- *shinny* (Researcher- *and what was shinnies power?*) *shines the plaques away*

Boy 4- *sunny and you could blind them away*

Girl 3– *teeth chief sue, she has a like make the plaques make a path they can go out on*

Girl 3– *mine was called shiny,* (Researcher– a*nd it shinned the plaque away*?) *yeah*

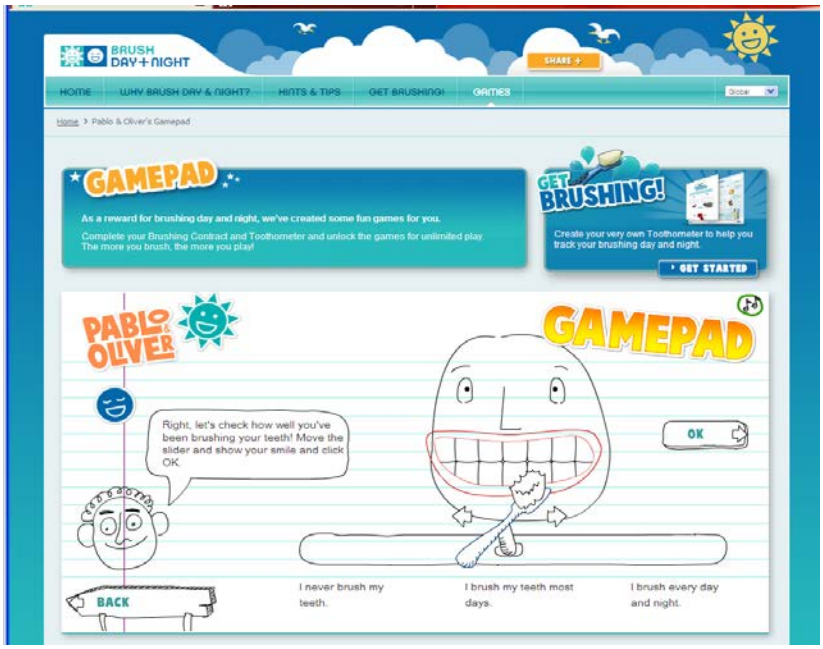
Girl 1- *teeth chief plaque, it prevents the plaque from being there so they are evicted*

7.4.2.3 Parents post-intervention evaluation questionnaire results relating to the SOHP process evaluation

The response rate from parents for completion of the post-intervention evaluation questionnaire was poor at 19% overall (34/180 intervention group participants). This means the results presented below cannot be considered representative of the whole intervention group parent population, and are likely biased.

As mentioned in *section 5.8 (p.192)*, there was no independent method to assess the website available to the researcher, therefore usage could only be estimated from questionnaire reporting. Of those who responded to the post-intervention parents' evaluation questionnaire there was low usage of the website reported, with n=29/34 parents reporting not accessing the website and n=28/34 reporting their children had not accessed the website at home. Those parents who returned the questionnaire reported that children who had used the website mainly accessed the games, which acted as a reward for good brushing with parents being able to set the time allowed on the games (*Figure 7-6*). Within the free-text responses, for those who returned the questionnaire, parents explained that not having access to a computer or the internet were reasons for not going online.

Figure 7-6 Screen shot of website highlighting how parents can reward children with time on games



One of the key elements of the home programme was the children's brushing calendars. In addition to gaining the views of the children, parents were asked how they viewed these in helping facilitate behaviour change. Although the results cannot be taken as representative, of those who retuned the questionnaire, during the intervention period n=32/34 reported their children used the brushing calendar and brushing twice-daily. *Figures 7-8 & 7-9* from returned brushing calendar pages provide examples of differences in children's brushing routines, with one showing a more stable pattern (*Figures 7-8*) compared to the other (*Figure 7-8*).

Figure 7-7 Example of brushing calendar where child brushed more frequently

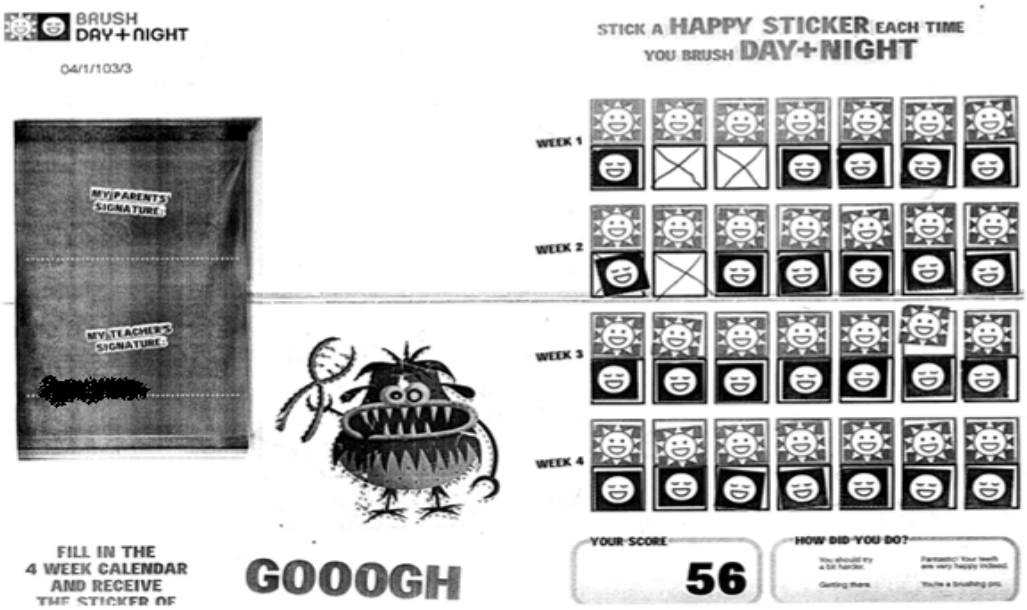
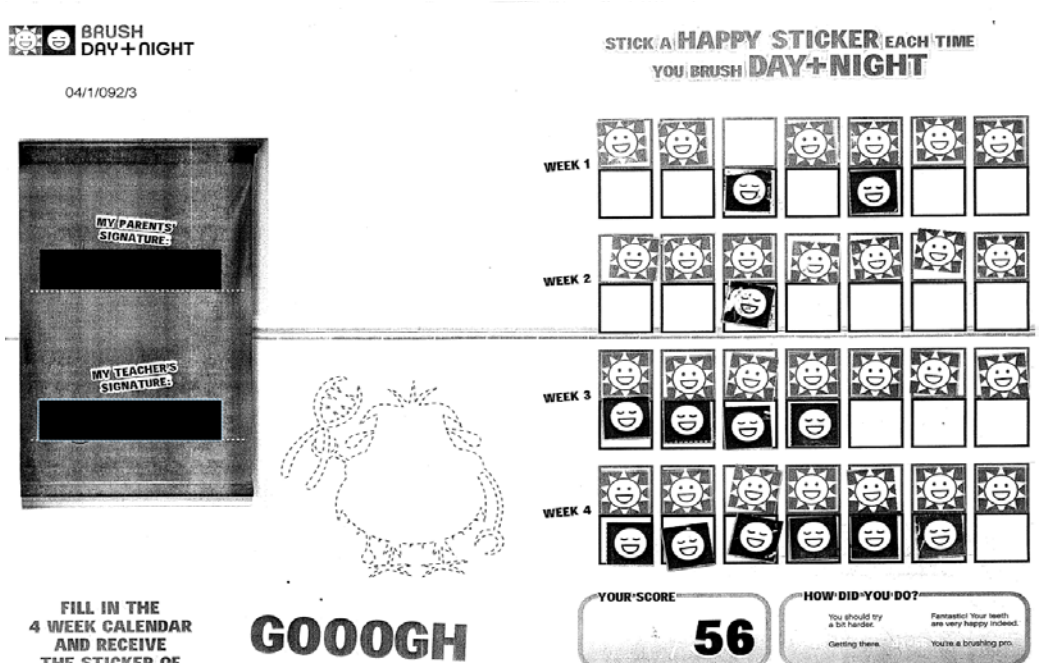


Figure 7-8 Example of brushing calendar where child brushes less frequently



As well as children being asked their overall impression of the SOHP, the post-intervention parents' evaluation questionnaire also asked for comments on their overall impression of the whole SOHP. Although it is unlikely it represent the whole parent sample, as with the children's overall perception of the SOHP, parents who responded had overall positive impressions, but those who already reported

established routines provided mixed views within the free-text responses around the SOHP impact:

> *"We took a visit to the dentist."*
> *"The programme has highlighted the importance of good dental care to my child. She has also become aware of sugary food and frequency of daily intake of these."*
> *"As explain previously we as a family already have routines in place which we follow daily, so the charts were more of a fun exercise to confirm what* [child] *does"*
> *"I do feel that it is good & encouraging for others that do not have good brushing routines."*
> *"Very pleased with this programme, put together with school providing toothbrushes & promoting oral care. I think that all schools should introduce this programme very worthwhile."*

Parents were also asked to comment on the current material in the home pack sent home via the children following the baseline research tools being collected. Although it cannot be generalised, n=32/34 parents said they had received the pack; with n=29 of these reporting the content was useful. However, n=17 of these parents reported they had not learned anything new, compared to n=12 who felt they had learned something, suggesting revisions may be needed. Within the qualitative feedback one parent suggested it would have been useful to include details of local NHS dentists, and another felt the information was useful for their child to read and learn as it contained more detail about how the mouth develops up to the age of 12.

Although it cannot be generalised, overall, for parents who completed the post-intervention parents' evaluation questionnaire, their perception of their children's engagement was positive with n=31/34 reporting they felt their child enjoyed the intervention. However, their perception of the effectiveness of the programme lower with n=27/34 parents reporting the intervention was useful. Despite this of the n=27, all but one envisaged continuing to use the brushing calendar to encourage their child to brush twice-daily. N=25/34 parents reported a perceived benefit to their child's toothbrushing routines; compared to n=6 who felt it had no

impact on their child's behaviour. More detailed explanations provided by parents in free-text on the questionnaire were:

> *"I think my son has learned some aspects about his teeth & the programme has re-enforced his responsibilities, so he knows he needs to take care of his teeth."*
> *"Just made my daughter more keen on brushing her teeth, it helped me with getting her to brush her teeth, it was fun to do with her & we could talk about how imp*[ortant] *our teeth were."*

Two of the parents highlighted the wider effects the intervention had on the family:

> *"3 year old uses chart as well."*
> *"We had a routine in place at night but morning brushing was hit and miss, the focus on brushing has also encouraged my older son to brush more often in the morning."*

Of the parents who perceived there was no impact, predominantly they reported this was due to routines already being in place:

> *"…we as a family already have routines in place which we follow daily, so the charts were more of a fun exercise to confirm what* [child] *does."*
> *"I have always been particular about them cleaning their teeth as soon as a first tooth started coming through so our routine is the same, however I do think this is a good exercise for people who haven't always done this."*
> *"Not improved because parents have always overseen brushing but it has been useful in enforcing the importance of brushing/ establishing routine."*

Although it is unlikely to be representative, of those parents who returned the post-intervention parents' evaluation questionnaire they explained how the intervention had increased their child's awareness and knowledge of the length of time that should be spent brushing:

> *"Will also brush teeth most mornings instead of just at nighttime."*

"[Child] *learnt that she must brush all surfaces of the tooth and that brushing should take 2 minutes."*

"[Child] *is much more careful about brushing in all areas and keener to do it herself."*

"[Child] *is more aware of how to brush. I was aware of oral healthcare from talks I attended at mother & baby groups at …clinic."*

"More aware of personal hygiene & brushes her teeth more regularly, also more aware of how important it is to look after her teeth."

7.4.3 Results follow-up

7.4.3.1 Children's follow-up SOHP evaluation questionnaire results relating to the SOHP process evaluation

As part of the intervention to help facilitate the establishment of twice-daily brushing children were provided with a 1-year brushing calendar for continued reinforcement in the home. It was found from post-intervention to follow-up, that there was a reduction from 82% (n=137) to 33% (n=48) of children reporting using the calendar regularly, with 21% (n=30) reporting only sometimes using the calendar (not using 46%, n=66). The calendar was designed to support engagement with the home, however only a small proportion of children indicated receiving (17.3%, n=22) or sometimes (12.6%, n=16) receiving support from parents or other family members (70.1% no support, n=89).

To understand the durability of the main message around when you should brush *Table 7-4*, below illustrates that fewer children remembered the key message of the programme '*Brush Day & Night*' (post-intervention 55%, n=91) at follow-up (47.9%, n=70) (6-month), suggesting greater reinforcement is needed during this period to sustain this message.

Table 7-4 Children's Follow-up evaluation questionnaire results to examine retention of the key message of the SOHP

Can you remember when you should brush your teeth?	Childrens self-reporting % (n)
Day & Night	47.9 (70)
Morning & Night	34.2 (50)
Everyday	2.1 (3)
Only once-a-day	5.5 (8)
Used meal times to denote brushing	2.7 (4)
Other	7.5 (11)
Total	146 (missing n=34)

Post-intervention the '*Teeth Chiefs*' were viewed by children as one of the most enjoyed materials in helping them learn about OH. As shown in the *Table 7-5* below, in the follow-up evaluation questionnaire 56.2% (n=82) of the children could not remember the characters in the cartoons (compared to only 29.5% post-intervention, n=33), which may also reflect the longevity of the cartoons messages.

Table 7-5 Children's follow-up evaluation questionnire results in relation to the '*Teeth Chief*' cartoons

Can you name any of the *'Teeth Chiefs'*?	Childrens self-reporting % (n)
Name one	11.6 (17)
Name two	6.2 (9)
Name three	8.2 (12)
Name four	4.1 (6)
Incorrect characters named	10.3 (15)
Pablo & Oliver	3.4 (5)
Not able to name any	56.2 (82)
Total	146 (missing n=34)

7.4.3.2 Children's follow-up FGs results relating to the SOHP process evaluation

The brushing calendar was designed to help facilitate establishment of sustained twice-daily toothbrushing. However, within the follow-up FGs many of the children who reported not using their brushing calendar reported that this was because they were lost. They also reported that help with the stickers from their parents had waned:

> 03.1 Researcher- *are any of you still using your sticker books?*
>
> Most children- *no*

Girl 3- *I am* (Researcher– *and is it still helping you*?) *yeah*
Researcher- *and why aren't you using your sticker books?*
Boy 1- *because I don't know where it has gone*
Girl 2- *the same*
Girl 1- *don't know where it is*
Boy 2- *don't know where it is*
Boy 1- *I got bored of it*

05.1 Researcher– *has anyone helped you with your stickers?*
Girl 4- *my mum has*
Girl 5– *no*
Boy 3- *no one is helping me*
Researcher– *is anyone getting help with their sticker book?*
Boy 4- *my mum*
Girl 4– *I've lost mine*
Other children now also say they have lost theirs
Boy 5- *my dad threw it in the bin* (Researcher– y*our dad threw it in the bin when did he do that*?) *ages ago.*
Girl 4- *I think my mum put it somewhere*
Boy 5- *I lost in one day, and then I found it again and then my dad um then my brother lost it.*

In addition, through the follow-up FGs a small number of children reported a shift in how they viewed the need for support in relation to them getting older *("I am saying I'm old enough I'm 8 mum I can brush my teeth by myself (*Researcher – *so does it annoy you when she tells you to brush your teeth?) yeah"*). This change in attitude around how they view their own ability to manage their brushing and the need for support may impact sustainability of any behaviour change.

Post-intervention, children and teachers were positive in their reporting of the '*Teeth Chiefs'*, feeling they aided understanding of the key OH behaviours. At follow-up through the FGs it took time for children to remember the materials in the SOHP (lessons, games on the website and the cartoons), although in time they

were able to recall the some of the messages, cartoons and aspects of the lessons:

03.1 Researcher– *and what do you remember from the lessons that you did in year 2?*
Girl 1- *their teeth called canines, pre-molars and primary molars*
Researcher- one more
Boy 2- *incisors*
Researcher– *what else do you remember*?
Boy 3- *I remember the videos with the teeth chiefs, and the plaque'os. The teeth chiefs are called Ollie, fang, minty and mo*
Researcher– *and do you remember the song? One of the songs*
Girl 3- the two minute song
Researcher- *and do you remember anything else*
Boy 1– *I remember doing that quiz and getting my teeth checked*

Boy 3– *what did you think of the lessons you have done on teeth*
Researcher- do you remember what you did in year 2?
Girl 3– *you have to do a quiz and if you have done it you tick it*
Researcher– *yeah and what about the lessons you did in class?*
Girl 4- *you have to draw a picture of toothpaste*
Boy 2- *they were quite easy*
Girl 5- *it was a bit hard* (Researcher– *what bits were hard*?) *on the second sheet were you have to colour the teeth*
Boy 3- *it was really exciting*

Researcher– *what do you remember about those lessons in year 2*
Girl 5- *were we get to watch the teeth chiefs*
Boy 4- *and we got toothpaste and al them things*
Girl 6- *you got the book were you got to stick the stickers in*
Child- *what did you think of the teeth chiefs? (*Researcher– *so I think this is the bit you remember*)
Boy 1- *it was brilliant and fantastic*
Girl 1- *it was good when they were killing the germs*

Researcher-*who remembers what the germs were called?*

Girl 2- *plaque*

Researcher– *so the characters?*

Girl 2- *Ollie*

Boy 1- *fang*

Boy 4- *Mo*

Girl 2- *minty*

Researcher– *does anyone remember what any of the stories were or the songs?*

Some children– *sing the tune*

Boy 1- *one was where he was hiding in the bush and then he was singing and the when they though he was funny*

Girl 3- *I really liked it cos when the good guys killed all the germs it made me laugh a tiny bit*

Girl 1- *one of them was at a sleep over and she forgot to brush the plaque away*

Boy 1– *do you know those teeth things they were funny*

7.4.3.3 Parents follow-up evaluation questionnaire results relating to the SOHP process evaluation

The response rate from parents for completion of the follow-up evaluation questionnaire was again poor at 23% overall response rate (41/180), meaning the results below cannot be considered representative of the whole intervention group parent sample, and are likely biased.

Over the follow-up period those parents who returned the parent follow-up evaluation questionnaire had mixed impressions about the continued effectiveness of the SOHP: n=22/41 felt the intervention had led to an improvement (post-intervention, n=26/34) compared to n=10 who felt no improvement was evident over the previous 6 months. Overall n=31/41 reported their child brushing twice-daily.

As found in the children's follow-up SOHP evaluation questionnaire there was a reported reduction in brushing calendar usage with only n=11/41 parents reporting the calendar still being used. As the calendars were designed to last the year, of

those parents who returned the parent follow-up evaluation questionnaire only n=6 indicated they would continue to use them until they ran out, n=11 envisaged their children might continue to use it but n=19 had no intention of using it. Common free-text responses expanding on this were:

> *"Initially used chart as novelty. Always brushed teeth twice-a-day or more. Always has dental check-up twice a year."*
> *"Although we haven't used the chart my child understands better the importance of brushing your teeth regularly and properly."*
> *"He will brush his teeth every morning and sometimes at night. A chart does not help."*
> *"We use the chart for about 6 weeks but as no-one was asking for the sheets back/following them up, we stopped using them and fell back into our regular routines. The programme temporarily improved our habits but there was no further input after the initial setup."*

Parents also provided explanations of the positive effects of the calendar:

> *"Chart has developed discipline in the child."*
> *"More confident brushing procedures, that chart has really peaked his interest he always wants to get 100% on chart."*

In relation to the supporting website, as found post-intervention, of those parents who returned the parent follow-up evaluation questionnaire they still reported the website to be an underused resource (n=8/41 reported their children accessing the site). Four reported children were accessing the games, three accessing information and one accessing the videos. Additionally n=6/41 (n=3/32, post-intervention) of those parents reported accessing the website, most commonly for information.

Although not representative, at follow-up the overall perception of those parents who returned the parent follow-up evaluation questionnaire, n=23/41 parents felt that since the start of the SOHP they had seen a benefit for themselves and their child, this compared to the n=12 who felt they hadn't. N=24/41 of the parents felt the programme had continued to help with the routine in the home and through the free-text parts of the questionnaire explained:

"My son has continued to brush his teeth for 2 minutes as recommended."

"Overall message of dental hygiene has stuck and he is now taking much more care when brushing, he has just had a real check up with a dentist."

"It got him (and my daughter) into a good routine."

N=10/41 parents who felt the SOHP had not helped, explaining that this was because they already had a brushing routine:

"Maybe stressed the importance again but has always had good oral hygiene."

"Always brushed her teeth twice-a-day without any problems- didn't make a difference."

"I have always been strict where my children's teeth are concerned and as my children gets lots of homework to do I found the chart as added daily job, hard to keep up with but my children already look after their teeth so stopped using the programme as soon as my [child] *was becoming bored with it, however for families that are not in a regular pattern brushing their teeth they would probably benefit more."*

7.4.4 Results: SOHP process outcomes for intervention school teachers, who delivered the SOHP

In all but one instance the teachers (n=7) completed the post-intervention evaluation questionnaire on the day and returned it to the researcher prior to the completion of the visit.

The results of the questionnaire have been divided into sections: 1a) Supporting resources; 2) lessons and lesson materials; 2a) lesson 1; 2b) lesson 2; 2c) lesson 3; 2d) worksheets; 3) '*Teeth Chief*' cartoons; 4) '*Brush Day & Night*' website; 5a) Children's engagement; 5b) Parents' engagement.

1a - Supporting resources: When asked to indicate which resources were more important and less important for helping the children through the SOHP the

teachers responses varied: the *'Teeth Chief's*' and mouth models were seen by all teachers as the most important, with only one feeling the posters were important.

> *"The website, videos and slides were all helpful in engaging the children and promoting discussion about teeth"* (05/1).

One teacher (04/1) reported not using the posters as part of the SOHP, with the other teachers reporting using all of the provided resources. As with the limited impact reported by parents and children, only two teachers felt the website was important.

Despite teachers in *study 1* feeling lesson-plans needed to be created to fit into the National Curriculum (NC) requirements, these were reported as not being essential to the SOHP. Overall teachers felt the posters, lesson plans and website were the area's most in need of development to improve their ability to support the SOHP. Two teachers' also reported the slides were in need of development to aid both teaching and children's understanding:

> *"The slides are good. Could maybe do with a few more giving more details on decay and foods, especially the idea that how often you eat food has an effect. Maybe something looking at the number of acid attacks in a day different food patterns has. They need the visual image as well as the theoretical idea"* (04/1).
> *"Slides 5,6,7,8 didn't really support the children in their learning and they found the material a bit repetitive"* (02/1).

2 - Lessons and lesson material: In addition to delivering the programme as it was intended and set-out, some teachers made small additions. The teachers reported that changes were designed to help improve children's understanding/engagement, make the programme more active, and align it with the NC currently being taught. All the teachers reported they would reuse the current '*Brush Day & Night*' SOHP:

> *"I found it easy to deliver and the children enjoyed the class work"* (06/1).
> *"Yes- But I would add in the extra bits again"* (05/1).

> *"It has been good. I have added in my own resources and extra sessions to get more out of it. We have designed healthy meals and labelled parts of teeth and designed our own germs!"* (04/1).

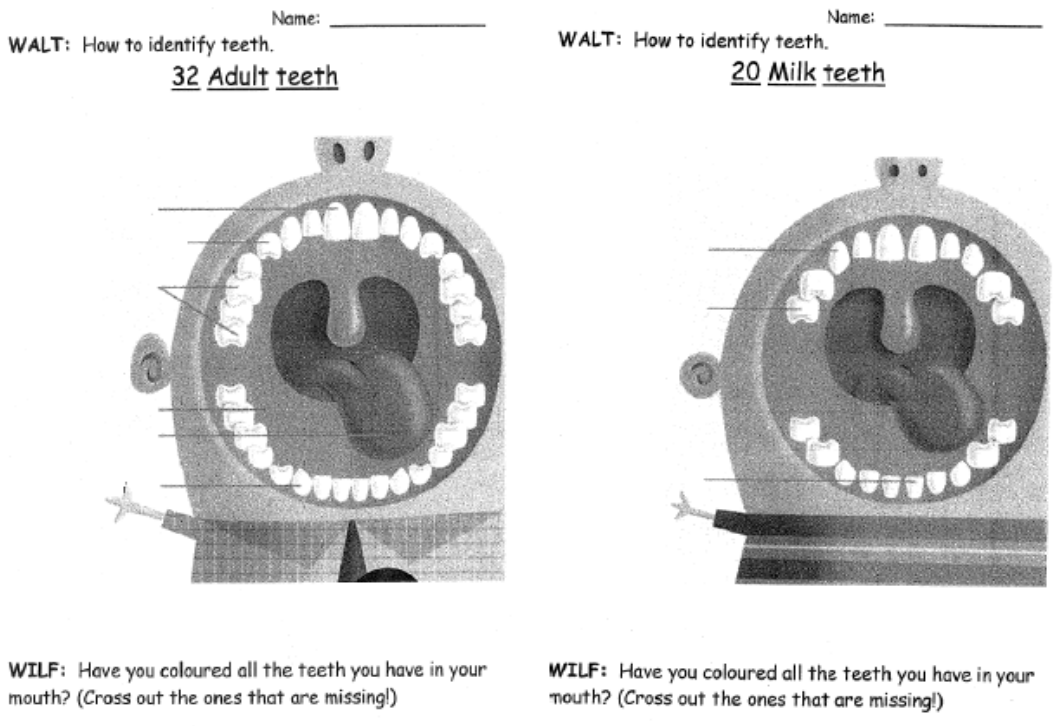
The majority of the teachers felt the material was suitable for 6-7 year olds, but one felt only some was suitable. All of the intervention teachers held the belief that it was important to teach 6-7 year olds about OH:

> "*Just getting them talking about it is good. Understanding that the teeth they get now have to last them forever!"* (04/1).

2a - Lesson 1 ('*The mouth, the teeth and their roles*')**:** In addition to delivering the standard lesson as designed, three teachers made small additions. These related to allowing children to begin to understand about their own mouth and teeth:

> *"…included two denture pictures for the children to compare with what they could feel and see (using mirrors) within their own mouths"* (05/1, Figure 7-9).

Figure 7-9 Worksheet created by a teacher to support children's learning (graphic from original slides in the SOHP)



Another teacher explained an addition they made:

> *"Added in an activity where they had to cut out and stick the teeth into the correct places. This encouraged them to look in a mirror inside their own mouths and recognize the teeth"* (04/1 – via blog) adding to this in a later question their reasons for adapting the intervention *"It needs more activities adding to it to make the learning more active."* Further, via the blog they reported: *"They enjoyed learning the names of the teeth and related it to work we had done previously on herbivores and carnivores."*

The final teacher's change aimed to help introduce the notion that what we eat affects our teeth and the difference between good and bad food. The teacher explained "*for understanding work, children wrote down foods*" (03/1) (this involved writing down good and bad food for our teeth).

2b - Lesson 2 ('Main teeth problems: Germs and Cavities')**:** Lesson 2 introduced more complex ideas around OH and the effects of nutrition. One teacher felt presently the lesson and the materials did not help complete understating:

> *"Could have done with more. They didn't really understand the idea of acid and where it came from. We did discuss this, but the idea that all food can damage teeth, but some does more damage than others was difficult. They took more from the idea that sticky sugary food sticks to your teeth and the germ like that. Sheet 2 was very easy for them to complete"* (04/1).

This was followed up in relation to the materials designed to support the lesson:

> *"The PowerPoint slides showing how the decay happens to a tooth were good and children engaged well with this idea. They really liked the cartoon germs"* (04/1).

Prior to starting the lesson two teachers reported checking previous knowledge from lesson 1:

> *"At start of lesson, asked children what they already know about teeth & what they want to find out, used their questions to guide teaching of subsequent lessons"* (03/1).

> *"…they enjoyed recapping the names of the teeth and the things we had already learnt"* (04/1).

As with lesson 1, the core of the lesson was delivered as intended but some teachers made additions to increase children's engagement:

> *"Added in more active learning to the session. I got the children to label teeth and design germs of their own"* (04/1).

2c - Lesson 3 (**'***Brushing day and night with fluoridated toothpaste'*)**:** Continuing the difficulties expressed by one teacher in lesson 2 with regards to the more complex and abstract issues, within lesson 3 a different teacher further expressed details of perceived challenges faced by the children, in respect of reminerlisation and demineralisation:

> *"Vocabulary – Yr 2 couldn't really understand remineralisation and demineralisation….Children understand the correct toothbrushing technique and the importance of brushing day & night. They found the concept of fluoride difficult to understand"* (02/1).

In addition to delivering the core of the programme as intended, two teachers who previously made additional also did this within lesson 3:

> *"Children brought in toothbrushes from home to demo to each other how to clean teeth. They designed their own Teeth Chiefs''* (03/1).

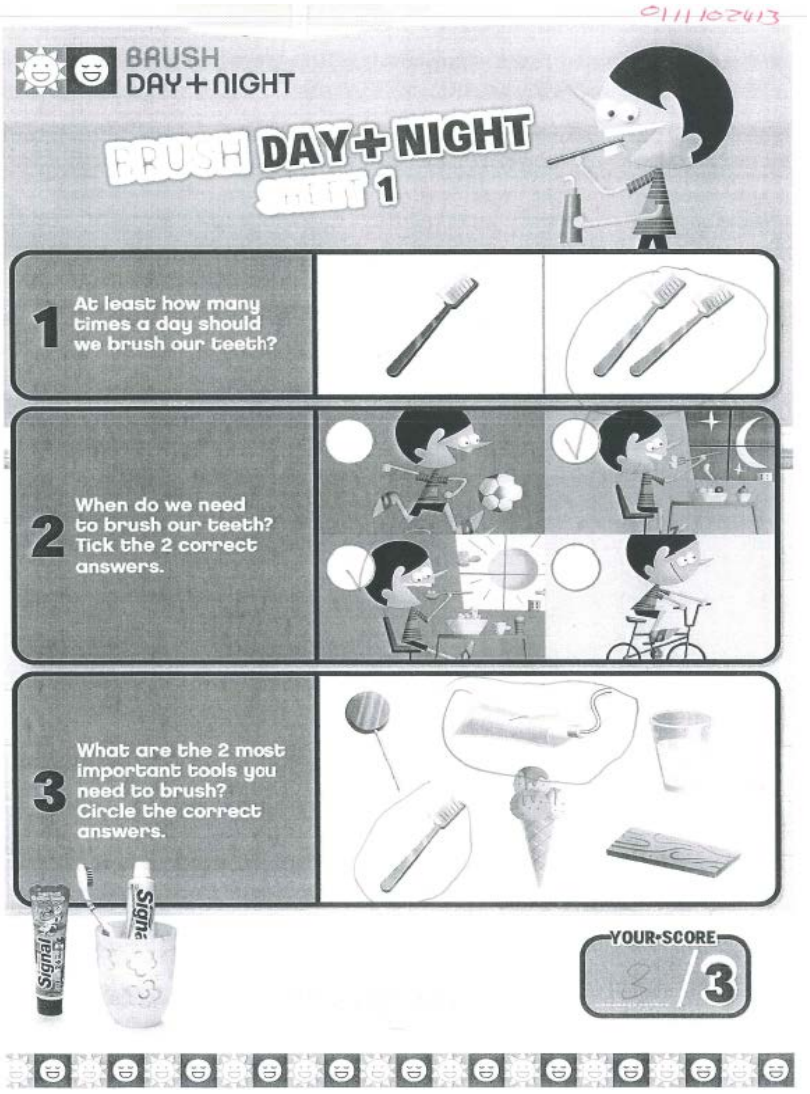
The second teacher (04/1) brought the website into the lesson as a reward and because some children were unable to access it at home.

2d - Worksheets: Overall teachers were not as positive about the worksheets as the lessons (example of completed worksheets in *Figure 7-10-13*). Two felt they were not aimed at the appropriate level, one felt they did not compliment the lessons and another reported they only sometimes complimented what they had taught:

> *"A good level but quickly completed. Some further extension work on the reverse would have engaged the pupils longer"* (05/1),
> *"Feel it would be better to aim at children in reception"* (06/1),

"Brush D&N worksheet 1 very easy presented no challenge" (02/1).

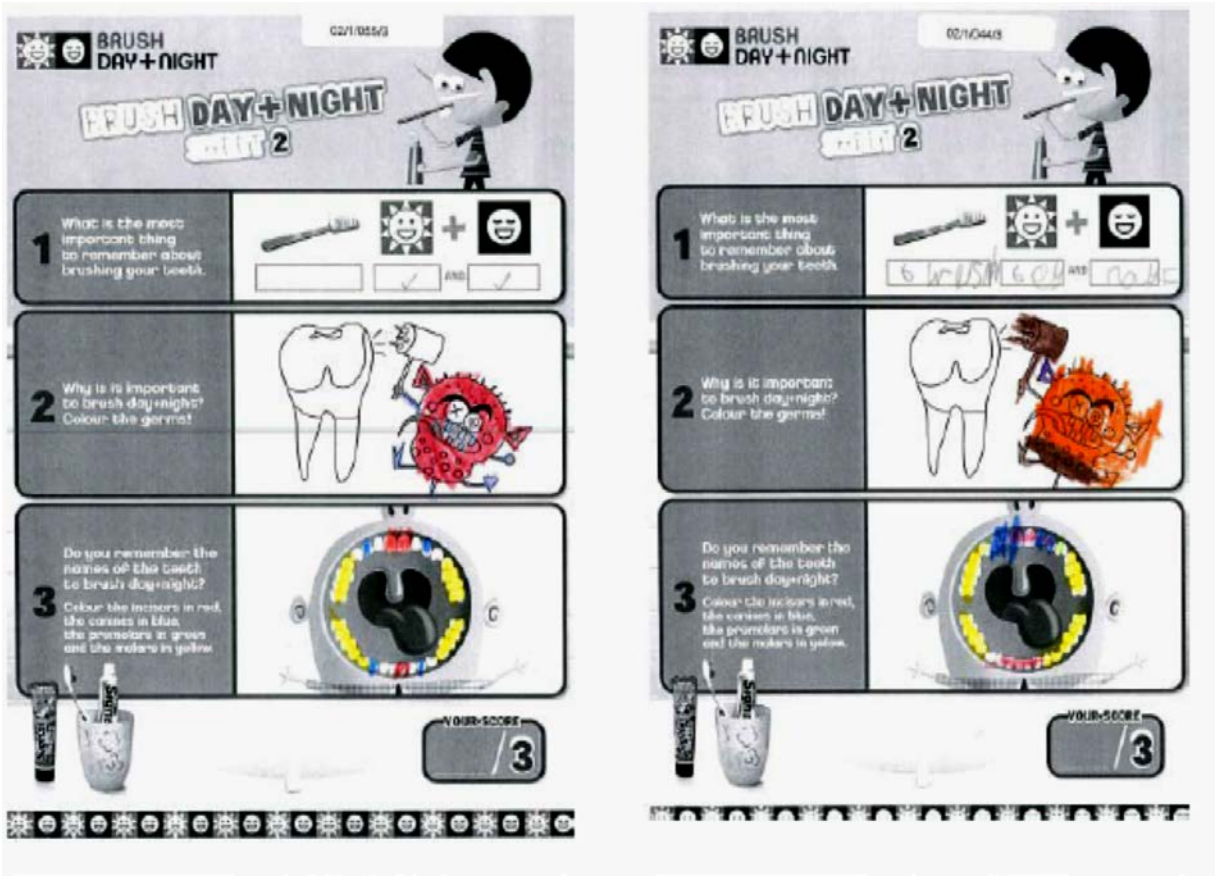
Figure 7-10 Example of completed worksheet 1



In relation to worksheet 2 (examples in *Figure 7-11*) one teacher reported:

"They enjoyed the worksheet but found the last question very difficult as the mouth is quite small" (02/1)

Figure 7-11 Example of completed worksheet 2



All teachers felt the children struggled with the less prescriptive and more creative third worksheet (*Figure 7-12*):

> *"Sheet 3 children found difficult to group ideas…Some worksheets could've been a little more 'difficult' so children had to really think about the lesson"* (03/1).
>
> *"Some were a bit easy & quick to do. The last one was rather vague, especially as most of the children hadn't played the games"* (04/1).
>
> *"The children enjoyed the work in class. They loved the big teeth and toothbrush. Also the website went down well. The worksheets were easy to complete on the whole. They found the worksheets where they had to share a magical tooth memory hard. I shared what I do with my children and they liked the video of the boy whose dad acts as a tooth police officer and checks the boy's*

teeth. They found the naming of the teeth hard and colouring in question difficult. Have gone over this a few times" (06/1).

Figure 7-12 Examples of completed worksheet three

3 - '*Teeth Chief*' cartoons: One problem highlighted by one school was the file format of the '*Teeth Chief*' cartoons. This led to problems playing the cartoons, and resulted in them watching the *Pablo & Oliver* videos online instead. Despite the schools being asked regularly how the SOHP was working day-to-day, this issue was only communicated in teacher's post-intervention evaluation questionnaire.

Overall teachers reflected the feedback of the children and felt they enjoyed the cartoons; with 6/7 teachers indicating they would re-use them, and another feeling they helped the children's understanding. One teacher used the cartoons to develop additional activities (*section 7.3.4.4*); with children having to think about the superpower they wanted from brushing, which appeared to have an impact on these children's learning from the SOHP.

4 - '*Brush Day & Night*' website: Three teachers reported using the website; with two teachers feeling that it supported the intervention "*the class loved the videos and the games*" (04/1). Only one teacher indicated they used it to obtain extra resources. One teacher demonstrated the games page on the website for children to use at home. Those who did not access the website explained issues of "*no facilities*" (03/1) and lack of time "*just didn't have enough time to explore the website*" (01/1); "*the end of the school year was a chaotic rush!*" (05/1).

5a - Children's engagement: All teachers indicated the children enjoyed the SOHP, however through their discussions in class one teacher reported feeling the children did not enjoy the materials in the home. When asked more specifically if they felt the SOHP had an impact on the children's OH behaviour only two felt it had.

> *"They are more aware of what is good/bad for their teeth & cartoons have made it fun learning for them"* (03/1).
> *"Some children have been very positive. Those who rarely brushed their teeth before seem unchanged in their behaviour"* the same teacher via the blog during the intervention reported, *"Yes, all the children are talking about brushing their teeth and they love the charts they took home."* This teacher further explained *"Many children said they only brushed their teeth in the morning or before they went out. Reminding them about the importance of brushing day and night seemed to help them" and "Children are still talking about brushing their teeth but some still admit to only brushing their teeth sometimes"* (04/1).

Two teachers were unsure of the effects and found it hard to determine even when talking to the children:

"The children enjoyed the work and have clearly learnt a lot from the materials. As to whether this has had a significant impact on oral hygiene, I'm sceptical" (05/1).

"Not sure if it would change the behaviour at the moment. The results of the tests on the children's teeth will be interesting to see" (03/1).

Teachers were not in agreement about the most beneficial part of the SOHP, however they felt raising the children's awareness was one of the most beneficial aspects:

"Unsure" (01/1),

"Cartoon to engage them in the start, calendars to motivate them" (03/1),

"Talking about brushing and raising awareness" (04/1),

"Making the children aware of good practice" (05/1),

"The plaque test" (06/1).

As teachers had the experience of delivering the SOHP they were also asked what future revisions they felt were needed:

"Perhaps do a topic work in this, linking it in with other subjects more" (03/1),

"Maybe show them what teeth look like when they are rotten" (04/1),

"I wonder if a school brush bag system, similar to the Foundation unit, might be useful in encouraging a brush routine" (05/1).

5b - Parent's engagement: Although the SOHP was predominantly delivered in the school, the link between activities in the home and the school is an important but challenging element needed to aid behaviour change. Teachers were asked how they perceived the engagement of parents with the SOHP (*Table 7-6*)

Table 7-6 Teachers post-intervention evaluation questionnaire result around parents engagement with the SOHP

School	How well did the intervention engage parents?	What gave you this impression?	What do you feel could be done to improve parental engagement in the future?
01/1	*"Partially engaged and hard to tell"*	*"Did not receive feedback from all parents."*	*"Unsure"*
03/1	*"Well"*	*"Response from questionnaires. Parents occasionally chatted at the door & explained any issues which had arisen from toothbrushing. I think it has made them more aware of the importance."*	*"Perhaps to have a parent & child 'teaching day' where the parents also have a 'lesson' about teeth, and correct brushing behaviour."*
04/1	*"Hard to tell"*	*"No feedback, only 10 or so children brought charts in for us to see."*	*"Better education in the wider community. Doctors pushing the importance of toothbrushing."*
05/1	*"Hard to tell"*	*"Lack of follow-up support from an otherwise keen and supportive group of parents."*	*"Their lack of engagement surprised me!"*
06/1	*"Partially engaged"*	*"Had to send two lots of* [consent] *forms out. Also children said some parents threw away teeth calendars, some parents said calendar was too fiddly."*	*"Do earlier maybe in reception."*

Further, through email feedback, one teacher noted:

> *"Yes, everything's going ok and the kids seem to be responding well, they've been going home and telling their parents some of the facts that we have found out, which is a good sign!"* (04/1).

Additional feedback provided by the teacher in school 06/1 (via the blog) highlighted the challenge of a SOHP to engage the harder to reach families, as well as those who already had good habits:

> *"Think the programme is fine but not sure how you get more parents involved….Most children did not seem to be using the*

chart at home. Not sure if it would be better to use the programme with younger year group."

"Hard to say. Those children who cleaned teeth well before continue to do so. When I asked who was completing the chart some parents said they did not need to, some had put it in the bin and others said the chart and stickers were too fiddly and time consuming. Again we did not get permission from lots of parents despite going out and chatting to them ourselves. The parents who gave permission are the ones who generally have a good tooth routine with the children Still seemed to be some parents who have a fear of dental talk and did not want to engage in conversation."

7.5 Discussion of the process evaluation conducted as part of *study 2*

7.5.1 Observational discussion around the impact of school environment on *study 2*, a lesson observation and displays found within intervention schools

Although there was no structured evaluation of the school environment, it is felt the observations noted during the evaluation are important to highlight. School environments influence: the whole school ethos, the children, learning and teaching approaches and targeting of health related topics (St Leger, 2001; Langford et al., 2014). It is also felt by the researcher that school ethos can impact how schools engage with research. Variations around research engagement can occur within schools as well as between schools, for example split teaching posts and the schools engagement with parents.

All schools in *study 2* had achieved Healthy Schools (HS) status, indicating a belief that improving their children's health and wellbeing forms an important part of the school day. Within *study 2* some of the school HS coordinators decided the school should be part of the study and then consulted the teacher. For other schools there was a wish to use the intervention as part of their work towards the enhanced HS model in conjunction with the local NHS trust supporting the SOHP evaluation.

In talking to and working with the schools, some teachers appeared to be more active in encouraging and reminding the children about brushing than others, but

still experienced the challenge of influencing a behaviour that does not naturally occur in the school. For example, within one of the lower SES area intervention schools the teacher and head were the most forthcoming at being involved and ensuring all children took part (only 1 child did not have consent). Through discussion the teachers explained that to ensure the children used the calendars they only sent home what was required and used tally charts each week (something that future versions could consider as part of a school monitoring or reward system), which was felt to be the best way to ensure they were used. This highlights how teachers can feel an extra duty to help the children. Further, within this school the notion of routine was difficult and required a greater amount of explanation and support, during the completion of the research tools. How engaged teachers are with an intervention and how important they see the topic can influence the success of the intervention, but ultimately for many behaviours there is a need to engage the home (*Chapter 3*).

During the initial visit to collect baseline data, at one school the teacher wanted to be present for the plaque exams (*Figure 7-13*). This was to help her own understanding and aid the children in feeling at ease as they knew the teacher and were reassured that she was ’ok’ with the evaluation process. A second teacher explained to the children that the plaque exam was fine and they would not have allowed it, if ‘*there was anything bad going to happen*’.

Figure 7-13 Teacher observing dental exams at baseline

The plaque exams for one intervention school were carried out in the library area where many other classes were able to see. This led to discussions with teachers and pupils around what was happening and why it was important. On a few occasions it also led to children with toothache or other anxieties being brought by their teachers to ask if the dental hygienist could talk to them to help put them at ease. Although the current SOHP was not designed to work with the whole school, this highlights how activities can engage the whole school.

Although not asked directly, there were evident differences in the teachers' levels of experience. One new teacher (07/1), who reported this was their first position since being qualified) explained post-intervention that they had struggled with the schools requirements at the end of the school year, delivering their normal lessons and incorporating the SOHP. Within this school, the head teacher felt strongly they should be part of the intervention and had informed the teacher, which is likely to have impacted their engagement with the SOHP.

In one intervention school a job share operated (06/1) which affected the running of the SOHP. Due to the nature of the school timetable, evaluation visits were carried out on days when the second teacher was present. Through this it was apparent the intervention was being delivered by the first teacher and the second teacher was not engaged, indicating the children may not have been receiving consistent reinforcement as schools with only one teacher.

Through conducting the study it appeared that within schools in higher SES areas rules and a focus on doing well were taught/expected, with many children appearing to struggle to move away from the need to get things correct as part of the research. In conducting the research tools the children wanted to ensure all answers were 'correct' and when one child could not answer a question as they perceived it should be answered they got upset. The teacher in one of the intervention schools had incorporated the SOHP into science, and the children's science books. However, just prior to the post-intervention research tools being conducted the worksheets had been sent home at the end of term. The teacher was worried the completed worksheets would not be seen so children were told to re-do them to allow us to see their understanding.

Although not widely reported as an issue within this evaluation, children are increasingly taken out of class for extra activities or lessons. Within this programme if children missed a lesson teachers did not redeliver missed components. One parent reported:

> *"When I asked if she enjoyed the programme she said that she had missed a lot of it due to rehearsals for the school play/choir in lesson time. Maybe better communication is needed between yourselves & school staff to check children are not missing out."*

This child also reported in the evaluation feeling they missed a lot because of choir, but enjoyed the games at school, found the lessons they did take part in quite easy and had been using their brushing calendar at home.

Within *study 2* it was not possible to observe all of the lessons due to the study design (e.g. staggered role out) and, as the whole class were included in the lessons, some teachers with lower consent rates felt it might go against parental consent wishes. Through an observation of lesson 2 it was possible to see that the core of the programme was delivered as intended, and observe some slight changes.

To begin the teacher recapped the previous lesson to ensure the children had understood the key messages (names of teeth) using the provided mouth models. To try and help the children who struggled with the concept of germs, children

were asked to think about good/bad germs and what germs can do. In observing this it was possible to see the need for more resources around this topic, either through slides, worksheets and props. Following delivery of the core components as intended, the teacher added in practical activities using a mirror to look at their own teeth and record which they had (to expand on the activity on worksheet 2) and using red/green teeth to get the children to write good/bad foods down (*Figure 7-14*). The aim of the changes was to increase the number of activities and check children's understanding. The teacher appeared conscious of the need to ensure that changes fit with the style and language they perceived in the SOHP. Finally, to improve the learning from the '*Teeth Chiefs'*, the teacher discussed what they had learnt in the previous cartoons. During the observation, before the cartoon only 8/23 knew they needed to brush for 2 minutes and that saliva had protective properties in the mouth. Children appeared able to understand the progression of the story through the cartoons and recalled the '*Teeth Chiefs'* song explaining brushing length. The observation of lesson 2, allowed the use of worksheet 2 to be observed. Although within the observation the children were able to complete the initial questions with ease, it was evident the mouth on the final section was too small and many children struggled with identifying the teeth. This supports the finding within *section 7.4.4* were some teachers reported this worksheet to be challenging for the children. It is recommended that this be modified in future version to enlarge the mouth model.

Often within schools current topics of work are displayed, to improve whole school awareness. In 3/8 intervention schools, there were display boards relating to the '*Brush Day & Night*' SOHP (*Figure 7-14*). The final school had taken their display down the previous day to conduct a whole school assembly to explain what they had learned.

Figure 7-14 Example of displays in two schools as part of the SOHP evaluation

Two schools visibly continued to use the materials provided with the SOHP in year 3 classrooms (*Figure 7-15*).

Figure 7-15 Posters being used in year 3 intervention group class alongside healthy eating work

During the follow-up visit to one of the low SES schools it was evident they had continued the theme of teeth and OH in year 3. Within the class there were displays of key facts about teeth and information about looking after your teeth. Other schools reported they planned to reuse some of the resources when delivering the OH component of the NC (which fell after the end of *study 2*).

Through observing the schools and working in the schools during the evaluation the impact of the school environment and teacher engagement were clear. Some control and intervention school teachers were more organised and clear as to the research while others seemed to have less of an understanding and more willingness to allow the researcher to deal with all aspects. There were also

differing levels of engagement with head teachers and other support staff, with some contact being solely with the teacher.

7.5.2 Lessons from *study 2* process evaluation and outcomes

From the main findings of *study 2 (section 6.7*) and the process evaluation a number of lessons can be learned in relation to changes that could have been made to enhance this study methods and future similar studies (*section 7.6*).

Whilst the emphasis of the process evaluation was on the intervention group it is important to also reflect on the intervention and control groups in relation to selection and function. As outlined in *chapter 4* the framework model proposed by Grant et al. (2013) for designing process evaluation when conducting a cluster-randomised controlled trial, provides a useful framework to reflect on *study 2*. Within *study 2* the location of the two clusters were pre-selected because a geographical split was used for randomisation. Schools were allocated to intervention and control before consent was gained from schools and participants. Recruitment after randomisation to a cluster can introduce biases in recruitment and consent rates as the schools and participants have prior knowledge of the group they have been allocated to (Puffer, Torgerson, & Watson, 2003; Eldridge & Kerry, 2012). Within *study 2*, control schools were provided with the intervention, home and parent packs after the 6-month follow-up (wait-list controls) (*section 6.5.4*). This allowed for the provision of the intervention to these children but also ensured a non-intervention control was used.

Grant et al. (2013) highlight the need to think about processes involving the clusters. Within *study 2* the consent rates for schools and the parents for their children to take part were lower for the control group than those allocated to the intervention group (*section 6.8.2*). This meant the required sample size for the control group was not reached, which can limit the reliability of the outcomes and the possibility of the results being down to chance or having additional biases. Further to this, although all of the teachers delivered the lessons as directed and using the correct timings, some of the teachers made slight additions to ensure their classes got the most out of the SOHP. Although this means all children received the intervention as intended, some children also completed additional activities which may have impacted on their knowledge/behaviour. It was clear that

some of the intervention schools were more invested than others, with two of the schools continuing to reinforce the messages during the follow-up period.

In relation to the second section of the model by Grant et al. (2013, *Figure 4-3*) the current study was not powered to draw analyses across SES. It was also reported that there were instances in schools where children were out of the class or absent, meaning they missed sessions, which likely impacted the effectiveness of the SOHP for these children. In relation to the maintenance of the intervention, having the teachers as the main deliverer of the intervention and driver of the SOHP was designed to help sustain the programme over time (and its ability to be re-delivered to classes as needed). The sustainability of the SOHP was aimed to be supported through the materials and activities on the '*Brush Day & Night'* website which parents, children and teachers can access to help reinforce behaviours and download additional resources (e.g. brushing contracts and calendars), but there were reported issues with engagement throughout the study.

The schools received only limited incentives for taking part, in the form of the resources needed for the study (which they kept) and the materials for the children. As such although some of the schools linked the evaluation into their HS initiative there was no added incentive provided for school to be part of the evaluation.

Further; the different locations of the intervention increased the complexity of delivery (e.g. as there is a need to gain an understanding of different schools as well as how the intervention worked within homes) and also the chance that discussion/activities may occur outside the teachers or researchers knowledge (e.g. discussion by parents or children outside of school, dental visits or treatment during the study period). Within this evaluation the change in school year and teacher may have impacted the level of reinforcement received during the follow-up period. The new teachers were not given a brief about the SOHP, as there were no set reinforcement activities planned in the SOHP design.

Through examining *study 2* within the context of the process model proposed by Grant et al. (2013), as outlined by some of the examples above, it can be seen that there were both strengths and areas that could have been improved within the evaluation of the '*Brush Day & Night*' programme.

7.5.3 Discussion relating to the fidelity of the intervention

Within school programme evaluations fidelity in respect of the implementation of an intervention is often considered. Gearing et al. (2011) define intervention fidelity as the "*extent to which core components of interventions are delivered as intended by the protocols*" (p79). Within this study a challenge was to ensure the SOHP was delivered as it was intended (1 lesson per week with cartoons using the provided resources), a requirement for testing the intervention effectiveness. Also without a video record of all lessons it is not possible to know fully how the SOHP was used by teachers.

Mowbray et al. (2003) report programme drift can be common in community settings which can be acceptable up to a certain degree (if adaptions are non-essential components) for local adaptations; however the core components (essential to the programmes aims) should not be altered. Within school-based research teachers bring their own personalities to teaching and their own styles. In relation to this there are a growing number of studies reporting the problem of teachers routinely adapting programmes. For instance, Hansen et al. (2013) found that in examining 306 videos of intervention sessions around drug prevention in middle schools that all of the teachers delivering the intervention made adaptations and that the frequency and quality affected the intervention. Through their study Hansen et al. (2013) concluded that teachers needed to be guided as to how a programme should be delivered, what adaptations are acceptable/unacceptable (e.g. should be avoided) and that adaptions should only be made if it is clear they will improve the overall interventions ability to achieve its goals. Similarly, Miller-Day et al. (2013) found that although only 68% of teachers reported making adaptations to lessons within a drug prevention programme, observations found 97% had made changes.

Within *study 2* teachers explained post-intervention that changes were often made in relation to the ability/needs of the class. Miller-Day et al. (2013) concluded that their study illustrates not only the complexity of changes, but also the natural changes teachers make within a classroom. Both Hensen et al. (2012) and Miller-Day et al. (2013) recognised the issues this can cause studies, and the impact on understanding intervention effectiveness.

Within this study the critical components were delivered as intended guided by a programme manual. The contents of the school programme introduction and lesson guides outlined the expected content to be delivered, use of resources, and was supported by additional information provided about how the programme should be delivered specifically for this evaluation. This was designed to ensure all children received the same messages and all the intended information. However, in addition to all children receiving the core programme, some children completed additional activities, added by some teachers who felt they provided enhancements to the SOHP. Christopher et al. (2003) in studying fidelity in substance use programmes concluded in relation to the finding that many teachers did use their guide but made changes:

> *"We can thus now say with confidence that some measure of adaptation is inevitable and that for curriculum developers to oppose it categorically, even for the best of conceptual or empirical reasons, would appear to be futile"* (p. 387).

The challenge in research is that this impacts conclusions that can be drawn. Han & Weiss (2005) report that the key to ensuring an intervention is delivered well is training the teachers, but after a while implementation of programmes can decrease (even if supported more centrally) if there is no on-going training. Within this study changes were not communicated until the completion of the intervention, making it hard to correct the process during the study and remind teachers of the importance of not making changes.

Finally, a review of research on the influence of implementation on outcomes by Durlack & DuPre, (2008) reported that levels of implementation have a clear effect on the outcomes of a programme, and the level of implementation achieved. Durlack & DuPre, (2008) stress that there is a central need within studies to understand how core components are changed, what is added and if anything had been omitted in order to understand the impact on implementation and outcomes. For example within *study 2* it is possible to capture and document additions (e.g. create your own teeth chief, colour the teeth you have) to the core delivery of the SOHP, increasing transparency of the reporting of the intervention and the evaluation (*section 7.4.4*). Durlack & DuPre (2008) suggest that rather than seeing

adaptation as implementation failure within a programme (due to issues of fidelity) there needs to be a focus on finding the correct mix of fidelity and adaption (which need to be measured/reported during implementation).

In relation to this, in addition to the challenge of ensuring teachers delivered the programme as intended, there was a need for the home components to both provide a reflection of 'real' use; while trying to encourage use to understand the impact on the SOHP. Within this study it was not possible to document how the home and parent pack were used in detail, in part due to the poor parent response rate. Although, through the self-report evaluations from the children and the small number of parents post-intervention and at follow-up it was possible to gain some limited understanding. In relation to the children's pack, the toothbrushes and toothpaste were reported to be used by a large proportion of the children. However, the use of the calendar reduced greatly over the course of the study, a finding supported by parental reports. Further to this the lack of engagement with the website suggest that the intended reward system for completing the desired brushing behaviour (twice-daily) was not being used to help reinforce good behaviour. In relation to the parents' pack it is not possible within this study to gain much of an insight into how this was used in the home, how long the provided information was retained, and how this was shared with their children. Parents' willingness to take part in the intervention, their own beliefs around OH and their ability to form OH routines can affect their engagement. Although all children, regardless of if they were provided with consent, were provided with resources and took part in the lessons, how involved the parents felt cannot be determined as they were not sent any of the parent questionnaires or evaluation questionnaires (due to not consenting to being part of the study).

Overall the teachers still perceived the SOHP in a positive light, despite it being an additional element to teach at a busy time of year within the schools. Although the teachers were positive about the SOHP, as outlined in *section 7.4.4,* they also reported suggested changes (e.g. making the intervention more active for the children, parental engagement issues) that need to be considered in the design of the SOHP to increase the effectiveness and ability to produce a sustained behaviour change. It is also clear that any resources provided to schools need to be able to accommodate a spectrum of abilities both between and within classes.

Teachers own beliefs: on the importance of the resource and knowledge of their class, affected how they delivered the SOHP. Teachers agreed with the evidence (see *chapter 2* & *3*) that the home influences the success of changing behaviour and it can be a challenge to achieve the continuity between the school and the home and the exchange of resources at given times. Overall teachers felt the SOHP changed knowledge but did not feel it greatly impacted behaviour, due in parts to how well the school had been able to engage the children's parents.

Finally, Cohen, Manion & Morrison (2007) write:

> *"…research values precisions, control, replication and attempts to generalize for specific events. Teaching on the other hand, is concerned with action, with doing things, and translates generalisations into specific facts. The incompatibility between action and research in these respects, therefore, can be a source of problems…"* (p. 312)

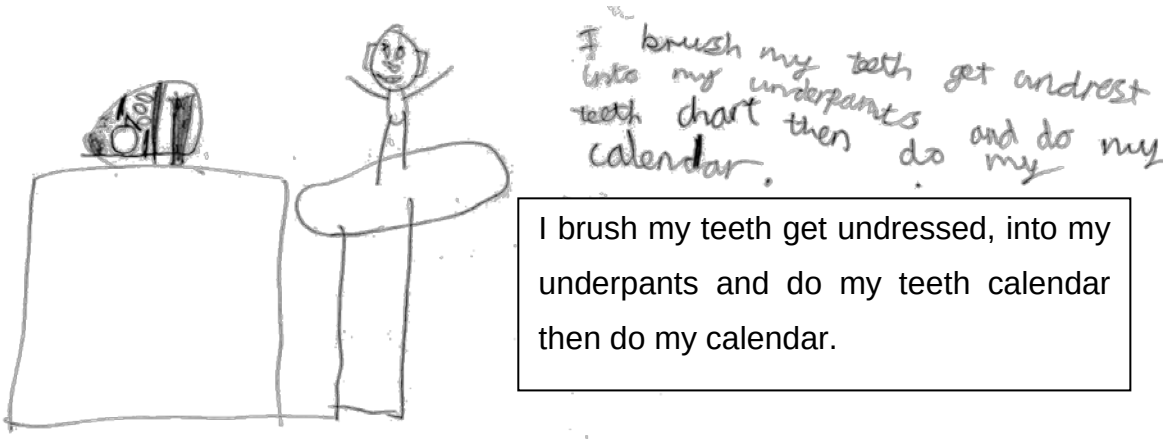
Within cluster-control trials the aim is for any intervention to be standardised to aid conclusion being drawn. However, as discussed above within this research all children received the core components of the SOHP, and some also completed additional activities. In all cases, other than the observed lesson, these changes were communicated post-intervention; limiting the ability for teachers to be reminded about delivering the programme as intended during the evaluation period. In hindsight, although contact was regular with teachers, the message standardisation for the purposes of research could have been clarified within each contact. Future research around developing further materials in the SOHP (with teachers and children) could consider taking an action research approach, which would allow teachers and researcher to be more reflective during the research about the programme and any changes they felt were needed, using a more iterative process. Cohen, Manion & Morrison (2007) write action research "*can be used in almost any setting where a problem involving people, tasks and procedures cries out for solution, or where some change of feature results in a more desirable outcome*" (p. 297). Within the current research the aim was to understand the effectiveness of a pre-design SOHP in its current form, rather than develop something iteratively (which action research would have been useful for),

but outcomes were likely impacted by changes. Due to the changes, despite all receiving the core SOHP, it is not possible to separate out the effects of each to determine the effectiveness of only the core components. However, future SOHP could consider involving teachers in the design of studies and materials to ensure biases relating to changes are limited.

7.5.4 Brief discussion of the use of mixed-methods within the process evaluation

As with other aspects of *study 2* the process evaluation used a mixed-method approach with children's post-intervention and follow-up evaluation questionnaires, post-intervention and follow-up FGs, teacher's feedback and parent's post-intervention and follow-up evaluation questionnaires. A more detailed discussion around the use of mixed-methods within the main part of the study can be found in *section 6.8.5*. Although the draw & write (D&W) (described in *section 6.6.2.2.3*) was not an intended part of the process evaluation (no additional statements were added) one child did use the D&W to explain how they were using the materials in their routine.

Figure 7-16 Example from the D&W of how the brushing calendar has influenced this child's routine (01.1.015.3)



I brush my teeth get undressed, into my underpants and do my teeth calendar then do my calendar.

This shows how children will use different methods to explain different aspects, but that using them as a package can help a complete picture to be gained. As part of the process evaluation and in line with the child-centred ethos of this thesis it was important to gain a more in-depth view of how intervention children experienced the SOHP, both to help with any recommendations following the study and also to provide greater insight into potential reasons behind the clinical and behavioural

outcomes (e.g. challenges linked to delivery and the materials that may have impacted the potential for behaviour change occurring). In line with this Grant (2013) writes "*knowing if an intervention is statistically different from a control group is no more important than understanding the qualities, usefulness and challenges inherent in the intervention to the participants in the study*" (p74).

Further to this one child post-intervention used different methods to explain how current dental problems can inhibit correct toothbrushing behaviour (e.g. "*brush one* [of] *my sore teeth*", 07/1/067/3). Overall, this child had low plaque levels (baseline plaque 0.25, post-intervention plaque 0.17, no follow-up data) indicating that although the child reported having a problem they were still likely to have brushed their teeth regularly, which was supported through the self-reported brushing frequency. This illustrates how the different methods can be used to gain more insight into individual children as well as the children collectively, which may be useful for helping target interventions.

As with any use of mixed-method research there is a need to consider how the method may have impacted the outcomes. With this study the children's outcomes were central, as the intervention targeted their behaviour. Following this it was necessary to know how those delivering the intervention perceived and reported their views on the programme. Finally, as a home pack was included and the behaviour occurs predominantly in the home it was necessary to ascertain the views of parents (issues around low sample size for parents discussed in *section 6.8.3*).

In relation to parental involvement for the post-intervention and follow-up parent's evaluation questionnaires, as with the main parent questionnaire, response rates were a limiting factor. Post-intervention the return rate for the evaluation questionnaire was very low (19%, n=34). The response rate for the follow-up evaluation questionnaire being marginally higher at 23% (n=41). Across all questionnaires, parent's response and engagement was a major challenge and limitation of the current study; affecting the generalisability of the outcomes from the parents questionnaire. This can limit the ability to gain a full understanding of how parents perceived the intervention in the home and it may have introduced biases (e.g. in relation to the types of parents who responded). Future studies

should consider methods to improve the response rate of parents questionnaires. Two methods that could be used are: incentives, which have been found to increase response rates but can also introduce other potential bias in people responses (Torgerson & Bland, 2009) and follow-up mailing of questionnaires and reminder letters sent home via children (Nakash et al., 2006).

The use of mixed-methods allows quantitative data to be supported by and enhanced through a narrative which adds explanation to outcomes (e.g. why did they enjoy or not enjoy the SOHP) instead of results just being for confirmatory purposes (e.g. did they enjoy the SOHP – yes or no) (Teddlie & Tashakkori, 2009). Additionally the use of a mixed open and closed evaluation questions for parents and teachers allowed them to provide greater explanation around some of their answers. For example, with the teachers, this allowed them to explain how they delivered the core components but also their decisions to deliver additional activities. This enabled a deeper understanding of the depth and impact these additional activities had. Through this research, despite the challenges, the ability to provide greater insight to quantitative outcomes is a strength of the thesis, notwithstanding the added complexity and outlined limitations.

7.6 Recommendations

The following two sections aim to answer the research question: *what recommendations can be made from the evaluation of the SOHP for future version of the 'Brush Day & Night' programme?*

7.6.1 Recommendation relating to intervention design and delivery

Following *study 1* to understand the components of the intervention, the Abraham & Michie's (2008) 26-item taxonomy of behaviour change techniques (BCT) was used. Through this it was possible to determine that the initial programme was designed to mainly provide information, methods of monitoring and set goals relating to toothbrushing (as SOHP designed - *Table 3-3; study 1 - Table 5-11*). Presently within OH it is not known which BCT are most effective in help establish changes in behaviour. For children the SOHP could consider the addition of activities around demonstration of the behaviour (e.g. toothbrushing), and grading the tasks set (on an individual basis) to provide greater feedback on performance (e.g. from parents, teachers and if available, through technology). However, more

research is needed around determining the effectiveness of specific BCT in OH research.

A theme witihin the evaluation was the need to increase the activeness of the intervention. The current SOHP engages the children's parents in a passive manner (e.g. provision of leaflets); as such there are opportunities to increase the amount of the programme specifically targeting behaviour, rather than only increasing knowledge. Overall, there is a need to strengthen the design of the intervention in the home (the natural location of the behaviour) and allow greater differentiation to be made in relation to children's current behaviour and developmental abilities. One way to do this would be through additional activities to be completed in the home with parents support (see for example Worthington, 2001). This would potentially allow children to stretch their ability and understanding as required around the key concepts. At the age of 6-7 the important element of the SOHP is getting the key messages across and beginning to build a stable routine in the home, with parental support.

Within the intervention the children taking part were provided with toothbrushes and toothpaste. Through the post-intervention evaluation questionnaire and FGs a number of the children indicated they had already run out of toothpaste after having to share with the family ("*my mum always used my toothbrush*"), with some expressing not liking this ("*Boy 3- my mum, dad and sister keep using my toothpaste and my toothbrush (Researcher- do you not like that?) Boy 3- no, so I have to use my finger*"). Some of the children felt ownership of the materials they were provided with through the SOHP and did not always want to share. Post-intervention one parent wrote "*3 year old uses chart as well*" illustrating that a programme can include the whole family, which may increase the likelihood of behaviour being maintained. Future versions of the '*Brush Day & Night*' intervention could consider opening the materials up to the wider family (and where possible all children in the family should be provided with the tools needed) in terms of who uses them and who is targeted around support/information. This is likely to also improve the ability of the programme to become embedded within a family routine.

Part of the aim of this research was to determine the suitability of the materials to facilitate and establish twice-daily brushing. A challenge with new interventions is the level it has been designed at and the suitability in relation to the age of the children which can be hard to determine until it has been taught and evaluated in its intended setting. Within the feedback of the SOHP there was a dichotomy of responses in relation to the children and teachers perceptions of the difficulty of the current SOHP. This highlights a challenge for those designing interventions to account for differing developmental abilities that may be found both within classes and also between schools:

> Researcher – *what else do you want to tell me about the work you done on teeth?*
> Girl 1 – *it's good*
> Researcher – *do you think it helped you*
> Girl 1 – *I think it's a little bit too easy*
> Boy 1 – *it's too easy*
> Researcher – *so next year I need make it harder*
> Girl 1 – *no keep it easy*
> Researcher – *do you think you would learn more if it was harder or easier*
> Girl 1 – *make it 10% harder*
> Boy 1- *medium*
> Girl 3- *harder*
>
> Child 1- *takes too long to do work, don't want to do sheets, think important but didn't want to do*

Although all of the teachers said they would reuse the programme, and one commented that it was easy to deliver, many felt it needed additional activities. It is recommended that the creation of a larger resource pack for each lesson would help regulate activities, thus helping to maintain the intervention fidelity. Having a larger number of activities can aid teachers by providing additional activities for those who finish early and also could differentiate the activities by ability to potentially better support children in the class (three teachers felt aspects of the SOHP were too easy for the children currently). Although it only occurred in one

school in this research future development of the SOHP also needs to consider that split teaching occurs and develop methods for ensuring consistency of messages and that reinforcement is equal to those schools not operating job shares.

For both the school and the home there was a supporting website which contained additional materials (e.g. brushing contracts, new charts, copies of school materials and academic articles that have informed the programme design) and support (e.g. through FAQ section and guidance for teachers). To aid the sustainability of the SOHP those targeted need to feel the website is accessible, useful and a source of support/materials. A website can provide a way of disseminating the intervention and updates to the intervention. It may also help encourage a community around the intervention. A recommendation would be that teachers are able to add suggestions in a forum to help build resource packs around the core aspects of the SOHP, which would also allow greater monitoring. The issues around physical access to the website and also access by choice to the website is something that needs to be addressed in future development, either by alternative methods of reinforcement where internet/computers are not available, or improved promotion of the website.

Presently there are three structured lessons, but the findings of the study would suggest a move to 4 lessons containing: a taught section, two '*Teeth Chief*' cartoons, a home project and peer work (*Figure 7-17*) may help. This would provide teachers with a less rushed approach to the intervention and allow time to ensure that all children have understood what they have learnt and increase the ability to incorporate the SOHP into other NC topics. To help improve the likelihood of behaviour change, as well as knowledge change, the proposed revisions of the lessons should be aimed to improve the links between knowledge, skill practice and behaviour related activities. As used by teachers in this study, the inclusion of recap and check activities are recommended. This will allow children who are struggling to be provided with additional support and if required inclusion of suggested activities around areas of weakness. A vital part of new health interventions for teachers is being able to link across the NC to broaden children's understanding and also help develop understanding around the interconnectedness of topics. Any changes made to the '*Brush Day & Night*'

SOHP need to reflect this on both a national and international level to help with the acceptability of the programme to teachers. For example, the teacher from school 06/1 reported "*lessons fine but would fit in better when do topic*[s] *on health*". Due to the nature of the evaluation the intervention needed to run in all schools simultaneously, so this could not be accounted for. However, future studies or use of the SOHP should consider when it is run in relation to what schools are teaching and the NC.

Figure 7-17 Suggested revised school intervention as a result of conducting *study 2*

		Suggested content of lessons		Rationale	NC links
School visits spread out across weeks (potential to provide teachers with disposable cameras to document SOHP)	Week 1	Lesson 1	Lesson 1 (different types of teeth, brushing, mixed dentition) & worksheet 1.	Assessment of current knowledge prior to start, importance of key messages in SOHP.	Health Topic
	Week 2	Teeth Chief Cartoon 1	Worksheet – which child and adult teeth do you have?	Peer support activity; check understanding of types of teeth.	PSHE, maths
		Teeth Chief Cartoon 2	Activity – D&W about your routine to get ready in the morning and the evening. Thinking about the order and where toothbrushing integrates.	Solution focused work to improve children's understanding of habit and routine.	Literacy
	Week 3	Lesson 2	Lesson 2 (dental decay, food effects) & worksheet 2.	Assessment of what learnt, brushing at home, any facilitators and barriers and how these can be overcome?	Science
	Week 4	Teeth Chief Cartoon 3	Egg & Vinegar demonstration – demonstrate effects of acid on enamel and how fluoride can protect them.	Provide a visible link to effects that cannot be seen quickly for teeth around acid.	Science
		Teeth Chief Cartoon 4	Activity – using good and bad coloured teeth, write things that are good and bad for teeth, that can help or can damage teeth.	Effect behaviour, food and lifestyle have on teeth.	PSHE, literacy
	Week 5	Lesson 3	Lesson 3 (understanding brushing and fluoride, importance of brushing and how to brush) & worksheet 3.	Assessment of what learnt so far and importance of when to brush.	Health topics
	Week 6	Teeth Chief Cartoon 5	Activity – design your own teeth chief characters – what superpowers will it have to defeat the plaque'os (potential for a short play for parents).	Reinforcement and able to check children's knowledge of how to protect teeth.	Art
		Teeth Chief Cartoon 6	Activity – take a picture of brushing at home; bring in toothbrush and with partner demonstrate how you brush your teeth.	Peer support activity, check understanding of technique.	PSHE
	Week 7	Lesson 4	Review lesson of work done on teeth to reinforce key message.	Solution focused work building on previous work to determine any changes made to routine, barriers and facilitators.	Health topics
	Week 8	Parental engagement and school engagement sessions to share information learnt and help teachers consolidate key messages.			

At present the messages in the lessons around toothbrushing are more prominent than those around cariogenic food and findings from this study suggest there is a need to adjust the balance between the topics. This mismatch between weighting of these components has been found to also occur within the RCTs included in a Cochrane review evaluating school programmes aimed at reducing dental caries by Cooper et al. (2013). Future versions need to look at providing reinforcing materials for the sugar-snacking components as well as toothbrushing components in the home.

In future evaluations a longer SOHP could provide greater opportunity to observe lessons or teachers could be provided with cameras to help capture the SOHP within the schools. Where resources allow, implementing greater monitoring during delivery of lessons may help reduce the number of changes made following the delivery of all of the core components. Further, future evaluations could consider the use of 'train the teacher model', to help ensure teachers are aware of the key components of the programme and also have the correct knowledge of OH topics prior to delivery (Nyandindi et al., 1996).

Although the sample size is too small to gain a full understanding of the impact of SES, there appeared to be differences in understanding across schools. For some schools, splitting the intervention to incorporate the more abstract ideas to be part of the NC in year 3 (7-8 years old) may be more beneficial than a more complex year 2 (6-7 years old) intervention. Although the outcomes of the parents questionnaire cannot be generalised intervention and control parents felt that the NC age of 7-8 years old was too late, with all suggesting ages below this, from as young as the first tooth appearing up to the age of 7. There is a need more generally within school for OH to be given more prominence in the NC from a much younger age, leading to the more detailed NC component when the children are experiencing mixed dentition.

Although having a recommendation to introduce brushing in school would complement the delivery of the SOHP, it also does not produce the right environmental cues for the behaviour (Wind et al., 2005). Additionally, in one intervention school during an initial meeting, the head teacher reported they felt it could (at times) have negative effects with parents feeling '*well they brush at*

school' and shifting more responsibility from the home to the school to look after the children. As such if a school brushing programme was to complement the SOHP greater research would be needed into the impact this had on brushing at home and the engagement of the home.

7.6.2 Recommendation relating to material changes

In addition to the recommendations above around the change in lesson structure and the incrase in the size of the teachers pack, there are a number of recommendations around the materials of the school and home pack. The development of changes to the materials could be both in print and through developing the supporting webiste to allow the exchange of ideas and sharing of resources (which can be controlled by Unilever to ensure quality and that they fit with the core of the SOHP).

The worksheets were found by some children to be easy and others to be challenging. The mixed feedback from teachers around the worksheet was echoed by the children "*worksheets because they were easy*," (02/1/064/3) contrasting to "*worksheets too easy*" (02/1/039/3) and "*the worksheets were hard*" (03/1/084/3). Future versions should re-evalaute the worksheets with additional questions to challenge children across the developmental spectrum as well as consider the size of the images relative to children's age. Through the teachers' feedback and the challenges children had with worksheet 3, it is suggested there is a need to create a teachers' sheet providing additional guidance, to allow them to more effectively support the children.

Despite changes to the slides as a result of *study 1*, there still appears to be a need for revision (e.g. for germs, bacteria and carciogenic snacks and drink). This links to aspects of the evaluation where there appeared to be topics that children struggled with (e.g. germs) where the need for more resources, either through slides, worksheets or more props could be considered. To help reinforce the messages within the lessons, future versions should consider containing greater resources on some of these topics to support teachers with teaching the how and why as well as the knowledge around the more abstract topics (e.g. through slides/props/worksheets). Having additional resources will also aid teachers with checking knowledge, so they can recap any necessary sections but also help

children by reinforcing messages. As part of this evaluation teachers were provided with mouth models and USBs with all the materials which appeared valued to provide support with teaching, so where resources allow it is recommended these are provided.

Through the evaluation the '*Teeth Chiefs*' cartoons were among the most well received resources. From the children's and teachers' feedback, it appears the cartoons were a valuable addition to support learning and help increase awareness of the impact of poor oral hygiene through effects of plaque (in the plaque'os) and how brushing can protect our teeth (through character superpowers). With the cartoons there is room to develop how they are included. Providing synopses of the cartoons, activities that can link into them and also potentially developing more cartoons could help improve and sustain the SOHP. In addition it is recommended to add in an activity around designing your own '*Teeth Chiefs'*, with resources created to help facilitate this, due to the popularity of this activity within the school where the teacher added this to the SOHP. In one school there was an issue with the format of the provided cartoons on a USB stick and there is scope in future revisions to include the cartoons in multiple formats.

It is evident through the folllow-up period that there would be a benefit from the provision of some structured activities at home (and in the school) during this time. This would help to increase engagement, and acknowledge the feedback received about the lack of engagement after the initial SOHP had ended.

Within the parent pack information is provided around OH from 0-12 years old. This presents an opportunity to develop material that allows parents and children to read and learn together, through the inclusion of adult and child friendly text. Through this the activeness of the home pack and engagement with the home is likely to be increased. Although the current parent home pack material may be too complicated for some children (in terms of the language used), there is the potential to use participatory methods to help develop material designed specifically for parents and children) to read and learn from together. In addition to aid the link to the home and parents reinforcing behaviours key messages from each lesson could be sent home, which can provide parents with an opportunity to

discuss these with their children and for this to be enhanced through some joint project work around the topics.

Within the evaluation the supporting website was reported to have been underused. Currently the website address was only printed on the back of the brushing calendar (*Figure 7-18*), limiting the visual reminder of the address. Greater highlighting of the website as a reinforcement tool and an additional source of information upon completion of the SOHP is needed.

Figure 7-18 Example of website promotion on back of children's brushing calendar

Finally, as suggested by one parent, the addition of dentist's details should be considered at a local level, and this has the potential to be incorporated into the locally produced OH report.

7.7 Chapter Summary

This process evaluation aimed to answer 3 of the research questions (*Figure 2-1, p. 309*) relating to aim 3 of the thesis. This summary presents the principal findings in relation to the research questions and goals of the chapter.

1. Is the current material provided with the SOHP (*School programme, Children and parent's home pack and supporting website*) suitable to facilitate establishment of sustainable twice-daily brushing?

Within this evaluation the supporting website seemed to have limited impact on children and parents, due to the limited engagement. Although some children reported changes in behaviour and all the teachers said they would reuse the programme some changes are needed to improve the ability of the SOHP to impact children's toothbrushing and sugar-snacking behaviour both initially and longer term.

The feedback from children, parents and teachers indicates the '*Brush Day & Night*' SOHP intervention in its current state has many facilitating factors but also long and short term barriers to its success. Post-intervention, generally children expressed enjoying the intervention. It was also apparent that the impact of the SOHP varied greatly across the schools and was influenced by lesson enjoyment and the elements at home. At follow-up the key messages were still remembered and understood by most children but the use of the reinforcement tools had dramatically decreased over the 6 months. The decrease in knowledge and engagement with the materials of the SOHP suggests there is a need for greater active engagement within both the school and the home during the follow-up period. This will potentially aid maintenance of any changes in behaviour or provide a longer period to aid correct behaviours developing.

2. Does the delivery of a SOHP (*School programme, Children and parent's home pack and supporting website*) impact on the sustainability of the new health behaviours and effects on family routine?

Parents' who already perceived they had strong toothbrushing routines in place felt less of an effect overall, but importantly many could also see a benefit for families who may be struggling. Other parents reported it helped them to establish brushing in the home. Parental engagement was challenging within the evaluation. Future revisions of the SOHP should consider increasing the links between the school and the home and the activeness of the parent's materials to move away from leaflets. The website was underused through the course of the evaluation,

limiting its intended link between the home and school as well as aiding parents to reinforce good behaviour.

The intervention group children had a mixed feeling about the SOHP and the home pack. Their evaluation responses highlight some of the complexities in changing behaviour, with tools used for brushing being a barrier for some who also reported keeping their teeth clean as an important part of their routines. Children echoed the reports by the teachers and parents that the website was an area not used as intended to support and aid reinforcement of behaviour. Overall the children found the '*Teeth Chiefs*' the favoured part of the school programme, but engagement with the brushing calendar reduced from post-intervention to follow-up.

Teachers were the main deliverers of the lessons and for encouraging the use of materials in the home. Teacher's overall felt the SOHP was able to improve the children's knowledge but were not sure about its ability to change behaviour. Although they all delivered the core components as intended, some teachers felt it necessary to add some additional activities to enhance the experience of their class and the ability of the SOHP to help change behaviour and the children to learn. All of the teachers reported they would re-use the programme when teaching OH in schools, indicating an overall positive reception to the '*Brush Day & Night*' programme. Within this evaluation it was not possible to monitor the delivery of all lessons, so only limited conclusions can be made about how the exact delivery in classes impacted the outcomes of the SOHP.

3. What recommendations can be made from the evaluation of the SOHP for future versions of the '*Brush Day & Night*' programme

Future school programmes may need to be able to provide additional support to different groups of children to help improve effectiveness. For the SOHP a challenge was transferring the programme and engaging the home. Improving this link is likely to strengthen the ability to produce sustained behaviour change. Greater links are recommended to be made with the home (e.g. through project work at home with parents and summaries of each lesson).

In addition to considering different brushing patterns to target support, future versions of the SOHP should increase the ability of the SOHP to allow for different

abilities in the class to ensure all children benefit from the programme. This could be done though an increased teachers pack, with a greater number of activities. Teachers felt there were many positives but were unsure how the programme engaged parents and did not feel it impacted on behaviour, only knowledge. This was impart influenced by the key feature of the teacher's feedback around the need to increase the overall 'activeness' of the SOHP in terms of activities to complement the lessons and help children solidify what they have learnt, both through greater resources and an increased number of activities.

7.7.1 Chapter conclusion

Overall, this chapter presents children's own reporting of how they perceived a new SOHP, alongside parents and teachers views of the intervention. As traditionally proxy reporting from teachers and children's parents is commonplace within OH research with 6-7 year old children, this study helps advance the knowledge of how young children perceive the SOHP. This is an important part of beginning to improve the effectiveness of SOHP through understanding what children have liked or not liked, what they have thought helped and not helped and finally what areas need to be improved to best support them.

This study also adds to the evidence base around some of the challenges of transferring a SOHP into the home (and the importance of this) and the impact of teachers delivering a set of lessons. Process evaluations are not always carried out as part of SOHP evaluations, so through this study the context to the main clinical and behaviour outcomes reported in *chapter 6* are provided, which helps advance knowledge around how global programmes work on a local level.

Chapter 8 - Study 3: Feasibility of using data logging toothbrushes to test the validity and reliability of children's last 24-hour toothbrushing self-report

8.1 Chapter overview

Due to Unilever making data logging toothbrushes (DLT) available for the final stage of the research [70] *Study 3* was a validation study, of the children's questionnaire against an objective measure (DLT), the aim was:

- Testing the validity and reliability of the children's questionnaire using data logging toothbrushes
- Using data logging toothbrushes to establish current brushing habits of 6-7 year olds in low/middle socio-economic status (SES) schools

Although conducted retrospectively to *study 2*, this provided greater understanding of current free-living toothbrushing behaviour of 6-7 year olds in Salford.

Initially this chapter outlines the literature relating to the use of accelerometers[71] (the technology enclosed in the logger brush) specific to oral health (OH). Due to the limited research in this area, this chapter also briefly explains the use of accelerometers in relation to physical activity (PA). As the DLT had not been trialled frequently with children, a 5-day pilot (n=10) was carried out to determine the optimum settings. Following the pilot, children (n=108) were sampled from middle and low SES schools for a 6-week study.

Unilever Research and Development provided technical support for *Study 3*: supplied the brush cases and loggers for use in the field, and use of the base and software on their premises.

8.2 An introduction to accelerometer literature

The literature has been divided into two categories to differentiate between the aims of different types of brushing technology, defined as '*smartbrushes*' and '*logger*' brushes. The initial section describes '*smartbrushes*' used (on the whole) in static situations (not in the home, making them unsuitable for this study). Many

[70] Available from October 2011
[71] Accelerometers record objective details about behaviour around day of use, time of use and duration of an event.

‘*smartbrushes*’ are designed to allow visual feedback to guide brushing patterns, ensuring a person brushes all areas of their teeth.

The second section of the literature describes the use of ‘*logger*’ brushes; designed to provide greater flexibility in research locations. Through the use of accelerometers, which aim to provide understanding of the details of toothbrushing events over a given period, focussing on: day, time of day and duration of brushing, to provide a greater insight into routines and daily habits, rather than technique and area of brushing. Within dental public health (DPH) the use of DLT to date has been limited (*Table 8-2* for non-Unilever studies and *section 8.2.3* for Unilever studies). Unilever have evaluated the loggers within family units (mother, father, and children) and limited children; using both the version used in *study 3* and previous versions.

In PA research, accelerometers have been used widely (Ward et al., 2005; Taraldsen et al., 2012), as well as being readily available in less complex forms to buy for personal use (e.g. devices made by Nike either to monitor peoples activity and also within research ActiGraph products). The first personal logging toothbrush only came on the market in late 2012, providing instant feedback via a link to an application (app) that helps track individual brushing (‘*BeamBrush’*). Although it is possible to buy ‘smart’ toothbrushes (e.g. Braun Oral-B Triumph 5000 5-Mode Power Toothbrush with Wireless Smart Guide) they are expensive and do not provide personal feedback but a programme to follow to support correct brushing patterns and timings.

The previous lack of an objective toothbrushing measure, available for use in the home, has resulted in a continued reliance on self-report, proxy self-report or clinical outcome measures in OH research (e.g. dmft and plaque). Milgrom (2001) explains:

> “…*it is a misspecification of the caries prevention problem to define the outcome in terms of visible tooth lesions, whether they be cavitated or not. This continues the fiction that the problem begins at this stage when it is only that our risk models and detection tools are inadequate to detect the problem at an earlier stage*” (p1102).

Previous measures of problems (e.g. dmft) and lack of behaviours (e.g. plaque), can be superseded by early intervention to improve behaviour before dental problems occur (if focus is shifted to behaviour). Milgrom (2001) advocates the key to achieving behaviour change and correct brushing behaviours is ensuring understanding of the behaviour within the home and the impact parents have on children's brushing.

8.2.1 Use within OH research

Smartbrushes: Within OH research, smartbrushes are most frequently used to initially determine a person's toothbrushing technique and then, through the aid of visualisations and instruction, to help people modify their technique accordingly. Limitation of many current smartbrushes:

- The need for static locations due to the equipment requirements,
- The limitations of the brushing position information provided by device,
- The size of accelerometers contained within the brush.

As can be seen in *Table 8-1*, only one published study to date has been conducted with children, within kindergartens', rather than in the children's homes.

Table 8-1 Previous published smartbrush studies

Study Reference	Type of brush	Location of study	Participants	Rationale for study	Outcomes	Constraint outlined by authors
Allen, Hunsley & MacGregor (1996)	**Force sensing** (built into off shelf brush)	Designed for dental clinicians	Adult dental patients	To develop a method for clinicians to provide a better understanding of patients exhibiting dental problems, brushing force, to allow intervention and correct brushing.	Development of software and device allows for online data capture of force while toothbrushing.	Dentist based, limited testing, and scope for adaption due to brush and software.
Lee et al. (2006)	**Smartbrush** (measuring direction and position of the brush through a 3-axis accelerometer)	Lab setting	6 subjects (with no cavities or severe periodontal disease)	Highlight the potential technology can have to aid the prevention of dental caries by helping develop correct brushing patterns.	Able to identify brushing pattern and begin to measure location.	Difficulties with detecting the exact brushing location. Tested using pre-defined brushing patterns for subjects to follow.
Lee et al. (2007)	**Smartbrush**	Lab setting (future research planned in dental clinic)	6 subjects (with no cavities or severe periodontal disease)	Classification algorithm development of toothbrushing patterns. 8 patterns tested to evaluate the algorithms ability to detect common brushing patterns.	The outcome of the algorithm showed a "*detection ration of 98%*" (p4211)	Difficulties in detecting brushing inside the arches and direction of the brush
Chang et al. (2008)	**'Playful Toothbrush'**	Static set-up developed **in**	13 Children (mean age	Children presented with a virtual	Enhance time, number of brush	Children must actively engage with the

Study Reference	Type of brush	Location of study	Participants	Rationale for study	Outcomes	Constraint outlined by authors
	(vision-based motion tracker brush, UbiComp technology)	**kindergartens** with cameras, mirrors and computers	77months – 6.4 years old)	image of unclean teeth, which are cleaned as the child brush using game. Tracking of movement by sensors and cameras.	strokes and thoroughness of the children, unclear how improved brushing outside the school.	programme on a continued basis to improve. Limitations detecting brushing region.
Kim et al. (2009)	3D interactive **smartbrush** education programme to help improve brushing habits - the sensors were contained within the brushes accelerometer and magnetic sensors	Unclear exact location of study but requires static location and the participant to be a certain proximity from the receiver, to allow an estimate of participant's brushing pattern and location.	4 subjects average age 25 years old.	Aid correction of brushing techniques through visual feedback.	Proposal to help make brushing enjoyable through guidance and feedback.	Require some level of simulation due to limitations of obtaining direct signals from inside the mouth.
Lee et al. (2012)	**Smartbrush**	Washroom of local facility	15 subjects (mean age 23 years old)	Further developments split the mouth into 16 different brushing locations to aid measurement and teaching of technique to participants within a fixed setting.	Through new system were able to detect over 97% of regions in the mouth correctly during brushing.	Resolves the main location issues from early studies. Highlights how people frequently brush not as separate regions but across regions/surfaces making the detection of exact location at a given time difficult

Loggers: Although the evidence is limited *Table 8-2* outlines the two key OH logger studies, both conducted with adults. Presently previous published research with children has all been conducted by Unilever (*section 8.2.3*).

In addition to the issues of subjective and objective measures, McCracken et al. (2005) outlined a number of design and mechanical issues (similar to those later experienced during *study 3, section 8.6.4),* which resulted in the loss of some data. A further issue raised by McCracken (personal communication, 2009) was the cost to design and progress the technology due to the brushes not being reusable, which was much higher than the cost of the loggers used through *study 3*. McCracken et al. (2002, 2005) aimed to understand the accuracy of brushing diaries to determine their suitability in future research; rather than to directly progress knowledge around objective behaviours.

McCracken et al. (2002) reported that even with visual prompts (LED light coming on indicating brushing has lasted 2 minutes) to indicate the correct brushing time; this did not impact on a third of the recorded instances. After adolescence, brushing habits become more challenging to impact, both in terms of frequency and duration, with those who brush their teeth more than once-a-day by the age of 12 more likely to continue this behaviour into adulthood (Levin & Currie, 2009). The lack of adherence by adults within McCracken et al.'s (2002) research to the visual prompt may also be a reflection of a standard brushing pattern Unilever have reported occurring within adults with a habitual brushing behaviour.

Table 8-2 Non-Unilever logger studies

Study Reference	Type of brush	Location of study	Participants	Rationale for study	Outcomes	Limitation outlined by authors
McCracken et al. (2002)	**Logger** (electric logging brushes adapted by Philips for the study)	Homes - North East England	n=17 Adults - attending non-surgical clinics to manage chronic periodontal pain	Also provided with a 2 month brushing diary to record length of each brushing episode	34% of logged brushing episodes lasted the recommended 2 minutes compared to 61% reported in diaries; this was despite brushes having an LED timer indicating to subjects when they had brushed for 2 minutes.	Brushing diaries were not an accurate reflection of the objective outcomes obtained from the loggers
McCracken et al. (2005)			n = 14 Adults - attending non-surgical clinics to manage chronic periodontal pain	Also provided with diaries over 8 months (with loggers only being provided for 4 months of this)	For episode 1 34% of events lasted 2 minutes; with episode 2 showing 24% compliance. Reported behaviour was 58% of episodes lasting 2 minutes.	A person's recall was not an accurate reflection of their behaviour

Other objectively measured studies: A number of studies have monitored children's brushing time, frequency and technique using other methods. Sandström et al. (2011) used video cameras in a controlled school setting in Sweden (6–12 year old children, n=82) and a stopwatch to record length of brushing event in order to determine how this influenced children's ability to remove plaque. They reported 6 year olds averaging brushing for 65sec ±24 sec (p45), and established that children could benefit from instruction to increase brushing time with the relationship between brushing time and plaque removal only having a connection in older children (up to12 years old). Similarly MacGregor & Rugg-Gunn (1979) videoed brushing at English schools and reported an average overall time of 60.3 sec (±23.8) for 11-13 year olds (n=85), with only a small amount of this time focusing on lingual surface. In a separate study by MacGregor, Rugg-Gunnand & Gordon (1986), investigating number of brushing strokes and plaque levels for 13 year olds in North East England (n=57), the mean brushing time was found to be 51.1 sec (±15.4). These three studies indicate that many children are not meeting the recommended 2 minute brushing time.

The device as the tool and the measure: Unlike PA research, where accelerometers are placed on the outside of a person's body (e.g. hip, ankle, wrist) and detect a person's movement in relation to where on the body the accelerometer is worn (Cliff, Reilly & Okely, 2009), smartbrushes are attempting to detect locations and directional information within a person's mouth.

Logger toothbrushes are both the tool and the measure, which may affect behaviour differently to PA accelerometers. Increasingly, accelerometers in PA studies can be worn for the whole study duration, only being removed to avoid water damage and at night (Colley, Gorber & Tremblay, 2010). Accelerometers in logger brushes require a person at each brushing episode to choose the logger brush rather than their normal brush. If the logger brush was not used but a normal brush is used as preference, this will show within studies presently as no brushing event occurring, which may ultimately be incorrect.

As there is limited research using accelerometers within OH, the study protocol and analysis methods were designed considering both PA research (with regards

to study interval for test-retest) and also advice from Unilever experts (with regards to settings and habituation).

8.2.2 Accelerometers in other areas of Public Health

Although more frequently used in small scale PA studies, there is increasing use of accelerometers in large-scale population studies to help overcome the challenges of self-report data (Colley et al., 2010). Within PA research for children and adolescents, a period of at least 7 days is seen as sufficient to provide an understanding of their habitual behaviour (Trost et al., 2000). For younger children this can range from 4–9 days, and traditionally only 2-3 days habituation to wearing the accelerometers are required (Trost, McIver & Pate, 2005). Although the use of accelerometers within PA research is increasingly common, there are still areas where understanding and consensus around best practice are limited (Ward et al., 2005).

- *In relation to compliance (with respect to wearing of accelerometers)* – how this can be improved and how it is impacted by study design and participants, Trost et al. (2005) reported that despite its importance to research, little has been conducted to evaluate the issue, with researchers having to define their own compliance parameters for studies.
    - Van Coevering et al. (2005) reported varying compliance rates depending on the day of the study period, with only 50% meeting their compliance criteria for all 7 days.
- *In relation to analysis* – each study needs to define a day, how quiet time is coded to minimise under or over-reporting and how the large amounts of data produced by the accelerometers have been analysed (Cliff et al., 2009).

For research with 0-5 year olds using PA accelerometers it is recommended to change the epoch[72] time to avoid missing or miss classifying behaviour. Children's movement tends to be short and frequently changing both in terms of activity and intensity compared with adults (activity tends to change less frequently), having longer epoch times potentially leads to the misclassification or the loss of

[72] Defined by Dencker & Andersen (2008) as "An epoch is the time that physical activity data is averaged by the accelerometer, thus the time resolution of the measurement" (p134).

behaviour (Cliff et al., 2009). Within *study 3*, changes were made to quiet time settings and force settings (to help improve data capture of true events) to account for differences in children's toothbrushing behaviour compared to adult's toothbrushing.

Key definitions of terms used through chapter:

- Habituation[73]: Defined by Slater & Bremner (2003) as "*The process by which a response to a stimulus gradually declines over time*" (p486).
    - Used in relation to the time taken by the children to return to their normal brushing pattern once they had been given a logger. Children were given 2-weeks through *study 3*, and were only asked to use the new brush as part of their normal toothbrushing behaviour.
    - When a new device is provided there is expected to be some change in behaviour and 'playing' prior to normal behaviour resuming – whether this is an absence of behaviour or a measurable behaviour occurring.
- Conformity (compliance to use of brush): Defined as the children's loggers recording at least 3 true events (once or twice-daily brushing) a week.
    - Within accelerometer research compliance is often defined for each study dependent on the length of study, requirements of wearing accelerometer and parameters of data definitions (e.g. definition of a day).

8.2.3 Development of the logger used in this study

The loggers used within this study are part of a second generation development. Unilever have developed both a flexible DLT to use within homes and clinical settings, as well as a fixed smartbrush system '*Oralinsights*'. The smartbrush system is targeted within general dental practices at monitoring, guidance and digital feedback to improve a person's brushing pattern, supported by dental hygienists (Bates et al., 2008). Bates et al. (2008) reported for most patients, '*Oralinsights'* had a positive effect on their technique, increasing brushing time and brushing of previously neglected areas.

[73] Also referred to as acclimatisation to wearing or using the measurement device in PH studies.

Recently, Claessen et al. (2008; 2011) and Zillmer (2011) have conducted studies with children and families (mothers, fathers and children) during the development of a new generation of Unilever loggers used to better understand toothbrushing behaviours.

In order to explore the effects of modelling behaviours and influences of parents, Unilever developed a football related TV advert shown in China. This depicted a father and son watching football, with the child mimicking his father's behaviour watching the match and at the end of the evening mimicking him brushing his teeth. Claessen et al. (2008) analysis of the advert using the previous generation logger toothbrushes (test n=124 families, control n=122 families) reported results showing a "*small and short-lived effect on night brushing activity*" (p318), with both groups showing a similar morning brushing pattern. Claessen et al. (2008) also reported the logger data revealed participants were predominantly 'once-a-day' brushers, compared to self-reported habits of brushing on average 1.4 times a day. A similar self-reported brushing level averaging 1.5 times a day was found in *study 2* (*section 6.7.3*).

In evaluating a behaviour change campaign (video of father and son brushing, educational materials and a brushing calendar) in Saudi Arabia, control and intervention families were issued with logger brushes for 6-weeks (2-weeks habituation, 4-week for study) (Claessen et al., 2011). Over a week period on average, mothers had the greatest average brushing frequency (6.8 times), with father's average brushing 5.3 times and children's average brushing 3.8 times. Although for children Claessen et al. (2011) reported a significant difference between control and intervention brushing frequency as a result of the campaign (p=0.0242), no change was found for intervention group parents. Zillmer (2011) further analysed the data in relation to "*activity measurement and classification*" (p1) aimed at providing a greater understanding of the impact of the intervention on subgroups. Outcome data showed children most frequently brushed between 5–7 am and around 10 pm; with the minimum evening brushing around 8pm. In relation to the campaign evaluated by Claessen et al. (2011) and Zillmer (2011) they reported the greatest effect on children who previously brushed less than 4 times per week. Zillmer (2011) advocates caution with the use of data loggers and the subsequent data due to false activations being recorded which require removal

prior to analysis. Within *study 3*, logger event files were checked during data cleaning, to ensure false activations were not included in the analysis (*section 8.6.3*).

Further to this Hurling et al. (2013) used DLT as part of the evaluation of a "*novel internet based oral hygiene intervention*" (p88) targeting parents, with loggers used by children aged 5-9 years within an area of the North West (NW) of England. Parents also completed pre-study questions and set goals/rewards each week relating to brushing targets. Children were not asked to provide self-report measures of their brushing. Following the 3-week intervention the loggers revealed intervention children were brushing 38% more than the control. This study reported the mean number of brushing events as 0.94/day for control (decreasing to 0.77/day post-intervention) and 0.90/day for intervention (increasing to 1.07/day post-intervention) (p91).

Comparing previous Unilever research with *study 3*, it is possible to see how brushing patterns differ across cultures. This improves our understanding and subsequent ability to tailor global OH interventions, initially at a population level for cultures but also where possible (and/or necessary) down to the level of the individual as recommend by NICE (2007). Presently many global school oral health programmes (SOHP) do not account for the increasingly multicultural societies they may be delivered in. For example the '*Brush Day & Night*' SOHP evaluated within Salford did not contain all the correct messages required for the Jewish population (e.g. during Shabbat: the use of electrical equipment such as toothbrushes is not allowed and there is a need to use special toothbrushes/toothwash to avoid breaking set out rules - Thomas, No Date, p11).

8.3 Rationale for *study 3*

The children's self-report questionnaire (*section 5.4.2.1.1*) is a non-validated tool designed for the specific purposes of this thesis, based on Porcellato (1998) children's questionnaire on smoking. A major limitation of PH research is the reliance on self-report data. The validation of the children's questionnaire used in this thesis was necessary to understand its ability to record children's reported toothbrushing (Crawford et al., 2010).

Study 3 aimed to provide a more detailed objective understanding of 6-7 year olds' current home-based toothbrushing routines, better informing any redevelopment of the '*Brush Day & Night*' SOHP (*section 3.4*). There are no other published studies that use DLT to record free-living toothbrushing behaviour of 6-7 year olds over a month or objectively validated children's ability to recall their brushing habits over a 24-hour period, so this provides a unique aspect to this thesis. In order to be able to begin developing OH programmes that not only increase knowledge but have a lasting effect on children's behaviour, objective brushing data is essential to improve both design and targeting of programmes.

Study 3 aims to answer question related to the second overall aim of the thesis (highlighted sections, *Figure 2-1, below*). The objectives designed to answer the research questions were answered using a variety of research tools:

- Children's questionnaire
- Children's DLT
- Shortened parent questionnaire

Figure 2-1 The research framework (Aim 2)

8.4 Ethical and methodological considerations

8.4.1 Ethical consideration

The data loggers and brushing cases were designed, tested and supplied by Unilever. As a result they have been through rigorous ethics and health & safety committees in Unilever to ensure safety for use by participants. Prior to the study commencing ethical approval was granted by the University of Salford[74] and subsequently reviewed by Unilever ethics department.

Due to the participants being under 16, informed consent was gained from schools and children's parents. Children were asked to provide verbal assent as an ongoing process throughout the study. Children were issued with a logger contained in a special brush for a 1-month period. The children and their parents were informed that the brush recorded information about their toothbrushing behaviour but were not informed about exactly what was being measured to try and reduce any impact on behaviour (participant information sheet *appendix 38 & 41*). Guidance on ethics and how to inform participates of the accelerometers was sought from researchers who had experience within PA studies. The challenge is to ensure participants have enough information to make an inform decision to take part, while ensuring changes through monitoring of behaviour are minimised.

The logger units (brush and logger) are CE marked ensuring they conform to European health, safety and environmental legislation.

Data Sharing: Specifically for *study 3,* raw data was shared with Unilever for internal purposes only. As part of the informed consent parents were asked for specific permission for this to occur (*Appendix 38 & 41*). No identifying features were provided for the data which was retained confidentially by the researcher for analysis purposes.

8.4.2 New technology considerations

There are many unknown parameters around the use of the loggers with 6-7 year olds in the home, which could have impacted the outcome of *study 3*. The study was designed predominantly to test the validity and reliability of the children's self-

[74] Ethical approval gained 06/05/2011 number *REP11/069*

report questionnaire, the study design was informed by similar PA accelerometer research (Ward et al., 2005; Trost et al., 2005; Cliff et al., 2009).

When providing any new 'tool' as part of a study there are likely to be changes initially in a person's behaviour (Dencker & Andersen, 2008). Unilever estimate a person's normal toothbrushing behaviour, following supply of a DLT, will restart within 2-weeks (personal communication, 2012). For children, it is not known how much of an impact having their behaviour monitored through the logger would impact on brushing rates. As this was unknown, a 2-week habituation period was used in *study 3* (*Figure 8-2*) as used previously in Claessen et al. (2011) and Hurling et al. (2013).

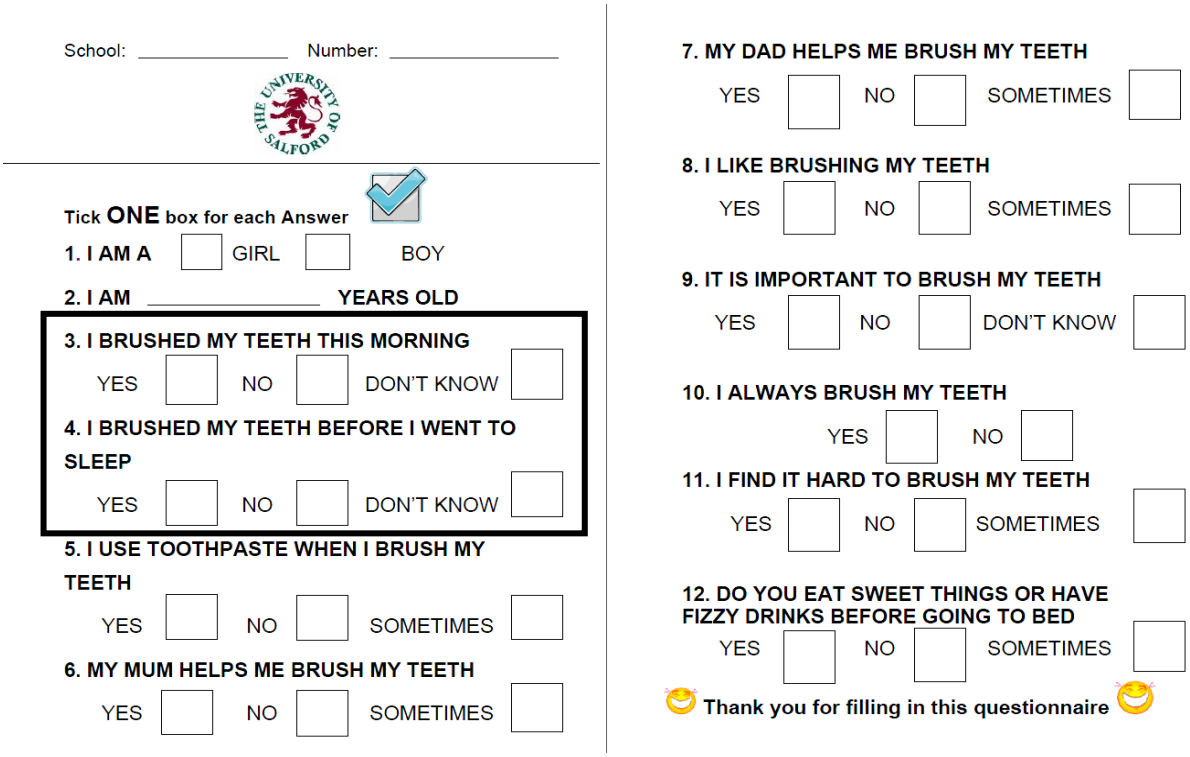
A previous Unilever calibration study to determine the accuracy of logger brushes found high correlation with manually timed (e.g. stopwatch) and logger data (e.g. event time records), with only a 5% failure rate of devices during studies (Claessen, Seeparsand & Wright, 2008). This study also reported that logger brushes did not significantly impact on the adults' brushing behaviour but the self-reported brushing times were significantly longer than the time recorded by the logger (Claessen et al., 2008).

8.4.3 Application of research tools

Data Loggers: For reason of confidentiality details about the data loggers cannot be reported in this thesis. The logger's configuration and outputs are managed through custom software. The logger is enclosed within a plastic toothbrush designed for children with a smaller head and softer bristles, than the adult toothbrush case.

Questionnaire: The children's questionnaire used through this study has been previously described in *section 5.4.2.1.1*. The same procedure for delivery was used as in *study 1*. *Figure 8-1* illustrates the questions analysed in the validation study using the loggers.

Figure 8-1 Children's self-report questionnaire



School: _____ Number: _____

Tick **ONE** box for each Answer

1. I AM A ☐ GIRL ☐ BOY

2. I AM _____ YEARS OLD

3. I BRUSHED MY TEETH THIS MORNING
YES ☐ NO ☐ DON'T KNOW ☐

4. I BRUSHED MY TEETH BEFORE I WENT TO SLEEP
YES ☐ NO ☐ DON'T KNOW ☐

5. I USE TOOTHPASTE WHEN I BRUSH MY TEETH
YES ☐ NO ☐ SOMETIMES ☐

6. MY MUM HELPS ME BRUSH MY TEETH
YES ☐ NO ☐ SOMETIMES ☐

7. MY DAD HELPS ME BRUSH MY TEETH
YES ☐ NO ☐ SOMETIMES ☐

8. I LIKE BRUSHING MY TEETH
YES ☐ NO ☐ SOMETIMES ☐

9. IT IS IMPORTANT TO BRUSH MY TEETH
YES ☐ NO ☐ DON'T KNOW ☐

10. I ALWAYS BRUSH MY TEETH
YES ☐ NO ☐

11. I FIND IT HARD TO BRUSH MY TEETH
YES ☐ NO ☐ SOMETIMES ☐

12. DO YOU EAT SWEET THINGS OR HAVE FIZZY DRINKS BEFORE GOING TO BED
YES ☐ NO ☐ SOMETIMES ☐

Thank you for filling in this questionnaire

8.5 Pilot

As with the description of the loggers for reason of confidentiality with respect to the data loggers some details of the pilot study cannot be reported in this thesis. The aim of the pilot was to test the technology and feasibility of use of the data logger in children's own home.

8.5.1 Sample

In order to ensure the loggers were configured with the correct settings, an initial pilot using 10 loggers was conducted over a 5-day period with 5 pairs of participants that each had a different configuration of logger to determine suitability:

Father/son	Mother/daughter
Mother/son	Mother/daughter
Father/son	

The sample was taken from regions in the NW of England. As boys and girls brush differently, both in terms of frequency and technique, data was obtained from both (Maes et al., 2006; Levin & Currie, 2009). For each child one parent was asked to brush using an adult logger allowing: cross checking of the parent's brushing

signature to understand differences between adults and children; comparison of each setting to determine suitability and provision of limited data to explore differences between children and adult brushing levels.

8.5.2 Procedure

Participants (both parent and child) were instructed to use their DLT for 5-days as part of their own and their child's normal brushing routine (instruction sheet *Appendix 39*). Parents were also asked to record in a table the time of day when brushing occurred. This allowed the events file (or if necessary the samples file) to be cross-checked with self-report data. On the final day, parents were asked to assist their child to complete the children's questionnaire allowing initial analysis of how the objective (logger) and subjective (questionnaire) answers correlated.

8.5.3 Results

All loggers were returned intact and experienced no technical problems. Comparison of the output from the loggers to parents' reported brushing behaviour for themselves and their child is shown in *Table 8-3*. For children, as the minimum acceleration setting increased, the rate of events being recorded by the logger decreased. With parents, there was only one instance where toothbrushing was reported but not coded as a true event by the logger.

Table 8-3 Number of reported (subjective) v's number of recorded (objective) toothbrushing events

Participant (n=10)	**Parent number of reported events** (no. of possible events)	**Parent number of recorded events on logger** (average brushing time, seconds)	**Child number of reported events** (no. of possible events)	**Child number of recorded event on logger** (average brushing time, seconds)
Father/son	6 (8)	6 (102.1)	7 (8)	7 (59.8)
Mother/son	9 (9)	9 (83.6)	6 (6)	6 (59.7)
Father/son	8 (8)	8 (86.7)	8 (8)	6 (27.0)
Mother/daughter	6 (8)	7 (31.6)	7 (8)	1 (10.8)
Mother/daughter	7 (9)	6 (38.1)	8 (8)	1 (11.1)

On the final day of the pilot all children completed the children's questionnaire and reported brushing in both the morning and before bed. *Table 8-4* highlights how

children's reporting did not always match with parents' and the loggers' report of the child's behaviour.

Table 8-4 Child reported brushing frequency against parental reported frequency and logger output

	Child		Adult		Logger	
	Self-report		Proxy-reporting		Objective	
Participant (n=10)	**Morning**	**Before went to sleep**	**Child brushing in the morning**	**Child brushing before bed**	**Morning**	**Evening**
Father/son	Yes	Yes	Yes	No	Yes	No
Mother/son	Yes	Yes	Yes	Yes	Yes	Yes
Father/son	Yes	Yes	Yes	Yes	No	Yes
Mother/daughter	Yes	Yes	No	Yes	No	No
Mother/daughter	Yes	Yes	Yes	Yes	Yes	No

As found through the other studies, reported parental support varied. Three children reported not receiving support, with only 1 sometimes receiving support. Only one child reported finding it hard to brush their teeth with another sometimes reporting toothbrushing was hard.

Finally, feedback received from two parents indicated adult brushes were too soft so they felt their teeth were not clean enough and then used their normal brush. This may have led to a reduction in their normal brushing time.

Impact of pilot on main logger study: In conjunction with the expert at Unilever from the children's data and self-report the optimum settings for 3 areas were decided upon for the main study in relation to the different configuration of settings used within the pilot.

8.6 Main logger study testing validity and reliability of questionnaire

8.6.1 Sample

The sample size for this study was limited to a maximum of n=120 participants due to the availability of child specific logger cases (supplied by Unilever). School sampling was split into 3 phases due to logger units being available up to 40 units at any one time; one phase was conducted in the winter term of 2011 and two phases in early 2012.

Year 2 children from 5 schools (not previously part of *study 1* or *2*), located in low and middle SES areas across two wards in Salford took part. Initially head teachers and class teachers were asked to provide permission to conduct the research in their schools. Overall 110 children were provided with parental consent to take part in the study, of these 2 children chose not to take part once the research was explained. All other children provided their assent, with this being reconfirmed at each school visit. All but 1 school had a lunchtime brushing programme in lower years.

Table 8-5 Key characteristics of *study 3* schools

School Number	School Classification	Health School Status	MSOA 5yr olds Average dmft (2005/06)	MSOA 5yr olds% with decay experience (2005/06)	Ward 5yr olds Average dmft (2005/06)	Ward 5yr olds % with decay experience (2005/06)	Ward 2004 IMD	% entitled to FSM (FT) (2009)	Yr of Ofsted report	Overall grade Ofsted[75]	Overall Absences (%) (2008)	Persistent absences (%) (2008)	Effectiveness of early years foundation (KS1-2 cva)
1	Low	NHS	2.65	59	2.64	59	35.48	51.9	2007	2	5.0	2.1	2
2	Low	WTHS	3.85	68	3.42	67	68.81	56.7	2008	4	7.8	5.1	2
3	Low	NHS	Not available		3.42	67	68.81	56.3	Not available		5.2	3.8	N/A
4	Middle	NHS	1.65	42	1.79	42	32.13	13.4	2007	1	4.6	0.6	1
5	Middle	NHS	1.97	43	1.79	42	32.13	19.0	2007	2	4.7	0.0	2

Key to table abbreviations:
NHS – National healthy school status achieved; WTEHS – School working towards the enhanced healthy school award
MSOA – middle layer super output area (mean populations 7200, NHS Data dictionary 2011)
IMD – index of multiple deprivation
FSM- free school meals
FT – full time children entitled to FSM
Overall grade – the grade provide by Ofsted in report as to the standard of the school
KS1-2 CVA - measures the progress of a child while attending the school accounting for circumstances schools cannot control

At baseline:

n=63 girls and n=44 boys (missing n=1).

n=74 children were 6 years old; n=30 were 7 years old, and 1 child indicated they were 8 years old (missing n=3).

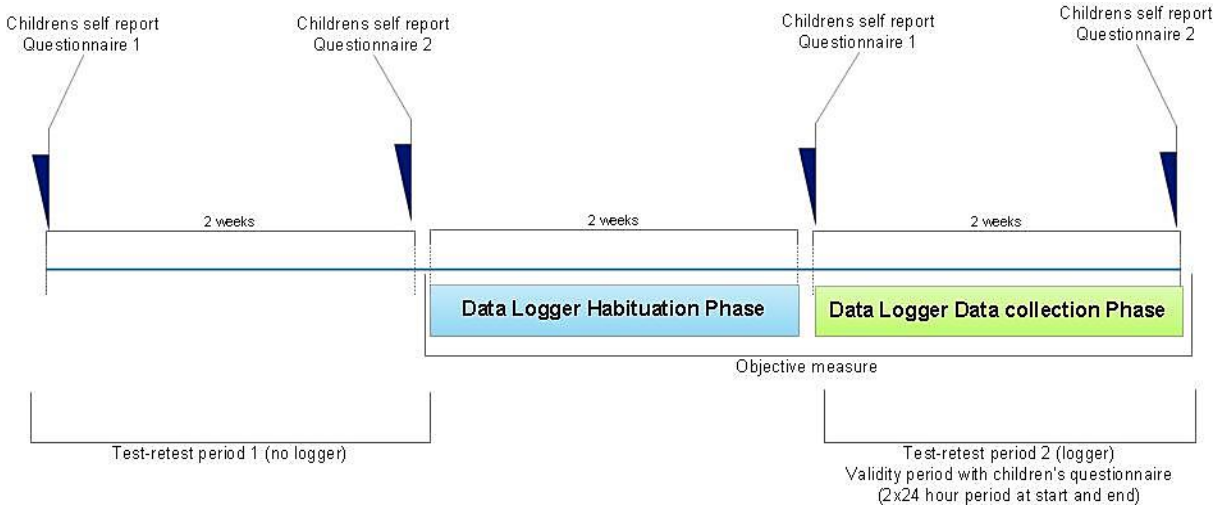
[75] 1 = outstanding, 2 = good, 3 = satisfactory, 4 = must be improved

8.6.2 Study design

The overall study design is illustrated in *Figure 8-2*. The design was divided into three different stages during the 6-week period to allow the reliability of the questionnaire to be determined using a 2-week test-retest pattern and the validity of reported behaviour to be tested against an objective measure.

All three phases were completed during term time to minimise the impact of brushing routine difference during holidays. Any changes to routine as a result were not of interest to the current study so it was removed as a potential confounding factor.

Figure 8-2 *Study 3* Children questionnaire validation study time line



A 2-week sequential study design was used for each of sections in relation to previous research (Lewis, McCollum & Joseph, 1999; Marx et al., 2003; Cruise, Lewis & Guckin, 2006). To accurately determine the test-retest ability of the children's questionnaire, there was a need to ensure long enough periods between testing to reduce practice effects, and memories of previous reporting being re-reported. The design also allowed for the incorporation of the 2-week habituation period, while not impacting on the reliability design aspect of the study.

Reliability of questionnaire: Measured through a 2-week test-retest period (Marx et al., 2003). The questionnaire was administered as a class activity to be completed individually at the beginning and then repeated again after 2-weeks (top arrows in *Figure 8-2*). This pattern was repeated in the final 2-weeks when the children had the DLT. This allowed comparison of test-retest reliability in first 2-

week period (without DLT) with the period with the DLT (last 2-weeks), to determine the impact (if any) of the DLT on self-reporting.

Validity of questionnaire when compared to matched loggers: Measured by issuing a DLT to children for a 1-month period. The initial 2-week period allowed the children to habituate to using a new toothbrush and return to their 'normal' routine (*section 8.4.2).* Data was used to determine the children's 'normal' brushing habits for: frequency, duration and time of day. Upon completion of the study DLT were collected, allowing data to be downloaded and loggers to be reused.

Children were provided with the simple instructions of '*use this brush instead of your normal one as part of your routine*'. During the study period, parents were asked to put the children's 'normal' toothbrush away so they were only able to use the DLT. Toothbrushes were individually numbered to allow monitoring of issuing and collection and for children's questionnaires to be associated with the correct logger data.

As with the previous studies, all children in the class, regardless of taking part in the study, were give a small thank you at the end of the study: toothbrush, toothpaste, pencil, rubber and stickers. Year 2 teachers were provided with a copy of the '*Brush Day & Night*' SOHP (as delivered in *study 2*) as well as resources (mouth models and brushes) to aid delivery.

The validity was tested by comparing data from the logger with paired data from questionnaires for individual children. This allowed a comparison for each individual child with complete data for subjective and objective measures for a previous 24-hour recall period.

Parent Questionnaire: A shortened questionnaire was provided to parents (21 questions, *appendix 42*). This contained the demographic questionnaire used within *study 2*. It further contained questions relating to their child's brushing habits, support, sugar-snacking and parents' brushing habits. This was designed to provide questions that matched the children's questionnaire. Within this study only brushing habits were of interest so it was not felt necessary to use the full questionnaire from *study 2*.

8.6.3 Data cleaning processes

Due to this technology still being in the prototype stage and no previous examples being available in OH literature, a number of rules were devised during this study to allow data cleaning and analysis.

The rules for data handling and cleaning were devised as follows:

- **Multiple events** – If the gap between multiple 'true' events was less than 5 minutes this was coded as 1 brushing event. This was due to the predicted sporadic nature of children's brushing while they are still developing a routine and technique.
- **Time of day** – For both weekdays and weekends, morning was coded as before 9am (to coincide with school times), day was coded as 9am–5pm and evening was coded as after 5pm.
    - **Limitations** – Presently within SOHP research weekdays and weekends are not usually differentiated within behavioural interventions (examples outlined in *chapter 3* and as evaluated in *study 2*).
- **Outlier events** – Any recorded event less than 30 seconds and over 200 seconds was checked against the samples file to determine if it was a 'true' brushing event from the trace.
    - This was due to the recommendation of 2 minute brushing and the extent to which these brushing events became outliers.
    - Example of a non-brushing trace is shown in *Figure 8-3* - illustrated by one or both series not meeting the threshold and showing a lack of consistency in pattern and board association between graph lines.
    - Example of 'true' brushing trace is shown in *Figure 8-4*.

Figure 8-3 Example of non-brushing pattern (Graph verticle axis titles withheld due to commercial sensitvity)

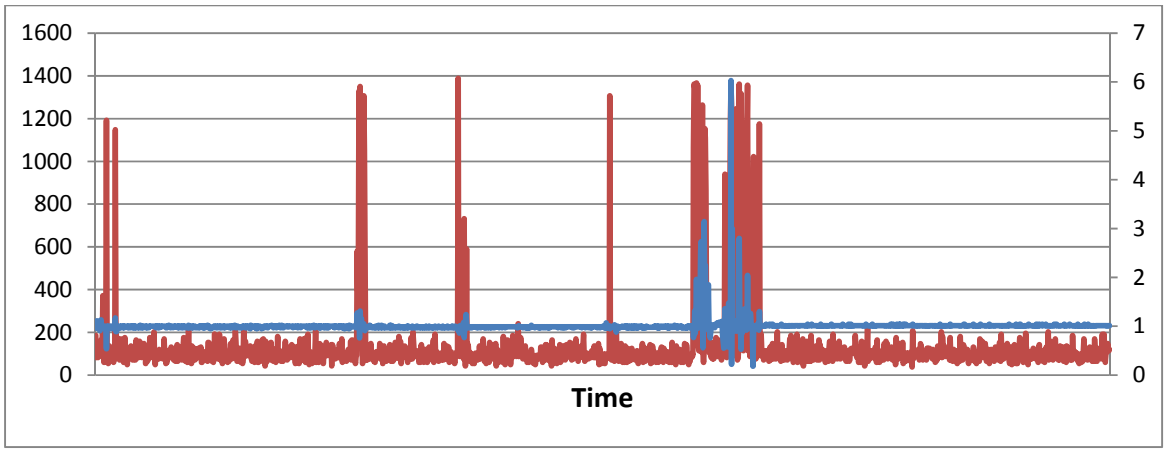
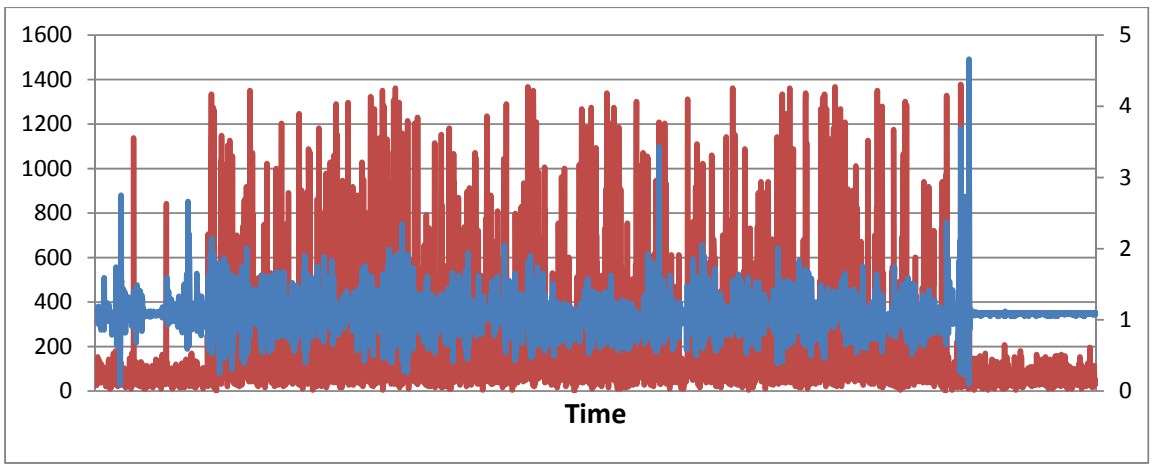


Figure 8-4 Example of brushing pattern (Graph verticle axis titles withheld due to commercial sensitvity)



- **For all participants** – For all children a trace of their average brushing time was checked along with the highest and lowest range events to provide a random check.
    - **Limitation** – Through the development of the software, Unilever are confident of the ability of the data capture so it was only felt necessary to perform random checks. As this meant not all events were checked, it is possible some untrue events may have been included in the analysis.
- **Handling incomplete data** – If children did not have at least 3 true events (once or twice-daily brushing) a week they were deemed to be non-conforming. This is influenced by the study outcomes of Claessen et al.

(2011) and Zillmer (2011) reporting children in Saudi Arabia average brushing 3.8 times a week.

  - **Limitation** – Although the optimum is for children to brush twice-daily everyday (C*hapter 2 & 3*), from *study 2* it was found this was not the case (C*hapter 6 & 7*). As such, if children brushed in either the morning or evening, it was felt this was sufficient to count for an episode for that day.

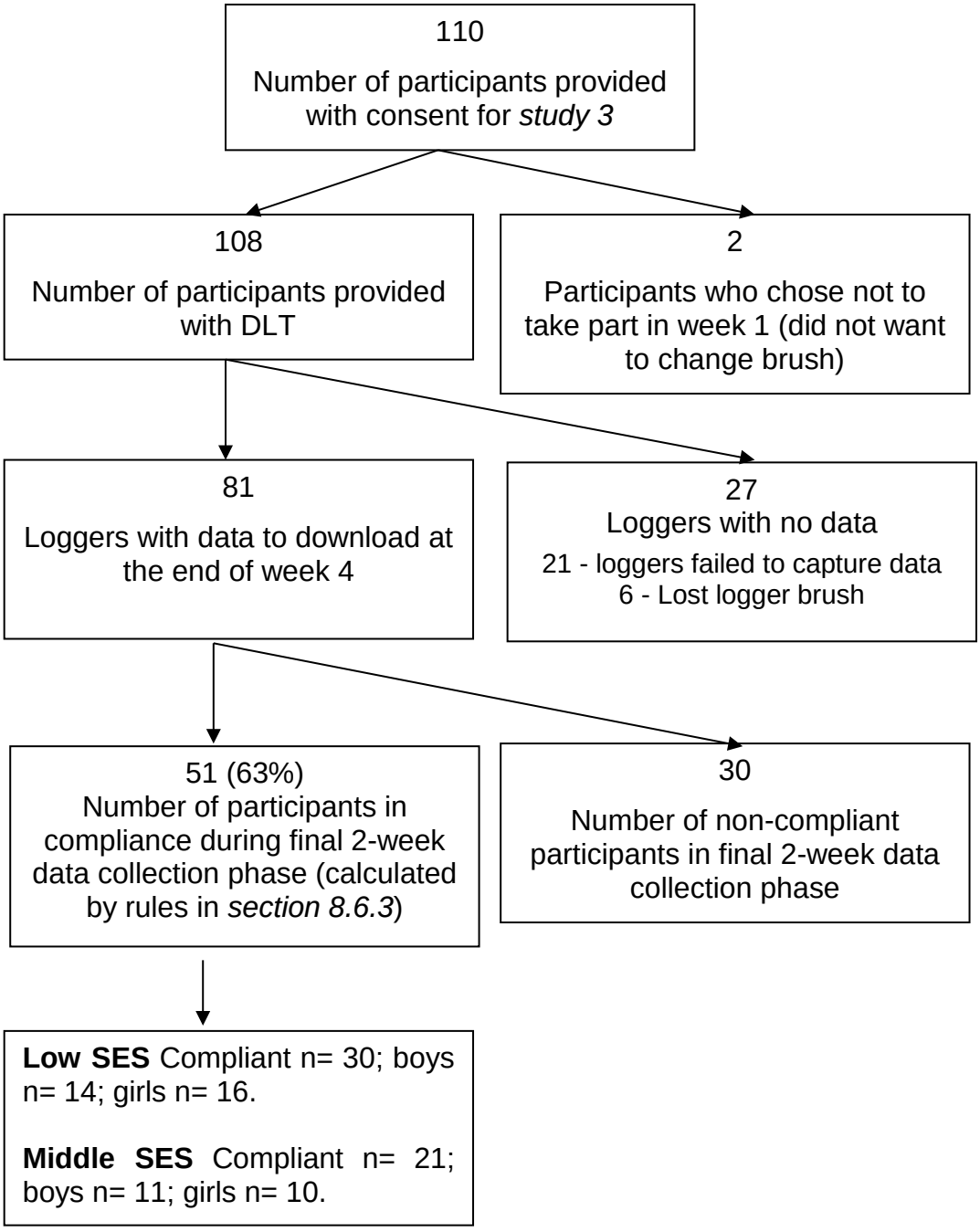
- **Handling incomplete data in data collection weeks** - If the brush had stopped being used during the first 2-weeks but showed use in the final 2-weeks, data was included in the questionnaire validation if all other criteria were met (e.g. *Table 8-6* met the inclusion criteria in the initial 2-weeks but did not brush 3 times a week for each of the final 2-weeks).
  - **Limitation** – From the present study design and logger data, it is not possible to determine if non-use of the brush is non-conformity, use of another brush or a lack of brushing habit. This is an area for future research and further technological development.

Table 8-6 Example of non-conformity output for the data analysis 2-weeks

Coded by logger				Coded by researcher	
Start	**End**	**Day**	**Duration (Sec)**	**Complete number of events**	**Complete event duration (sec)**
16/11- 16:18:14	16/11- 16:19:58	Wednesday	103.66	1	103.66
17/11- 19:35:11	17/11- 19:35:41	Thursday	30.18	2	30.18
18/11- 09:47:25	18/11- 09:49:18	Friday	112.96	3	112.96
18/11- 16:19:27	18/11- 16:20:24		57.36	4	57.36
19/11- 15:28:26	19/11- 15:28:52	Saturday	26.43	5	26.43
21/11- 09:56:11	21/11- 09:59:29	Monday	198.09	6	198.09
21/11- 16:27:39	21/11- 16:29:37		118.12	7	118.12
22/11- 09:55:41	22/11- 09:58:06	Tuesday	144.54	8	144.54
22/11- 16:29:02	22/11- 16:31:32		150.44	9	150.44
23/11- 09:47:05	23/11- 09:47:20	Wednesday	15.31	10	15.31
23/11- 16:22:21	23/11- 16:25:05		163.96	11	163.96
24/11- 09:48:50	24/11- 09:50:33	Thursday	102.25	12	102.25
24/11- 16:27:14	24/11- 16:30:15		180.42	13	180.42
25/11- 09:59:05	25/11- 10:00:57	Friday	111.96	14	111.96
25/11- 16:16:33	25/11- 16:18:43		130.92	15	130.92
27/11- 19:54:20	27/11- 19:54:45	Sunday	24.92	16	24.92
27/11- 22:41:03	27/11- 22:41:21		17.97	17	17.97
28/11- 09:55:02	28/11- 09:55:32	Monday	30.28	18	30.28
28/11- 09:56:17	28/11- 09:57:03		45.7		45.7
28/11- 16:38:41	28/11- 16:40:17		95.94	19	95.94
29/11- 10:06:02	29/11- 10:06:19	Tuesday	16.52	20	16.52
02/12- 13:55:33	02/12- 13:56:06	Friday	33.89	21	33.89
02/12- 13:56:44	02/12- 13:56:57		13.41		13.41
06/12- 16:22:27	06/12- 16:23:07	Tuesday	39.59	22	39.59
		Mean		**81.8675**	

Outcome of participants in study: *Figure 8-5* illustrates the flow of participants combining the three phases of the study and the outcome of the stages of data cleaning.

Figure 8-5 Flow of participants through study three data cleaning process



Within sample size calculations, future studies should account for conformity rates and data loss (through technical issues and brush loss) to ensure they are powered correctly (if they are not limited by the current cost and accessibility of the technology). Within this study there was an attempt to sample the maximum number of children possible within the available study time and the number of available logger units. Conformity rates may also be increased in future studies through refinement of the study design, as well as increased understanding of why

children are not using the brush to allow improved development of loggers and cases.

8.6.4 General results

Loss of data: Of the logger brushes that were returned (n=102), all brushing cases were intact. Twenty one loggers (16%) failed to record any data (this was only discovered at the point of data download). Finally, 6 loggers (5%) could not be collected at the end of the study due to: moving away, loggers being lost at home and loggers being accidently thrown away.

Table 8-7 Location of loss of data

School	SES	Number of children with consent (n=)	No data from brush (n=)		Brush not returned (n=)		Total number of children remaining for analysis (n=)	Non-conformity in final 2-weeks (n=)	
			Boy	Girl	Boy	Girl		Boy	Girl
1	Low	30	5	8	0	2	14	3	5
2	Low	10	0	0	1	0	9	0	1
3	Low	23	0	0	2	0	21	3	3
4	Middle	31	1	4	0	0	25	6	7
5	Middle	14	1	2	0	1	12	1	1
	Total	**108**	**7**	**14**	**3**	**3**	**81**	**13**	**17**

It was not possible to fully determine the reason for clustering of greater data loss in school 1 through logger failures (*Table 8-7*). This could be related to a larger sample size in phase 1 for school 1 compared to school 2 resulting in a greater chance of logger failures within the batch of brushes. Due to the type of failure it is unlikely it was related to the behaviour of the children or the way the brushes were issued or used/stored in the home.

Subjective Measure (Children's questionnaire): Conducted with all children, with consent and providing assent, present on the day the researcher attended (missing data outlined in *Table 8-8*).

Table 8-8 Location of loss of questionnaires per week by school

School	SES	Week 0 (n=95)		Week 2 (n=99)		Week 4 (n=101)		Week 6 (n=101)	
		Boy	Girl	Boy	Girl	Boy	Girl	Boy	Girl
1	Low	2	4	1	2	0	1	0	1
2	Low	0	1	0	1	1	1	1	1
3	Low	3	0	2	0	2	0	2	1
4	Middle	0	1	0	1	1	1	0	1
5	Middle	2	0	2	0	0	0	0	0
	Total	**7**	**6**	**5**	**4**	**4**	**3**	**3**	**4**

8.7 Children's brushing profile for study duration

8.7.1 Duration

Each brushing session (for both adults and children) is recommended to last for two minutes (NHS, 2011). However research with adults and children has shown this is frequently not achieved (McCracken et al., 2005). Within the '*Brush Day & Night*' programme 2 minute brushing is targeted through the SOHP, a song in the '*Teeth Chief*' cartoons, and conveyed in the parent's leaflets provided as part of the home pack.

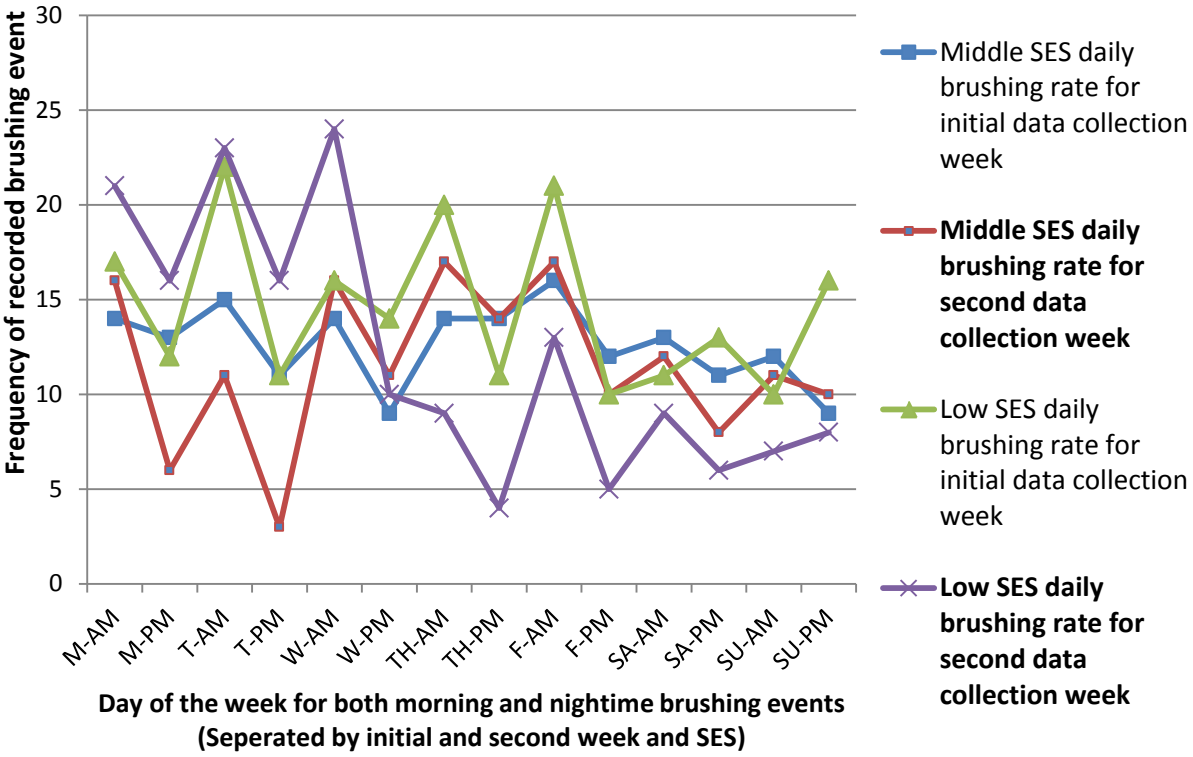
For the 51 children included in the final 2-week analysis, the cumulative frequency and average duration of brushing varied across days of the week (*Table 8-9*). The mean brushing time per event was 71.93 seconds, 48 seconds less than is recommended, but slightly higher than found in previous studies with children where brushing averaged around a minute (MacGregor & Rugg-Gunn, 1979; Sandström et al., 2011).

Table 8-9 Frequency and duration of brushing per day of week in final 2-weeks

	Mon	Tue	Wed	Thur	Fri	Sat	Sun
Total number of recorded events	133	119	96	78	118	87	92
Average brushing event duration (seconds)	70.55	68.18	72.26	70.07	68.53	79.13	74.77

Across SES, brushing occurred more frequently in mornings compared to evenings (*Figure 8-6*); with rates of brushing decreasing in the final study week. The data was analysed by study week as well as SES to understand how this impacted on the outcome.

Figure 8-6 Frequency of recorded brushing event for the 51 children who showed a conformity routine



Children attending schools in less deprived areas consistently brushed for longer than those in more deprived areas (*Table 8-10*). However, frequency of brushing follows the opposite pattern. In the design of future SOHP, there may be a need to target frequency and duration in different areas to be able to effectively achieve the desired behaviour change in each population.

Table 8-10 Frequency and duration of brushing events per week during the study period

	Low SES (n= 30)						Middle SES (n= 21)					
	Number of recorded events			Average brushing event duration (seconds)			Number of recorded events			Average brushing event duration (seconds)		
	Wk 3	Wk 4	Total	Wk 3	Wk4	Wk 3&4	Wk 3	Wk 4	Total	Wk 3	Wk 4	Wk 3&4
Mon	45	39	84	60.60	63.90	61.84	28	22	50	84.85	85.23	85.01
Tue	38	40	78	62.81	65.53	64.20	26	15	41	76.31	74.77	75.75
Wed	32	35	67	74.59	64.57	69.35	24	5	29	77.94	83.98	78.98
Thur	32	15	47	63.47	65.36	64.07	27	4	31	78.39	84.49	79.17
Fri	35	28	63	53.62	53.41	53.53	31	24	55	93.42	75.1	85.72
Sat	24	20	44	76.76	70.58	79.95	21	22	43	90.40	78.74	84.43
Sun	32	18	50	57.71	74.80	63.86	23	19	42	98.81	74.35	87.84
Mean	**34**	**28**	**62**	**64.22**	**65.45**	**65.26**	**26**	**16**	**42**	**85.73**	**79.82**	**82.41**

Through the present study it is not possible to fully understand the reason behind the fluctuating number of brushing events; although a drop in the rate of brushing at weekends was expected. It is possible that the higher brushing rates at the beginning of the week is due to routines being better implemented which decreases as the week progresses and potentially younger children's tiredness increases as a result of school. This is an area for further research to understand how SHOPs can be effectively designed to target the dips and the reasons behind them. Across the week when brushing occurred, the length of a brushing event only had an average range of 11 seconds, suggesting when children do brush there is some stability to their behaviour. At weekends the increased average time of brushing could be a reflection of greater supervision by parents when there is less of a rush around a school day and more flexibility in bedtimes.

Over the course of the complete month, the average brushing time (73.11 seconds, *Table 8-11*) was higher than the average for the final 2-weeks (*Table 8-11*). The complete month was analysed in addition to the final 2-weeks to understand how the habituation phase impacted overall toothbrushing patterns. Although the average time showed limited fluctuation after habituation, brushing events showed a different pattern across weekdays, with weekend's still remaining lower.

Table 8-11 Frequency and duration of brushing per day of week for one month period

	Mon	Tue	Wed	Thur	Fri	Sat	Sun
Total number of recorded events	216	226	230	216	199	147	168
Average brushing event duration (seconds)	73.90	72.67	74.43	72.45	72.49	75.74	70.13

Within the sample, children more frequently had a once-a-day brushing habit, showing similar finding to Hurling et al. (2013). For some children the time of brushing activity remained relatively consistent *Table 8-12*), indicating a set morning routine prior to school. One child consistently did not brush at the weekends or in the evenings, suggesting the routine is not as developed at potentially more flexible periods of the day.

Table 8-12 Example of once-a-day brushing frequency

19/03/2012 08:14:12	19/03/2012 08:16:30	Monday	137.74
20/03/2012 08:05:08	20/03/2012 08:06:28	Tuesday	79.93
21/03/2012 08:12:20	21/03/2012 08:13:20	Wednesday	59.15
22/03/2012 07:59:33	22/03/2012 08:02:33	Thursday	179.88
23/03/2012 08:16:21	23/03/2012 08:19:48	Friday	206.6

The stability of the routine was also present for some with a twice-daily brushing habit. The child in *Table 8-13* consistently brushed for longer than the recommended two minutes, so within a SOHP, this child may benefit more from support with technique rather than time.

Table 8-13 Example of a twice-daily brushing habit

19/03/2012 07:34:56	19/03/2012 07:37:30	Monday	154.01
19/03/2012 21:11:00	19/03/2012 21:12:44	Monday	104.15
20/03/2012 07:54:58	20/03/2012 07:57:13	Tuesday	134.83
20/03/2012 21:04:04	20/03/2012 21:06:02	Tuesday	118.02
21/03/2012 08:09:09	21/03/2012 08:13:01	Wednesday	231.88
21/03/2012 20:45:50	21/03/2012 20:48:54	Wednesday	184.73
22/03/2012 07:57:40	22/03/2012 07:59:36	Thursday	115.61
22/03/2012 20:25:54	22/03/2012 20:29:06	Thursday	191.74
23/03/2012 07:57:00	23/03/2012 07:58:45	Friday	104.5
23/03/2012 21:06:27	23/03/2012 21:08:49	Friday	141.89
24/03/2012 09:18:42	24/03/2012 09:21:14	Saturday	152.75
24/03/2012 21:31:52	24/03/2012 21:35:58	Saturday	246.94
25/03/2012 09:09:16	25/03/2012 09:11:41	Sunday	145.44

Although many others could have been chosen, these two examples illustrate the differing needs of children within the same population in terms of SOHP targets. Objectively measured baselines can help to ensure children are grouped in a way that has the greatest benefit for them and their parents. Improving our understanding of the fluctuation and the differences between behaviour by SES can aid design of future SOHP, to account for differing guidance required and the changes in brushing patterns at weekends, holidays and through illness.

8.7.2 Time of day

Many school programmes target both morning and nighttime brushing routines. Having a better understanding of the times children brush can help future development by increasing the ability to target differing brushing patterns. In 2001 Milgrom stated:

> *"Studies do not exist that clearly demonstrate the frequency-response relationship or even the optimal time of day for the behaviours, if indeed timing matters"* (p1102).

There is still a dearth of accurate evidence regarding children's brushing and how this impacts on dental caries and routines. *Figures 8-8-8-10* illustrates the average time of day brushing occurred within each phase (*phase 1 n=23, phase 2 n=21, phase 3 n=37*). This was calculated in STATA 10, by determining the frequency of brushing events occurring for each hour of the day. From this an average for the frequency of true events for each hour over the day could be calculated. This part of the analysis was divided into phases rather than SES. Weekdays and weekends were not separated as the SOHP currently does not differentiate between these.

Within *study 3* a greater proportion of children brushed in the morning, most frequently between 8–10 am. Peak brushing time occurred later than that reported by Zillmer, (2011) in Saudi Arabia (5-7 am), illustrating how cultural differences impact toothbrushing timing. In contrast to the morning routine the evening routine was spread over a greater range (7-10pm). Children in phase 3 (*Figure 8-9*) displayed a more even pattern of morning and nighttime brushing.

Figure 8-7 Average brushing time for phase 1 over 29 days

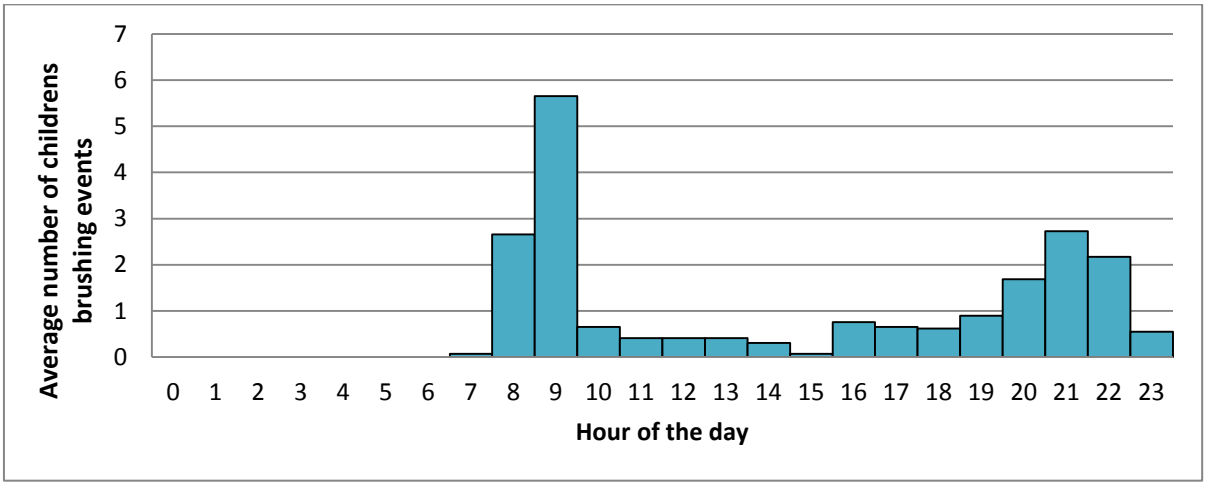


Figure 8-8 Average brushing time for phase 2 over 26 days

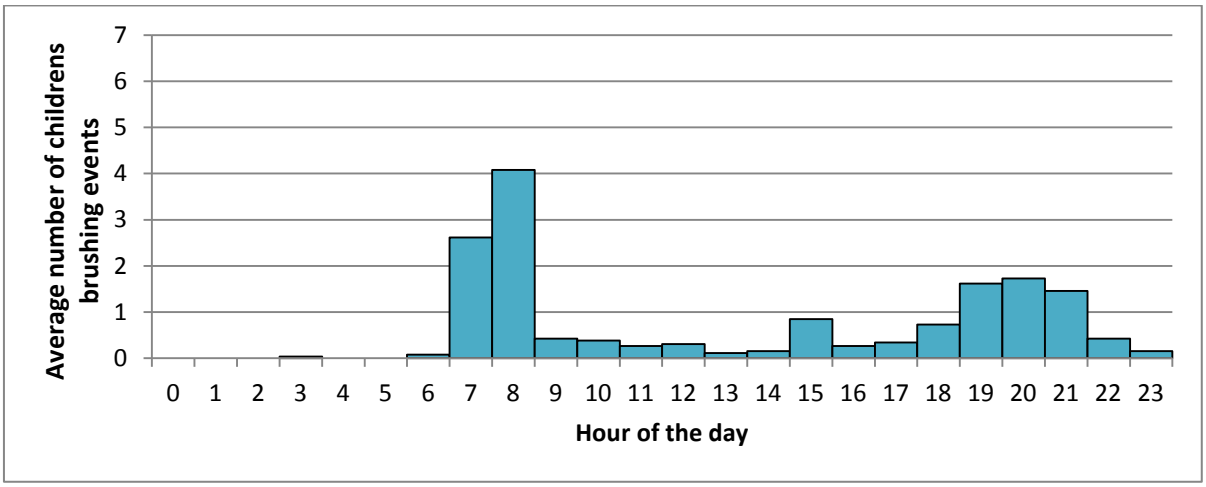
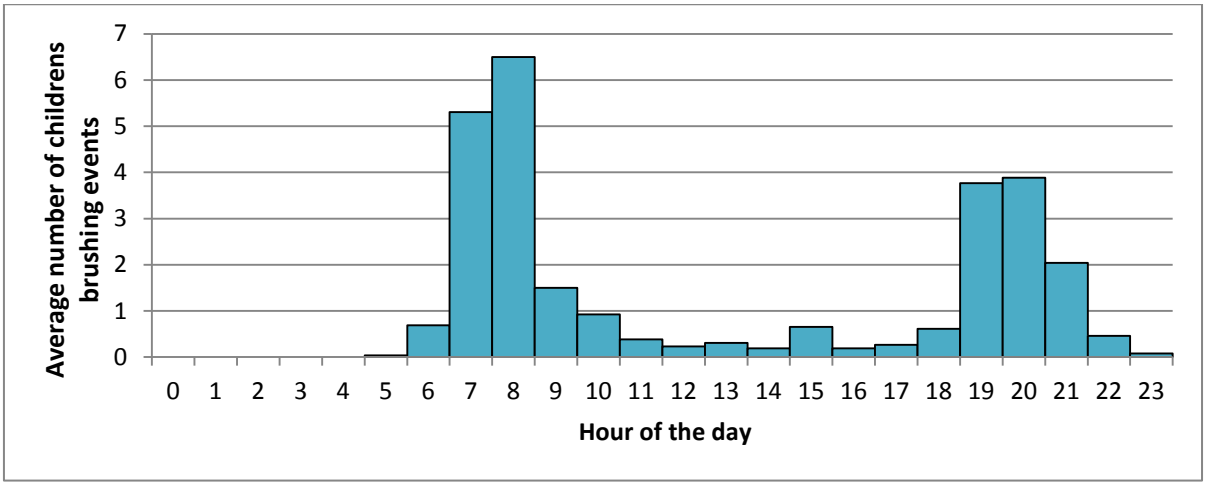


Figure 8-9 Average brushing time for phase 3 over 26 days



From the data in this study it would suggest that morning routines have greater stability and frequency. Different facilitators and barriers occur in evenings, mornings, weekdays and weekends, which need to be accounted for in future

SOHP. Although this study begins to answer some questions around brushing patterns, there are still a large number of unknowns and areas of future research.

8.8 Questionnaire results

8.8.1 Children's questionnaire

Reliability of measure: To understand the test-retest reliability of the children's questionnaire, percentage agreement and Cohen's kappa outcomes (using a significance level $p<.0005$) were calculated (*Table 8-14*) (Brown et al., 2004). Although the main focus of the study was around the 24-hour recall questions, test-retest statistics were calculated for the complete questionnaire to understand the reliability of all topics targeted. For percentage agreement at each of the two test-retest periods the matching pairs of questions were transformed to calculate the difference in responses, prior to the agreement being calculated.

Table 8-14 Percent agreement and Cohen's kappa statistic of children self-report questionnaire with and without the logger brush

Test-retest period	Week 0-2 (no logger)		Week 4-6 (logger)	
Measure	**Kappa**	**Percentage agreement (%)**	**Kappa**	**Percentage agreement (%)**
I brushed my teeth this morning	**.619**	**89.0**	**.527**	**89.7**
I brushed my teeth before I went to sleep	**.671**	**85.7**	**.669**	**84.5**
I use toothpaste when I brush my teeth	**.522**	**94.3**	**.547**	**93.8**
My mum helps me brush my teeth	**.671**	**88.6**	**.689**	**88.5**
My dad helps me brush my teeth	**.817**	**93.4**	**.763**	**92.9**
I like brushing my teeth	**.763**	**93.3**	**.675**	**84.7**
It is important to brush my teeth	**.560**	**96.6**	**.633**	**91.8**
I always brush my teeth	**.739**	**89.8**	**.872**	**94.4**
I find it hard to brush my teeth	**.661**	**81.8**	**.697**	**83.5**
Do you eat sweet things or have fizzy drinks before going to bed	**.685**	**79.3**	**.730**	**82.3**

Overall kappa outcomes ranged from questions showing moderate agreement (above .05) to very good agreement (above .08). The lowest level of percentage

agreement was found for children reporting nighttime sugar-snacking. It is likely this reflects the difficulties children had with this question throughout the three studies. The impact on reporting about liking to brush their teeth may also be explained by the feedback from children about the size of the brushing handle and having to change from their normal brush. However, the same impact on reporting was not seen in responses to finding it hard to brush. Overall the children's self-report questionnaire showed good test-retest agreement both with and without the loggers. The introduction of the logger appeared to have limited impact on the children's reporting.

As frequency of brushing was transformed into reported twice-daily toothbrushing, the kappa statistic was also calculated to determine if this combination had any impact on agreement in comparison to treating the question separately. The kappa results for week 0-2 of 0.739 and week 4-6 of 0.751 indicate good agreement for children's self-reported twice-daily toothbrushing. As with any measure, for all questions high levels of agreement were found, caution must be used due to issues of over-reporting and any social desirability bias. Despite this, the questionnaire appears to show high levels of reliability.

Validity of the measure: There was a non-significant association for conforming children (n-51) between children's reported brushing or non-brushing in the morning and evening and the events recorded by the loggers (x^2 (1) = .702, p>.425).

Table 8-15 2x2 chi square contingency table

		Recorded 'true' logger events		
		Yes	**No**	**Total**
Questionnaire response to brushing	**Yes**	88	64	152
	No	7	8	15
	Total	95	72	167

Overall there were 96 instances of agreement between logger and children's self-reported behaviour, with 71 instances disagreeing. As has also been found with adults, subjective measures frequently do not correlate with objective measures (McCracken et al., 2005), but can still provide a useful understanding if over estimation is accounted for.

Questionnaire results: Over 90% of the children reported using toothpaste when brushing their teeth across the 4 questionnaire points. As found in *study 1 & 2*, over 70% of children reported having no support from their parents around toothbrushing. This was despite 14% in the initial questionnaire and over 20% in the remaining 3 time points reporting that they found it hard to brush. When children are going through mixed dentition they can struggle with brushing some areas of their teeth (predominantly the back molars) so parents may still need to provide support during this stage of development.

Across the 4 questionnaire time points, over 85% of children reported that brushing was important, a reduction compared to *study 1* and *2*. A third of children reported sometimes having sugary-snacks or drinks at night, 40% of children reported not having any sugary-snacks, and the remaining children reporting always having sugary-snacks or drinks at nighttime. As with many SOHP, the current '*Brush Day & Night*' programme has sugar-snacking as a secondary message to brushing frequency.

8.8.2 Parent questionnaire

A 70% (n=76) response rate was recorded for the parent questionnaire[76]. Questionnaires were primarily completed by mothers (88%; fathers - 11%; kinship/foster carer - 1%), with 40% of mothers being between 31-40 years old (31% - 20-30; 27% - over 40 and 4% - under 20). Over half of the children lived in 2 parent households (55%) followed by 42% predominantly living just with their mother (1 child living with grandparents and 1 had other living arrangement). For both mothers and fathers, 28% reported they were currently unemployed, with more fathers' working full time (57%) compared to mothers (24%).

In relation to OH habits, 90% (n=68) of parents reported their child using a manual toothbrush in comparison to electric brushing (n=8). As the logger brush requires manual technique for cleaning the child's teeth those who use an electric brush may have resisted the change back to a manual brush.

As found through all studies, high numbers of parents reported (70%, n=53) children having responsibility for OH routines, with only 1 parent reporting this was

[76] Non responder (n=32) locations: n=12 school 1; n=5 school 2; n=7 school 3; n=4 school 4 and n=5 school 5.

recent. 21% (n=16) of parents reported brushing with their children and 4% (n=3) reported teeth being brushed by a parent. Reported rates of support were higher than those provided by the children.

Parents most frequently reported their children brushing 2 or more times a day (57%, n=43) with fewer reporting their child only brushing once-a-day (37%, n=28). However, one parent also reported their child brushing once-a-week or less and 3 parents reported their children brushing every other day.

As found with reporting of their children's behaviour, the highest reported frequency of parental brushing was 2 or more times a day (77%, n=58) with 21% indicating they only brushed once and 1 parent only brushing every other day.

8.9 *Study 3* discussion

Methodological and technical issues as with many new study designs, there were a number of areas that require consideration in future developments. This study provided DLT to children for a one month period, a considerably longer time than many PA studies, with simple instructions to use the brush as part of their routine instead of their normal brush. Conformity rates fluctuated greatly over both SES and the study month, which impacted on the validity of the results.

This study was not able to truly determine if non-use of the brush is non-conforming or is in fact a person's normal routine. This is an area where development and further research is needed. Within this study, one parent upon return of the brush noted that the child had not used the brush for the whole period as they had forgotten about it, this was during the second habituation week and highlights how data can be lost and may look like non-conforming. With the current design of loggers the researcher is blind to problems of non-compliance until the end of the study when the data is downloaded. A feedback mechanism allowing issues of compliance to be detected during study periods through development of future modifications to the logger could include in-field feedback or data downloading. This would alert the researcher to technical problems with the logger (e.g. the battery being drained) allowing for the brush to be replaced during the study period or to determine if the logger was not being used for a different reason (e.g. left in a bag or lost).

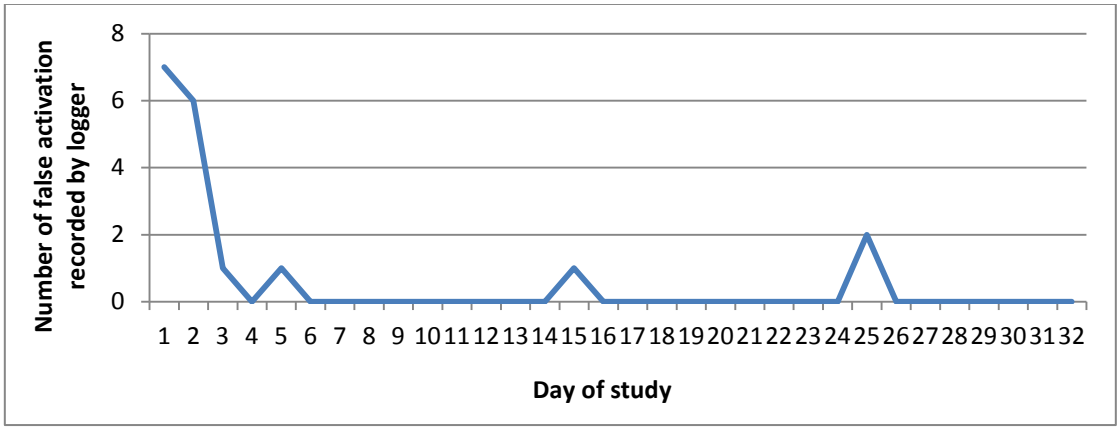
Although the raw accelerometer data is processed into brushing events through algorithms, there is still a large amount of analysis and decision making required. Within *study 3,* a number of rules and decisions were taken to analyse the data, which impacted on the analysis and the number of children in the final sample. Decisions around compliance and what constituted a true event were based on previous studies and the knowledge of those involved in the research. In future, having a greater understanding of the traces for children will aid development of more sophisticated analysis software. Within PA accelerometer data analysis, Masse et al. (2005) reported:

> "*…decision rules employed to process accelerometer data have a significant impact on important outcome variables. Until guidelines are developed, it will remain difficult to compare findings across studies*" (ps544).

As with PA until a larger number of studies are conducted to allow collective rules to be created analysis will remain a study by study decision process.

Habituation Period: In this study a 2-week habituation period was used but the results indicate a week is a sufficient period. Habituation periods were calculated for conforming children by determining the number of un-true events that occurred between the true events. A reduction in the number of untrue events, along with an appearance of a regular pattern of brushing suggest the child is no longer 'playing' with the brush and is only using it for toothbrushing. As can be seen in *Figure 8-10* for one child, by the fourth day of having the brush there were no false activations. Despite there being 3 further false activations, it appears that after a week this child returned to their normal brushing routine.

Figure 8-10 Example habituation pattern over the one month period



There were also some children who appeared to not have a period of habituation, and others who still had high levels of false activation throughout the study period. Having a better understanding of habituation time will not only improve future study design but can also provide an insight into the stability of routines. It is hypothesised that children who habituate more quickly to the change of brush (from usual brush to logger) have greater stability in their routine, so the type of brush does not impact on the stability of routine. Those who take longer or do not continue to use the logger brush may have a less stable daily brushing routine so a change in the brush can have a greater impact on the frequency of brushing by interrupting any routine. It should also be considered that non-conformity, as outlined below, may be as a result of some children struggling to accept the logger brush in replacement of their existing one.

As with many home studies, this one relied on parents to aid the study by removing children's normal brushes to ensure the logger was used. In future research, having cohorts who are willing to film brushing or non-brushing issues in the home will provide a better insight but this also has its own limitations. Additionally, having real time feedback can help the researcher to follow-up periods of inactivity with parents to help understand why these occur.

8.9.1 Children's feedback around the use of loggers

Reasons given by children for not using the loggers or how they found them difficult included:

- Size and width of the brush handles made it hard to hold which some children reporting this affected how they brushed their teeth.

- Some children struggled to brush the back teeth but this was again linked to the size of the handle.
- As they knew the DLT were recording things children would have liked to know what was being recorded sooner with quicker feedback than waiting for it to be analysed.
- Some of the children did not like the appearance of the brush, but others wanted to see what was inside the brush to understand how it worked.
- A few children declined to take part in the study or stopped during the study as they were unsure about the loggers or did not want to change from using their normal brush.

8.10 Chapter summary

The children's questionnaire showed good reliability across the 2-week test-retest periods, but showed a non-significant association between the logger and the children self-reported brushing. Although this shows that presently the self-report evaluation tool is not valid for this sample, it is reliable across time. As found with adults, the nature of over-reporting within self-report should be accounted for with children's reporting.

Through this study it can be seen that children's brushing does not follow a stable pattern over the course of a week; with brushing occurring more frequently in the morning than in the evening. Children within this sample were not brushing for the NHS (2011) recommended 2 minutes a day. The findings of this study suggest that children and parents' may require greater support depending on both time of day and day of the week. This would introduce a more complex SOHP design and require pilot research to establish the local rates of brushing but may ultimately lead to greater improvement in children's brushing and subsequently their OH.

This study highlights the potential of using DLT to improve understanding of children's routines as well as their ability to provide feedback to children and parents' about actual behaviour. Although the use of loggers is still in its early stages, there is the potential, along with traditional methods of SOHP delivery to provide quicker and more tailored feedback to all involved through greater linkage with the presently available technology. Children and parents are increasingly

living in a technology orientated world and there is a need for SOHP to utilise this technology to help link to the home and engage all involved.

8.10.1 Key behavioural findings from *study 3*

- Average brushing time 71.93 seconds.
- The most common recorded brushing frequency for children was once-a-day.
- Across the study brushing rates fluctuated between weekdays and weekends, with morning brushing occurring between 8-10am and evening brushing most frequently occurring between 7-10pm.

Chapter 9 – Discussion of intervention outcomes and research methodologies in relation to determining the effectiveness of a Global Oral Health Programme targeting 6-7 year old primary schoolchildren in NW England, UK

9.1 Introduction

Within this thesis there are three main unique aspects that have emerged:

- The use of a child-centred study design and creation of a unique package of research tools
- The child-centred evaluation of the '*Brush Day & Night*' school oral health programme (SOHP)
- The use of data logging toothbrushes to objectively record children's toothbrushing behaviour

These are discussed in relation to how they advance the current philosophy, the limitations and implication for future research, and SOHP.

The overarching focus of the thesis was to evaluate the effectiveness of a pre-designed global campaign called '*Brush Day & Night*' [77] with 6-7 year olds (*chapters 6 & 7*). Initially this was supported through piloting the individual research tools in relation to face validity for the children's questionnaire and trustworthiness for the qualitative measures (draw & write (D&W) and focus groups (FG)) and also their utility and feasibility as a methodological package. The pilot also aimed to explore teacher's initial impressions of the '*Brush Day & Night*' programme and understand any initial local adaptations required. In addition, data logging toothbrushes (DLT) were used to provide an objective measure of children's brushing in the home and allow a more robust test-retest study to be conducted to evaluate the reliability and validity of the children's questionnaire. A synopsis of the main findings of each study can be found in the relevant chapter summaries of *chapters 5–8*.

[77] It should be noted that within the evaluation in *study 2* not all aspects of the '*Brush Day & Night*' programme were incorporated; the social media and dental aspects of the programme may have increased the wider impact of the programme and streamlining of messages.

This study was conducted within two areas of Greater Manchester. The pilot study, the intervention group in the evaluation of the '*Brush Day & Night*' programme and the children in the DLT study were located in Salford. The control group for the evaluation of the '*Brush Day & Night*' programme was located in Tameside, a matched benchmark area (*section 6.4*). Both areas are predominantly urban, with areas that have a higher level of deprivation than the English average and health outcomes that are predominantly poorer than the English average (*section 1.3*). As this study was conducted with 6-7 year old primary school children, when interpreting the outcomes and considering the generalisability of these topics, the outcomes should be considered in relation to the age group and the setting the data was collected in (schools). Within the studies schools were sampled across socio-economic status (SES) but the samples sizes limited the ability to analyse at this level.

9.2 The use of a child-centred study design and creation of a unique package of research tools

Traditionally evaluations of interventions with 6-7 year olds rely on proxy reporting from parents and teachers to understand how they work, their perceived impact, and reported barriers and facilitators. Whilst dental public health (DPH) has historically relied on parental proxy reporting of toothbrushing behaviour, there is beginning to be a shift in the last decade to using more child self-report measures (Jokovic et al., 2004) and a recognition that parent's reporting reflects their perception of the 'truth' which can complement but not be equivalent to children's reporting (Abanto et al., 2014). Further to this Martins et al. (2011) found mothers reporting of their child's toothbrushing behaviour showed low levels of agreement with observed behaviour.

Throughout my research, there has been an attempt to move away from parental proxy reporting. My premise was that in order to understand a SOHP which targeted children's behaviour there was a need to understand their perspective/reflections on the SOHP and their reporting of relevant behaviours. Although it was recognised that parent's views were required to complement children's response, as they influence the behaviour in the home, their views were

taken as secondary to the children's and the teachers (Fisher-Owens et al., 2007; Bourgeois et al., 2014).

Children are able to offer a unique standpoint; either alone or supported by parents evidence. As such methodological issues should not be used as a reason for not engaging with children, if it provides the most suitable method to answer the research question. Through this research a mixed-method approach was taken, which was influenced by the pragmatic epistemological stance. The use of mixed-method was designed to provide answers to questions around behaviour, knowledge and attitudes and changes over time. As with any methodology there are strengths and weakness to a mixed-method design, Brannen (2005) writes:

> *"multi-method research is not necessarily better research. Rather it is an approach employed to address the variety of questions posed in a research investigation that, with further framing, may lead to the use of a range of methods. However, the resulting data need to be analysed and interpreted in relation to those methods and according to the assumptions by which they are generated"* (p183).

This research aimed to answer a number of research questions, and as such used a number of different but complementing methods with children, teachers and parents. Analysis was conducted in line with those suitable for each method with the clinical and quantitative methods being illuminated by the qualitative methods. Each of the research tools was designed to complement the others (e.g. through asking similar questions), thus aiding the robustness through the ability to cross-check reporting across the different methods. Additionally throughout this research the pros and cons of each research method were recognised (Brannen, 2005) (discussed in *chapter 4*).

As part of the research a new package of research tools with 6-7 year olds was designed (D&W, FG and children's questionnaires). Two of the tools were either bespoke (children's questionnaire) or unique in terms of usage (D&W) within this area of dental public health research. The D&W methodology was adapted from other fields (e.g. smoking, drugs) and methodological guidance in order to provide relevant qualitative information. The value of adding qualitative measures was to

provide insight into how the SOHP may be mediating or moderating summative quantitative outcomes obtained from clinical examination (e.g. plaque) and/or self-reporting (e.g. brushing and sugar-snacking) alone.

One of the key challenges in oral health (OH) research with primary school children is the availability of valid and reliable behavioural self-report measures relating to toothbrushing and sugar-snacking which can be applied to the evaluation of interventions (*chapter 3 & 4*). As such a bespoke children's questionnaire was developed around children's toothbrushing behaviour, support and nighttime sugar-snacking, and as part of this research evaluated in terms of the reliability and validity. Although, the questionnaire showed good test-retest reliability, a non-significant chi-squared test result was found between the subjective (questionnaire) and objective (logger) measures; which reflects findings from other studies that have correlated objective and self-report toothbrushing measures (McCracken et al., 2002; McCracken et al., 2006). Within the pilot study, some of the children explained their answers to help provide a checking system to the accuracy of their responses and also a way of checking the face validity of the questionnaire through determining what children understood of the questions.

As the developed children's questionnaire showed good test-retest reliability this tool could be used by other researchers wanting to ask 6-7 year old children directly about their behaviour using a child friendly tool. In studies with adults in comparison with objective measures it has been shown that self-reported behaviours are commonly over-reported (e.g. physical activity, Lee, Macfarlane, Lam & Stewart, 2011) or under-reported (e.g. consumption of alcohol, Klatsky et al., 2014). In relation to young children there is some research which suggests that children as young as 4 years old are able to hold a valid and stable view of themselves, indicating they should be able to report on certain topics given the correct age/developmentally appropriate tools (Sturgess, Rodger & Ozanne, 2002). Developmentally by the age of 6 children are generally able to understand different opinions but can see the world as 'black and white' (Robinson, 2008). In considering self-report with young children (instead of proxy reporting) Sturgess, Rodger & Ozanne, (2002) point out that "*practically, the children's view is valid because the child is totally involved in his or her experience the whole time*" and

that we can improve the accuracy and quality of what they report by using appropriate tools.

In research with adults and adolescents responses to questionnaires can be influenced by the social context, their understanding of the study aims and social desirability (Strange, Forest, Oakley, & Ripple Study Team. 2003). Future research could consider the inclusion of scales measuring the likelihood that children may provide socially desirable answers (Miller et al., 2014). Further to this, in dietary recall studies exploring energy under-reporting for children as young as three years old, it has been found that issues of under-reporting in relation to energy intake increase up to adolescence (Forrestal, 2011; Lioret et al., 2011). Huang et al. (2004) reported that younger children were more likely to over-report than adolescents who were more likely to under-report energy intake; with potential reasons relating to moving from being supported by parents in completing questionnaires alone. In conducting a dietary recall study with fourth graders (9-10 year olds) Baxter et al. (2004) highlight that 24-hour recall of dietary behaviour essentially relies on memory and for younger children researchers should have an awareness of how well developed children's memories are and that the length of time they are asked to recall impacts the outcomes. Currently there is limited research in OH exploring the impact of factors that can affect self-report responses with 6-7 year olds and the prevalence of under and over-reporting, indicating this is an area for future research.

Although D&W is widely used within other areas of research, this research was the first to use the method within a DPH community study to gain a greater understanding of children's knowledge, beliefs and attitudes towards OH and nighttime sugar-snacking. Within this research the use of D&W was guided by papers on the methodology, examples of previous use, the steps set out by Prosser (1998) and guidance from people experienced in using the method. Through this research it can be seen how tools more commonly used in other areas of public health (PH) research (e.g. smoking and physical activity) can be transferred into DPH. Although the delivery of the method is likely to be informed by guidance around D&W when adapting any tool it is important to carry out a level of pilot work. As found in this research the initial statements proved to be too complex and as a result of the pilot were simplified, researchers should be aware

of using simple statements when designing D&W. Within this research there was a mix of statements that directly asked about OH and those which did not directly ask about OH (e.g. around routines), this was designed to ascertain if children think of toothbrushing and sugar-snacking without being promoted. Future researchers should consider whether they want the statements to directly ask about the topic being researched or ask a more general statement (without a topic prompt) which allows different aspects of the children's knowledge to be evaluated.

Within this research it was found that children wanted to use the D&Wl in different ways; writing/labelling, drawing or using both methods. Further, some children wanted to take a great deal of time and care over their drawings which can be a challenge when there is a time frame for data collection. Future research could consider limiting how many statements are used, as this may allow children more time, there may also be a need to explain to the children more about how their responses will be used so they can decide how they need to be presented. Through this research all aspects of the D&W was used in the analysis where there was no need for interpretation (e.g. drawing and writing), however within D&W research there is a mix of studies that use and do not use the drawings as part of the analysis (e.g. Hughes, Wktton, Collins & Newton-Bishop, 1996; Bak & Piko, 2007). Future researchers need to be aware of ensuring that adult meaning and interpretation is not put onto the D&W, to aid this the D&W could be used as a starting point for discussion within a FG allowing the children to explain their D&W in more depth (Piko & Bak, 2006; Soanes, Hargrave, Smith & Gibson, 2009). Within Prosser's (1998) guide for the stages around analysis and reviewing D&W data, future research could consider the inclusion of children in this process to see how they would code and analyse the data (Angell, Alexander & Hunt, 2011).

Currently there is a dearth of evidence (*chapter 2 & 3*) around how children report routines in DPH (also discussed in *section 9.4* in relation to the use of DLT). As such one of the important outcomes of the D&W was the ability to improve the evidence base around how children report their morning and evening routines and how they integrate toothbrushing or sugar-snacking into this. Gaining this understanding from the D&W along with the information gained through the use of DLT can help improve our understanding of the home environment. Through the

evaluation period using the D&W the progression of routines increased in complexity from baseline, where many children only drew a single behaviour (e.g. of a child brushing). Following the intervention using the D&W many children were able to depict a sequence of events and where toothbrushing (and sugar-snacking) occurred. This may be due to children's awareness of their OH routines being increased (through the SOHP) and potentially due to children increasing in developmental ability through the study period. This helps provide a greater understanding for DPH around children's views of brushing routines in the home, any barriers and facilitators and how SOHP need to support the wider aspects of a routine. Through an improved understanding (e.g. of when children report brushing to occur in the morning and the evening as part of a routine), materials can be derived which support children to think about their routines and to aid the development of the correct contextual cues needed to help support behaviour change (Wind et al., 2005). The small number of children that D&W routines with no reference to toothbrushing could be a reflection of the lack of a regular routine or behaviour.

Although it was not possible within this research to analyse fully across SES (due to the limited sample size) there were some observable differences in how the children used the tools, reported behaviour/knowledge and through the process outcome reflected on the impact of SES on the evaluation. For example children within higher SES areas appeared to be more concerned with showing what they knew, wanting to know if they were correct and required less support across the methods. In contrast children in the lower SES school appeared to need more support and in the FG gave less depth to their responses. Further research may also identify if using a mixed-method approach may be more beneficial to some groups of children compared to others, in relation to gaining a complete understanding of their knowledge and behaviour and allowing them to be actively involved in the research process. Through this research there was a need to provide more guidance to some groups of children than others, within the set guidance there may be a need to consider extending a set of standardised more in-depth instructions to ensure consistency and transferability.

The use of the new tools in DPH and the outcomes illustrate how it is possible to translate methods into DPH, widening the ability to work in a child-centred way

and gain new insight. In addition to those outlined above, through this research there are a number of key lessons learnt in relation to the research tools:

- Firstly, through the initial pilot study there was a shift from researcher designed ('top-down') evaluation tools (e.g. D&W and FG) to incorporating several 'bottom-up' developments in relation to children and teachers outcomes (e.g. change in language, re-design of question and addition of resources for teachers); this aided the usability of the tools in later studies.
- Secondly, within the plaque exam children were able to play a role in helping to record their score, becoming a part of the research, and also having someone answer a questionnaire in the same area while waiting helped make the children feel more comfortable.
- Thirdly, although the FGs were able to provide answers which illuminated the quantitative responses, future research should consider how to improve the interaction between children, the use of props and having questions displayed seemed to be well received by the children but there were times when interaction was less evident as in some FGs.
- Fourthly, the research tools were designed to follow a stepped process (MRC, 2008), with the implementation designed to be delivered in a way that increased in complexity. This design was also aimed to help children move to thinking about OH from their current lessons. Through this study it is not possible to determine any order effects, and how this may have affected children's reporting and engagement; as such further research is needed to understand any impact of this design on outcomes.
- Finally, this research shows how a diverse range of tools (used in OH currently and from other areas of PH) can be used, to engage children to gain a fuller picture of the impact of an intervention from their perspective but that the limitations and confounding factors between these methods need to be accounted for in the design and analysis of future studies.

9.3 The child-centred evaluation of the '*Brush Day & Night*' SOHP

This research adds to the previous literature that SOHP are often able to change knowledge but not able to impact on behaviour at a population level (Kay & Locker, 1996 & 1998; Sprod, Anderson & Treasure, 1996). Whilst the evaluation of

the SOHP indicated that the intervention group (children) had increased their knowledge around OH (as with many previous SOHP) and the understanding of the need to maintain OH behaviours (specifically in relation to when, how often and how long they should brush), there were no population level changes in reported brushing rates or significant changes in plaque scores. Across the intervention period there were children who self-reported both positive and negative changes in behaviour across the three time periods. It may be that children changed their brushing behaviour but simply were not effectively removing the plaque. Reasons for the lack of significant behaviour changes were somewhat illuminated by the self-report measures, which highlighted that many of the children (and the small population of parents) already reported brushing twice-daily, and had low baseline plaque measures which likely corroborates this behaviour. The fact that OH in this group was already reported to be fairly good poses a challenge for interventions to then be able to detect a measurable change as a result of an intervention. This challenge can be somewhat overcome by the availability of DLT, which are recommended where resources allow, and that future research incorporate objective baseline measures and improve the accuracy of recording of current brushing at baseline and rates across interventions.

Children's recollection of key messages was poorer at follow up, than post-intervention. It appears that during the more intensive phase of the SOHP (the period between baseline and post-intervention), whilst the intervention was being delivered in schools by the teachers, that the children were engaged regularly, and therefore retained the key messages and learning from the intervention. However, post-intervention, when the activities within schools and lessons had been completed this learning appeared to tail off, which may be a result of the fact there was no active reinforcement of the messages and programme within the schools. Within the SOHP continued reinforcement in the home during the follow-up period was designed to be provided by continued use of the brushing calendar and through the website, both of which had low levels of reported use during the follow-up. Although the number of questionnaires returned by parents was too low to be generalised to the study population, in those returned by parents there were a number of comments in relation to the lack of support after the first month in

maintaining the intervention. For future SOHP it is recommended that having greater supported follow-up activities (to ensure a continued active involvement with the '*Brush Day & Night*' programme) would help with reinforcing the messages from the SOHP, improve maintenance and reinforcement of the core messages and behaviours and increase the likelihood of behaviours being sustained (Watson et al., 2011; Wind et al., 2005). Future design of the SOHP could be informed by an example of a programme targeting obesity in children with active follow-up. The GOALS programme continues to provide support to participants allowing them to return to take part as a full participant in intervention sessions when required and has been shown to produce a more sustained behaviour change (Watson et al., 2011).

A key to the implementation of this research within schools was the help of the Healthy Schools Coordinator. Future SOHP could make use of different co-ordinators working with schools to play a role in the maintenance and support of SOHPs, through potentially helping co-ordinate activities between schools. Their knowledge of the schools, helping to recruit schools and advice about requirements for outside interventions running in schools was vital and future research should consider ensuring stakeholders knowledge are considered in the design and checking prior to studies being conducted.

One of the challenges faced in this intervention related to intervention fidelity. Teachers were provided with both verbal and written guidance around delivery and the process of the research. However, while all teachers delivered all of the core components of the SOHP as intended, some of the teachers incorporated additional activities for the children. Within educational research it is known that teachers, in the majority of cases, add to an intervention to ensure it is the most beneficial for the children (Christopher et al., 2003; Hansen et al., 2013; Miller-Day et al., 2013). However, for future SOHP, prior to implementation of the programme it is recommended that providing teachers with basic training ('train the teacher' model) will not only help ensure their level of knowledge is suitable prior to delivery but will also help reiterate the need for a standard delivery as part of evaluations (Nyandindi et al., 1995). It is also suggested that packs provided for teachers include a greater number of activities to undertake with the children. These are needed to enable the teacher to differentiate between different abilities in the class

to ensure that all benefit from the programme. For example with the '*Teeth Chiefs*' there is the possibility to develop resources to accompany the cartoons to reinforce the messages (e.g. as occurred in the evaluation study creating your own '*Teeth Chief*'). Future versions could also consider the possibility of having a place for teachers who created new resources to share these on the website. It is anticipated that through having a better understanding of revisions being made by teachers, and being able to monitor these, this could potentially facilitate the incorporation of relevant best practice and improve the process evaluation information about the programme.

Although this study was evaluated with children in year two, some of the small amount of parents who returned the questionnaire reported feeling their children should learn about the importance of OH prior to year 2 (age 6-7 years). Within England, OH is first taught as a specific topic in year 3 (7-8yrs). OH messages are not continually reinforced in schools as children are developing their own OH routines up to adolescence; whereas other messages about nutrition (e.g. '5 a-day') and physical activity are reinforced consistently through school. The Scottish '*Childsmile*' programme works across the life course from birth through primary school, delivering consistent messages and providing resources to complement the programme (www.child-smile.org.uk). This is a national programme, in contrast to the more local toothbrushing programmes that occur in England. Although there are positives to both, developing a stronger life course approach to SOHPs is likely to increase the chances of changing behaviour, along with the national prominence of OH. It is suggested that a future version of the '*Brush Day & Night'* programme could look to target different ages through the development of OH routines.

The mixed-method approach was designed to provide a more complete picture of children's understanding and identifying areas where they have less knowledge and understanding. For example, areas such as germs and the time you should spend brushing were areas that children appeared to need more support to improve their knowledge and behaviour. For some children within this study toothbrushing appeared to be a trade-off between other activities they would rather be doing and also balancing the perceived cost-benefit of the behaviour. Although support was reported to be low by children in terms of brushing, this research has

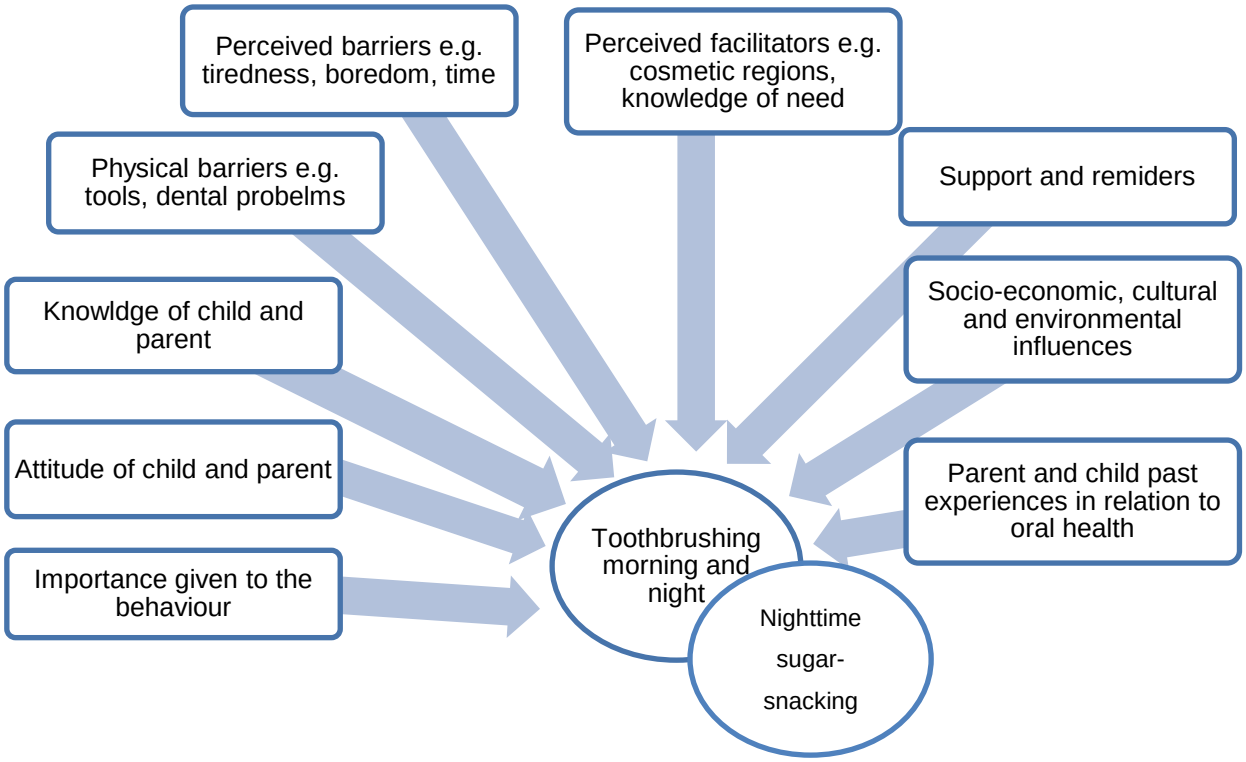
highlighted how children perceive ‘support’, and importantly that a parent reminding them about brushing was *not* seen as support. Within this study children used their own language/terminology to describe concepts (e.g. in *study 2* sugar bugs for germs and Velcro to describe how germs work), which differs from terminology used by adults. Children are still developing their vocabularies, and how they understand topics. This reinforces the fact that a purely top-down, adult developed intervention may use language that is too complex or does not correspond to children’s association with the topic, which may limit the impact of interventions. Moreover, this research adds weight to the fact children can report their own behaviour and knowledge levels, and that interventions would benefit from consulting children in respect of intervention design and evaluation.

Across differing PH areas there are common underlying social determinates that cause barriers or facilitators to implementing the desired behaviour. This has been highlighted through research by Yevlahova & Satur:

> *“Addressing causes of oral disease in isolation from the clients’ life and social circumstances is ineffective in both the short and long term”* (2009, p196).

With children this can be more complex as there is a need to consider the multiple influences in terms of both people and locations. *Figure 9-1* illustrates the main focus of the intervention (in the centre) and the factors that were found within this research that were most likely to be having an effect. These determinants reflect many of the aspects of the social determinants of health set out by Dahlgren and Whitehead (1991), as well as study specific determinants reported by the children, teachers and parents. Within clinical and educational interventions Watt (2005) highlights that lack of sustainable changes, can be due to the lack of consideration of the underlying causes of poor OH (e.g. underlying social determinates, access to suitable food and fluoride products).

Figure 9-1 Focus of the intervention and factors that were most likely to be having an effect



Within the evaluated '*Brush Day & Night*' programme there was a greater emphasis on the behaviour of toothbrushing in relation to sugar-snacking. The SOHP had two lessons focusing on toothbrushing, fluoride and teeth, compared to one lesson around germs and the impact of food. This imbalance was also evident within the focus of the home pack, both through the materials for behaviour reinforcement and the information provided for parents.

The '*Brush Day & Night*' programme was designed by a multinational company, to target certain behaviours but not necessarily account for all the wider determinates. There are a number of SOHP designed by multinational companies such as Colgate, GSK and Unilever, all of which aim to improve toothbrushing behaviour and provide infrastructure and resources (Bourgeois et al., 2014). Across many areas of PH where multinationals are involved in the design of intervention it can also be proposed that they have the secondary and necessary goal relating to business around impacting on brand recognition and potential market share (BMA, 2012). Unilever Oral Care have a long history of partnerships with the FDI designed to improve children's OH globally (focusing on twice-daily toothbrushing), with the '*Live.Learn.Laugh*' partnership now in its 10th year, and

including phases which build on learning from previous evaluations (Dugdill & Pine, 2011; Pine & Dugdill, 2011) to refine the programme and continue to improve effectiveness (Horn & Phantumvanit, 2014). The overall objectives of Unilever Oral Care and DPH align with respect to the desire to increase the use of fluoride toothpaste and optimum toothbrushing behaviour. One aspect of Unilever's sustainable living plan (in relation to improving health and wellbeing) is around improving OH[78], with the target having already been exceeded with 52 million people reached through campaigns since 2010 (Unilever, 2015). However, in many of the SOHP devised by multinationals there is less alignment around the need to equally provide messages and support around reducing nighttime sugar-snacking behaviour. In relation to this Unilever have sustainable living plan goals around reducing sugar in ready-to-drink teas, reduce calories in children's ice cream and providing health eating information through clearer and simpler labelling on products, with each of these reported as having been met (Unilever, 2015).

Although there are many benefits to working in public-private partnerships (PPP) there is also a need to consider potential tensions that can arise through differing agendas (Bourgeois et al., 2014; Ruckert & Labonté, 2014). Nishtar (2004) recognises that although there is a need for these partnerships, the complexities of them can raise a number of ethical considerations. These could include for example, challenges in contributing to common goals and objectives, conflict of interest and impartiality in health and operational and process challenges (e.g. participatory approach to decision marking, power relationships and governance structures). In England an example of PPP, which aims to bring together commercial, voluntary and public-sector, is the '*Public Health Responsibility Deal*' (2011) which has divided opinion as to its effectiveness and delivery mechanism (organised around voluntary pledges relating to alcohol, food, health at work and physical activity). Petticrew et al. (2013) highlight one of the concerns being around the interest of industry being given more prominence than potential benefits to PH and that due to the complexity of the deal it will be very hard to effectively evaluate. With any PPP there is a need for independent and external

[78] "We will use our toothpaste and toothbrush brands and oral health improvement programmes to encourage children and their parents to brush day and night. We aim to change the behaviour of 50 million people by 2020." (taken from - http://www.unilever.com/sustainable-living-2014/improving-health-and-wellbeing/health-and-hygiene/targets-and-performance/index.aspx#13-385596)

evaluations to be conducted to ensure they are impartial and independent of any of the bodies involved. The BMA (2012) raised concerns about the potential agenda of commercial organisations in relation to the Responsibility Deal relating to financial gain which is likely to lead to a number of conflicts of interest; but they also recognise that business and industry play a significant role in shaping PH environments. There are a number of tensions in PPP around governance, monitoring, regulation, resources, management, delivery and accountability that all need to be considered when working with industry (Nishtar, 2004; Ruckert & Labonté, 2014). However, despite the challenges there is a need for continued collaboration between public and private sectors that can help to provide the resources required to target OH and also help scale-up interventions.

Within OH whilst toothbrushing plays an important role in helping to reduce rates of dental caries, reducing children's nighttime sugar-snacking behaviour is also vital (Levine & Stillman-Lowe, 2004). A recent systemic review by Moynihan & Kelly (2013) found for those studies targeting children there was a positive association between sugar and caries. Within OH The impact of sugar as a mediator in the development of dental caries is un-disputed (Sheiham & James, 2014) however, within SOHPs the component of interventions that focus on this topic and elements of nutrition is often secondary and given less prominence than the focus on OH (Cooper et al., 2013). Through the qualitative research with the children, although they had a good understanding of foods that where healthy/unhealthy for our teeth, they were less likely to report drinks that were bad/good for our teeth. As found with areas of knowledge around OH when children were asked how sugar can impact on our teeth this knowledge was less well developed and an area for future SOHP to target. Across the studies it was evident that the children were very aware of '5 a-day' and that this was the main nutrition message given to them around keeping healthy. The design of future SOHP should consider providing material and information in the home that relates to the impact of sugar-snacking to help raise the importance of these messages.

The weighting of messages that SOHP focus on is likely to be impacted by the responsibilities, expertise and resources of those who are designing and delivering them. However, taking a holistic approach to combining topics within PH with common aetiologies is gaining prominence in the literature (Wiefferink et al., 2006;

Peters et al., 2009; King et al., 2015). However, this is not without challenges, for example the added complexity of delivering multiple messages. Whilst delivering one message helps interventions to be kept simple and more easily understood and it can be less complex to determine intervention effectiveness, it does not account for the interconnectedness of many PH topics and the common determinants that can impact behaviours (Busch, de Leeuw, de Harder, Schrijvers, 2013). For example, nutrition, OH and obesity share common aetiologies in relation to sugar, so it is feasible to suggest that programmes targeting these areas should be combined (Mobley et al., 2009; Cinar & Murtomaa, 2011). The '*Fit for School'* programme in the Philippines is an example of a primary school programme shown to impact behaviour and health outcome which targets daily toothbrushing with fluoride toothpaste, plus daily handwashing with soap and biannual deworming (Monse et al., 2013). This illustrates how toothbrushing can be combined with other behaviours effectively with young children. Currently, evidence around the effectiveness of interventions targeting multiple behaviours over those targeting single behaviours is mixed, and there is a need for further research around this topic in relation to primary school children and OH, with many examples of research being with older children and adults and not OH topics. For example, Busch et al. (2012) in reviewing interventions targeting multiple adolescent behaviours in schools found that for this age group in schools targeting more than one behaviour may be effective. Further to this, Brown & Summerbell (2009) in reviewing the evidence around childhood obesity interventions concluded for diet and physical activity interventions "*it is not clear whether it is more effective to target single or multiple behaviour change outcomes (energy restriction and increased PA)*." (p138). Further research is also needed around the best design for multi-message interventions in OH with primary school children. Vandelanotte, Reeves, Brug & De Boudeaudhij (2008) explain there are two main types of interventions targeting multiple behaviours; simultaneous and sequential; although other research has found difference in the effectiveness of the two designs their review found for physical activity and fat intake studies in adults the two designs appear to be equally effective and not impacted by the order of intervention delivery.

Globally, nationally and locally there are a large number of initiatives that target toothbrushing and nutrition in the schools, both within interventions targeting individual behaviours and those focusing on one behaviour with some elements of the second behaviour (Sprod et al., 1996; Kay & Locker, 1996 &1998; Stillman-Lowe, 2008; Dugdill & Pine, 2011), however, the challenge is that the behaviours are initiated, practiced and reinforced mainly in the home (Wind et al., 2005). The home can be a difficult location both to evaluate interventions and to initiate interventions effectively, as they are predominantly out of the full control of researchers. Moreover, the complexity of the home living arrangements that some children experience is often not accounted for through SOHP resources. It is known that the home is an important influencer and mediator in the development of behaviour and is also the natural location of toothbrushing behaviour so it is important to strengthen the links to help aid and sustain behaviour change (Castilho et al., 2013; Bourgeois et al., 2014). Within the current '*Brush Day & Night*' programme there are only limited links between the school and the home, with details of the content of the lessons not being fully conveyed to the home. Through the methods used in this study, i.e. through actively engaging the children in FG and understanding their routines as part of the D&W, it was possible to gain a greater insight into the home and how a SOHP may need to develop to help the correct cues to be acquired. It is recommended that future versions improve the link between the home and the school, either through sheets explaining each lesson or joint homework for children/parents.

In this thesis, as found with other interventions reviewed as part of the Cochrane review (Cooper et al., 2013), the materials provided as part of the '*Brush Day & Night*' intervention were more active for children (e.g. taking part in the SOHP and completing the brushing calendar at home) and teachers (e.g. delivering the SOHP in schools) than for parents. Parents were required to read the literature sent home and then support their child with the brushing calendar, and if possible, provide access and reinforcement through the website. Currently the wider family were not actively included within the intervention materials and design; with resources and encouragement materials only being provided to one child in each family due to availability and the focus of the evaluation. Through the feedback from children it was evident that other members of the family used the brushing

calendars and toothpaste and were included in changes to brushing routines. Although it is not always possible to provide full resources for all the family, having a means for other children to be involved may help improve the engagement in the home. For example, the '*BeamBrush*' allows the whole family to connect a number of their brushes to a single app showing individual toothbrushing behaviour, allowing families to compare and discuss the tracked toothbrushing and adding in elements of gaming to motivate family members to be the top brusher (http://beamtoothbrush.com/). Using this premise future SOHP could design apps containing digital brushing calendars where each child/parent can mark when they brush and then unlock individual rewards. Within OH it is also well known that the family environment and parent's behaviour impacts children's OH, so being able to actively involve them may enable greater behaviour change (Castilho et al., 2013; Bourgeois et al., 2014). Within other areas of PH, such as obesity interventions, the importance of including the whole family is recognised and now incorporated into interventions such as MEND (Law et al., 2014) and GOALS (Watson et al., 2011), and it is recommended that future versions of the SOHP could incorporate lessons from this research around involving the whole family. Within this thesis parent's attitudes towards their ability to change, initiate and maintain the targeted behaviour was not investigated, however, given the importance of parents in terms of reinforcement and influence on children's behaviour (Bourgeois et al., 2014), this is an area of further research in future evaluations of the SOHP.

Within the evaluation of the '*Brush Day & Night*' SOHP parental response rates were poor in comparison to the high children's response rate (*section 6.7.1*). This limited the ability to compare children's and parent's reporting and restricted the usefulness of the parent's data, impacting this aspect of the evaluation. In the evaluation of the '*Brush Day & Night'* programme the focus of the results of the parent's questionnaire was on the baseline reporting. In relation to the evaluation this impacted understanding of parents reporting of toothbrushing and sugar-snacking behaviour in the home and how they reported supporting their child to develop good OH practices. In relation to parental non-responders in caries prevention programmes and poor return of questionnaires, Splieth et al. (2005) found that these parents generally exhibited poorer preventative behaviours, and as a result children had poorer OH.

Research has shown that on the whole response rates to questionnaires are reducing but there are many studies which have obtained a higher response rate than achieved in the main evaluation study in this research (Nakash et al., 2006; Rolstad et al., 2011; Sahlgyist et al., 2011). In evaluating the '*Brush Day & Night'* programme the same questionnaire was issued at each of the 3 time points, which may have impacted on the response rate negatively. One parent commented at follow-up '*bit frustrating doing the same questionnaire 3 times*', suggesting questionnaire fatigue. In the final study involving the DLT the questionnaire was shorter linking directly to questions on the children's questionnaire (5 questions) and the demographic questionnaire (16 questions), this led to a higher response rate (70%) than the longer questionnaire. Compared to the questionnaire in the study using DLT, in evaluating the '*Brush Day & Night'* programme a greater amount of information was sought in relation to the aims of the study (around sugar-snacking, toothbrushing and routines and parent and child behaviour). Through lessons learned in this research, future evaluations should consider the necessity of information gained through a longer questionnaire and whether a shorter more focused questionnaire would improve the response rate while still providing the desired information in relation to the study aims.

There are a number of lessons that can be learnt from this study in relation to improving the response rate of the parent's questionnaire and limiting the impact of issues around being able to use the results. Questionnaire length, method of delivery, and complexity of the questionnaire has been found to impact on response rate (Edwards et al., 2004; Mond et al., 2004; Rolstad, Adler & Rydén, 2011). The findings from the Cochrane review by Edwards et al. (2009) around methods to improve postal and electronic response rates could have been better incorporated into the design of this research. For example, personalised letters sent to parents to ask them to send back the questionnaire. Further it may have helped to have held a session in the school to support the completion of the questionnaires and collect them straight away. Moreover it was not possible in this research, due to resources, to provide a pen (Sharp et al., 2006) or the use of incentives (Singer & Ye, 2013), which have been found can help improve the response rates for questionnaires. In the responses gained from the parents there is also a risk that parents wanted to be seen as enforcing the correct behaviours in

their children, therefore may have answered questions in a way that can produce '*social desirability bias*' (Rossiter & Robertson, 1975; Richman et al., 1999; Hofferth, 2000).

Through an analysis of the main focus of behaviour change techniques (BCT) within the '*Brush Day & Night*' SOHP it was found they were most commonly designed to change knowledge. It is recognised that increasing a person's knowledge alone is not sufficient to produce/sustain behaviour change (Stillman-Lowe, 2008), but is seen by some as a necessary prerequisite (Bourgeois et al., 2014). Future SOHP need to place a greater emphasis on ensuring the BCT embedded within the SOHP are designed to change behaviour rather than just increase knowledge. Programmes need to be long enough to initially aid the correct behaviour to develop, and enable habit formation; then to help maintain and reinforce a behaviour change i.e. ensure habitual behaviour is established and embedded in a daily routine (Oshikanlu, 2006; Verplanken, 2006; Wood & Neal, 2007). Consideration needs to be given to the theoretical underpinning for the interventions, and the range and types of BCT within interventions (to encourage active skill development and sustained behaviour change). There needs to be further research to explore how different BCT impact on the delivery and capability of the intervention design to change the desired behaviour (Abraham & Michie, 2008). In DPH it is currently not known what the most suitable/effective BCT are to help produce sustained changes in children's toothbrushing and nighttime sugar-snacking behaviour; leading to the need for further research in this area.

As this research was conducted with primary school aged children there were a number of ethical considerations, which are important to highlight for future research in this area. To ensure the children's autonomy an important aspect of this research was to allow children to go against parental consent, for all or part of the research. In evaluating the '*Brush Day & Night'* programme, this occurred in relation to the small number of children who declined the plaque exam and in the study using DLT the small number who did not want to take part once it had been explained. Verbal assent was gained as an ongoing process (once the studies had been explained) with children during each of the studies and their assent was also expressed through a willingness to participate or desire to not take part. When talking to the children about the studies and gaining their assent, it was clear that

many parents had discussed the research and sought their child's opinion prior to signing the consent form. Using these methods of obtaining consent from children may pose some limitations. Children may feel that if their parents have given consent they cannot go against this and also in a school environment some children may not feel able to decline participation. In this research it was felt to be most appropriate to use parental informed consent and child assent. The decisions to only gain assent with children was taken in relation to the need for informed consent from parents due to working in schools, the children's age and a decision that verbally describing the studies to children, allowing questions and gaining verbal assent following this would be the most suitable for this research and the class setting. However, future research could look at how to improve the consent process through the use of child friendly information sheets and consent forms (Hurling et al., 2013), which would allow informed assent to be gained from both children and parents. These could either be in the traditional form or to help younger children through different media (e.g. cartoons/comics). A further factor future studies need to consider if they gained informed assent from 6-7 year olds is their understanding. For example, Chappuy et al., 2008 found for 8.5-18 year olds, their ability to provide informed assent/consent and level of understanding varied between different concepts (e.g. disclosure, duration and voluntary participation) and across different age ranges.

Finally, through the evaluation of the '*Brush Day & Night'* programme, this research provides details that can be used to calculate sample sizes for future cluster-designed trials with schools. This study provides an estimate of standard deviation for the primary outcome (plaque) and an estimate for the intra-class correlation coefficient, which allows future SOHP evaluation sample sizes to be calculated.

9.4 The use of data logging toothbrushes to objectively record children's toothbrushing behaviour

This study was unique in the fact that there are no other published studies that have used DLT to record free-living toothbrushing behaviour of 6-7 year olds over a one month period or looked at objectively validating children's ability to recall their brushing habits over a set period of time.

Improving understanding around these aspects will improve the ability to: tailor interventions; provide a more accurate baseline measure of behaviour (than via self-report); allow an understanding of when behaviour is present or absent, and finally improve understanding of how brushing patterns differ in groups of the population (e.g. those who don't have a nighttime routine and those who don't brush for long enough). Gaining a better understanding of these aspects can help interventions and allow them to be tailored to best support the aspects of toothbrushing behaviour that require supporting within different groups. As this understanding is still mechanistic there is likely to still be a requirement to understand the 'why' around the outcomes of the objective measure to support the children and parents in developing the correct twice-daily toothbrushing routines. Further, through the use of DLT with different age groups and combining these measures with traditional methods (including qualitative methods) this could aid the development of an understanding of a child's toothbrushing behaviour across the life course. This would allow researchers and those designing interventions to develop SOHP that target the specific challenges around toothbrushing that appear to be experienced differently in different age groups.

In relation to the D&W results around routines (*section 9.2*) using the DLT mean toothbrushing rates (greater number of recorded events during the week compared to weekends) and mean brushing time (shorter during the week than at weekends) fluctuated over the week. Although the sample size was small, it was found that across SES brushing occurred more frequently in the morning than the evening. Peak brushing time was most frequently between 8-10 am, with a less prominent peak of brushing occurring in the evening (range from 7-10pm). As may be expected for the majority of children when behaviour was recorded using the DLT, weekend brushing occurred later in both the morning and evening. Trubey, Moore & Chestnutt (2014, 2015) found through two self-report studies with parents of 3-6 year olds that they reported brushing their children's teeth more frequently in the morning than the evenings and that brushing as part of morning routines was easier than evening routines. They reported this being impacted by the changing nature of everyday routines and parents motivations for brushing (e.g. cosmetic reasons in the morning). Further, the objective measures showed the mean length of a brushing episode remained relatively stable over the week (1

minute 11.93 seconds). Within the SOHP the '*Teeth Chiefs*' cartoons raised the awareness that children needed to brush for 2 minutes, but this finding suggests this may be an area that needs to be targeted within future interventions (e.g. by providing 2 minute timers) in addition to frequency of brushing. Through further research it may be possible to understand if children's depiction of routines in the D&W is a reflection of their objective brushing and how interventions can be tailored to support different groups of brushing behaviour. In the study using DLT there were a number of additional ethical considerations, due to the use of a behavioural measurement device and also asking children to change their current brush. In *study 3* children were asked to brush as normal using the DLT and parents were asked to remove their usual toothbrush and maintain their children's present brushing pattern. This was the first study to measure children's objective behaviour using DLT in a home setting; however greater research is needed into the most suitable ways to provide children with these toothbrushes while not upsetting routines. A challenge found within the study using DLT was the impact of providing children with a new 'tool' for brushing their teeth but also relying on them adopting this tool, as it was also the measure. As found in this study, this can lead to both sporadic data collection (e.g. brush not being used for periods of the study) and challenges of collecting data (e.g. data loss and data management).

Until the home and the variations in the home across communities, populations and cultures is understood (in relation to time of day, weekdays/weekends and length of brushing), sustaining a behaviour through only a SOHP and passive home intervention has the potential to continue to be problematic. As there is currently a dearth of research in this area relating to DPH there are a number of recommendations that can come out of this study for both future research and practice:

- Within evaluations of SOHP the use of DLT can aid understanding of how a person's behaviour changes or remains stable at different stages of a SOHP, providing greater insight into the process of behaviour change.
- Currently many SOHP treat all brushing instances as the same (for ease and practical reasons) but through the use of the DLT this research has begun to show that this is not the case with differing patterns of brushing observed in the morning/evening and on different days of the week.

Improving our understanding of objectively measured brushing behaviour most likely needs to be accounted for within the design of materials, teaching and supporting activities, in order to help facilitate and support any behaviour change through providing support where behaviours may be less well developed. An improved understanding can also help enhance the design of SOHP in developing materials that place more emphasis on toothbrushing being part of a larger routine in the morning and evening (e.g. in relation to meals, washing and dressing).

- A further area DLT can help to advance is our understanding around the makeup of children's brushing episodes (e.g. how long is the brush in contact with the teeth and where, when is the brush in the mouth but not being used, how often and for how long is the brush removed from the mouth and then brushing recommences). Gaining a better understanding of this will aid the design of SOHP and understanding of how best to support children and parents in the formation of the correct behaviours.
- Future research should also focus on understanding the issue of compliance as it is not currently possible, through this research, to know if no recorded brushing meant a lack of behaviour or if it occurred for another reason.
- Future research incorporating objective baseline measures has the potential to select groups of children and add elements targeting frequency, duration or stability of routines (i.e. targeted tailoring of interventions). For example, presently it is not easily possible to objectively identify children or families who may require greater support to achieve twice-daily brushing.
- There is the potential to develop real time feedback for teachers, researchers and dentists from logger brushes or apps that provide simple cues and questions which can help those who require greater support to be targeted, or parents who are not as engaged to be provided with additional support.

Finally, the development and use of the technology is initially resource intensive, however improving monitoring mechanisms may help ensure costs are diverted to those who require the greatest support to develop the correct brushing routine. Having an objectively measured view behaviour over a given time period allows for

more informed conversations with children (and parents) around toothbrushing. This could be through to showing them their brushing pattern and talking about the times when brushing may not be occurring as recommended, to allow more focused and personalised interventions. New OH technology has the potential to help improve the link between learning in the school with the behaviour and reinforcement in the home. It is envisaged that greater personalised feedback will help tailor the programme in relation to needs around frequency, duration of brushing etc. which is likely to improve the ability of the programme to change and sustain behaviour change. Research would be needed to understand the impact of adding complexity to the interventions on the home and schools and how this impacts outcomes and intervention fidelity.

The challenge is to integrate objective monitoring and correct behaviours around sugar-snacking and nutrition, which are more complex to monitor and impact. The difficulty is understanding, using a more objective measure how sugar-snacking changes between weekdays and weekends, but also between school and home.

9.5 Thesis conclusion

This thesis provides further insight into the previously little understood area of 6-7 year olds self-reporting of their OH behaviours and adds to the debate about the need to improve child self-report measurement within OH. In addition, this thesis for the first time provides an objectively measured understanding of 6-7 year olds toothbrushing habits within the home, aiding the development of future SOHPs. Through explanations of '*sugar bugs*' sticking to brushes and toothpaste, germs being like Velcro, sharing of toothbrushes still occurring and stories of home dental extractions by parents, this study has provided a unique understanding of OH, nutrition and the related topics that would not be gained from proxy reporting. This aids the understanding of concepts, language, beliefs, knowledge and behaviours of 6-7 year olds.

Through taking a pragmatic epistemological stance and using a mixed-method design this enabled direct engagement with 6–7 year olds on topics relating to DPH. Through improving the understanding of children's current knowledge and behaviour, the design, and method of delivering future versions of the '*Brush Day & Night*' SOHP intervention can be improved. The research supports previous

research by Marshman et al. (2007) and Marshman & Hall (2008) that DPH research with children needs to continue the move from research *on* to research *with* children.

As with many new SOHPs the '*Brush Day & Night*' programme has both facilitating factors and barriers to its effectiveness. Although schools continue to be an important site for the delivery of interventions it is not the natural location of the behaviour. Further research is needed to understand the life course of habit development in the home, potentially through the use of DLT longitudinally. Greater consideration needs to be given to the BCT within interventions, and how these impact on the delivery and capability of the design to change the desired behaviour.

Transferring interventions from the school to the home is still an area that needs development and further research, with new technologies potentially aiding the link between school, home and researcher. The studies in this thesis further highlight 6–7 year olds ability to be a key part of the research process and to provide valuable contributions (Gill et al., 2008; Freeman et al., 2010; Gill et al., 2011). The outcomes support the necessity to tailor methods and interventions to the age of the participants and their developmental level (Porcellato et al., 1999; Mitchell, 2011). Following this research there are still many unanswered questions about behaviour development in the home and how to effectively sustain and support this through SOHP.

There is a continued need to move OH from being seen as separate, to being integrated into other areas of health promotion. It is important to improve the links across national curriculum topics. Along with many areas of PH, DPH is at a time of transition in England in relation to structures of delivery. There is the potential to work in greater multidisciplinary teams, as is becoming common, and develop new technologies to aid classic designs.

As stated by De Winter et al. (1999) the overall message is:

> "don't develop programmes <u>for</u> children, but <u>with</u> them" (p22).

Although research can take longer, requires greater flexibility, and methodologies that may be new to researchers, 6-7 year olds *are* valuable contributors to DPH research and the evaluations of SOHPs.

This research has highlighted, through child-centred research methods, that the SOHP could be enhanced by additional BCT that focus on behaviour and skill development (as well as knowledge), a greater link between the school and home environment, and the incorporation of the variability in toothbrushing behaviour through the week, as revealed by the DLT.

References

Abanto, J., Tsakos, G., Paiva, S.M., Raggio, D.P., Celiberti, P., & Bönecker, M. (2014). Agreement between children aged 5–6 years and their mothers in rating child oral health-related quality of life. *International Journal of Paediatric Dentistry, 24*(5), pp.373-379.

Abraham, C., & Michie, S. (2008). A taxonomy of behavior change techniques used in interventions. *Health Psychology, 27*(3), pp. 379-387.

Adami, M.F., & Kiger, A. (2005). The use of triangulation for completeness purposes. *Nurse Researcher, 12*(4), pp. 19-29.

Alibali, M.W., & Nathan, M.J. (2010). Conducting Research in Schools: A Practical Guide. *Journal of Cognition and Development, 11*(4), pp. 397-407.

Allen, C.R., Hunsley, N.K., & MacGregor, I.D.M. (1996). Development of a force-sensing toothbrush instrument using PIC micro-controller technology for dental hygiene. *Mechatronics, 6*(2), pp. 125-140.

Allensworth, D.D., & Kolbe, L.J. (1987). The Comprehensive School Health Program: Exploring an Expanded Concept. *Journal of School Health, 57*(10), pp. 409-412.

Allukian, M., Jr. (2000). The neglected epidemic and the surgeon general's report: a call to action for better oral health. *American Journal of Public Health, 90*(6), pp. 843-845.

Al-Namankany, A.A., Ashley, P., Moles, D.R., & Parekh, S. (2009). Assessment of the quality of reporting of randomized clinical trials in paediatric dentistry journals. *International Journal of Paediatric Dentistry, 19*(5), pp. 318-324.

Amin, M.S., & Harrison, R.L. (2009). Understanding parents' oral health behaviors for their young children. *Qualitative Health Research, 19*(1), pp. 116-127.

Aminabadi, N.A., Ghoreishizadeh, A., Ghoreishizadeh, M., & Oskouei, S.G. (2011). Can drawing be considered a projective measure for children's distress in paediatric dentistry? *International Journal of Paediatric Dentistry, 21*(1), pp. 1-12.

Ammari, J.B., Baqain, Z.H., & Ashley, P.F. (2007). Effects of programs for prevention of early childhood caries: A systematic review. *Med Princ Pract Medical Principles and Practice Journal, 16*(6), pp. 437-442.

Angell, C., Alexander, J., & Hunt, J.A. (2011). How are babies fed? A pilot study exploring primary school children's perceptions of infant feeding. *Birth,38*(4), pp. 346-353.

Armfield, J.M., Stewart, J.F., & Spencer, A.J. (2007). The vicious cycle of dental fear: exploring the interplay between oral health, service utilization and dental fear. *BMC Oral Health, 7*(1), pp. 1-15.

Armstrong, R., Waters, E., Moore, L., Riggs, E., Cuervo, L.G., Lumbiganon, P., & Hawe, P. (2008). Improving the reporting of public health intervention research: advancing TREND and CONSORT. *Journal of Public Health, 30*(1), pp. 103-109.

Ashcroft, A., Burnside, G., & Pine, C. (2005). *Evaluation of the school-based oral health education programme 'Signaline' final report*. University of Liverpool. Lever Fabergé: Department of Dental Public Health, Primary Dental Care. Final Report for protocol DEN-HAB-05-001.

Ashley, P.F., Attrill, D.C., Ellwood, R.P., Worthington, H.V., & Davies, R.M. (1999). Toothbrushing Habits and Caries Experience. *Caries Research, 33*(5), pp. 401-402.

Association of Public Health Observatories & Department of Health. (2014a). *Health Profile - Salford Unitary Authority 00BR*.

Association of Public Health Observatories & Department of Health. (2014b). *HealthProfile - Tameside Unitary Authority 00BT*.

Assuncao, V.A., Luis, H.S., Bernardo, M.F., Martin, M.D., Leroux, B., Derouen, T.A., & Leitao, J.M. (2008). Evaluation of a 7-year school-based community dental hygiene programme in Portugal by high school teachers. *International Journal of Dental Hygiene, 6*(1), pp. 37-42.

Audit Commission. (2010). *Giving Children a Healthy Start: Health Report*. London: Audit Commission. Retrived from: http://dera.ioe.ac.uk/10723/1/20100203givingchildrenahealthystart.pdf

Aunger, R. (2007). Toothbrushing as routine behaviour. *International Dental Journal, 57*, pp. 364–376.

Axelsson, P. (2006). The effect of a needs-related caries preventive program in children and young adults - results after 20 years. *BMC Oral Health, 6(Suppl 1)*, pp. S7.

Bagramian, R.A., Garcia-Godoy, F., & Volpe, A.R. (2009). The global increase in dental caries. A pending public health crisis. *American Journal of Dentistry, 22*(1), pp. 3-8.

Bak, J., & Piko, B. (2007). Smoke-free world for children's welfare: Perceptions of smoking in preadolescence. *Children and Youth Services Review, 29*(3), pp. 283-293.

Baker, S.R. (2010). Socio-economic position and oral health: comparing proximal and distal indicators. *Social Science and Dentistry, 1*, pp. 5-10.

Baldwin, D.C. (1966). An Investigation of Psychological and Behavioral Responses to Dental Extraction in Children. *Journal of Dental Research, 45*(6), pp. 1637-1651.

Balen, R. (2006). Involving Children in Health and Social Research: 'Human becomings' or 'active beings'? *Childhood, 13*(1), pp. 29-48.

Balen, R., Holroyd, C., Mountain, G., & Wood, B. (2000). Giving children a voice: Methodological and practical implications of research involving children. *Paediatric Nursing, 12*(10), pp. 24-28.

Bánóczy, J., Petersen, P.E., & Rugg-Gunn, A. (2009). *Milk fluoridation for the prevention of dental caries*. Geneva: World Health Organization.

Barbour, R.S., & Kitzinger, J. (1999). *Developing Focus Group Research: Politics, Theory and Practice*. London: Sage.

Bartholomew, L.K., & Mullen, P.D. (2011). Five roles for using theory and evidence in the design and testing of behavior change interventions. *Journal of Public Health Dentistry, 71*, pp. S20-S33.

Bartholomew, L.K., Parcel, G.S., Kok, G., Gottlieb, N.H., & Fernandez, M. E. (2011). *Planning Health Promotion Programs: An Intervention Mapping Approach* (3rd ed.). San Francisco: Jossey Bass.

Bates, S., Collins, L., Treloar, R., Virtanen, K., Virta, E., & Vihavainen, N. (2008). *0428 Efficacy of OralInsights OHI System in General Dental Practice*. Paper presented at the PEF IADR, London.

Baum, F. (1995). Researching public health: Behind the qualitative-quantitative methodological debate. *Social Science & Medicine, 40*(4), pp. 459-468.

Baxter, S.D. (2009). Cognitive processes in children's dietary recalls: insight from methodological studies. *European Journal of Clinical Nutrition, 63 Suppl 1*, pp. S19-32.

Baxter, S.D., Guinn, C.H., Royer, J.A., Hardin, J.W., Mackelprang, A.J., & Smith, A.F. (2009a). Accuracy of children's school-breakfast reports and school-lunch reports (in 24-h dietary recalls) differs by retention interval. *European Journal of Clinical Nutrition, 63*(12), pp. 1394-1403.

Baxter, S.D., Hardin, J.W., Guinn, C.H., Royer, J.A., Mackelprang, A.J., & Smith, A.F. (2009b). Fourth-grade children's dietary recall accuracy is influenced by retention interval (target period and interview time). *Journal of the American Dietetic Association, 109*(5), pp. 846-856.

Baxter, S.D., Hardin, J.W., Smith, A.F., Royer, J.A., Guinn, C.H., & Mackelprang, A.J. (2009c). Twenty-four hour dietary recalls by fourth-grade children were not influenced by observations of school meals. *Journal of Clinical Epidemiology, 62*(8), pp. 878-885.

Baxter, S.D., Smith, A.F., Litaker, M.S., Guinn, C.H., Shaffer, N.M., Baglio, M.L., & Frye, F.H. (2004). Recency affects reporting accuracy of children's dietary recalls. *Annals of epidemiology, 14*(6), pp. 385-390.

Beaglehole, R., Benzian, H., Crail, J., & Mackay, J. (2009). *The Oral Health Atlas: Mapping a neglected Global Health Issue* (1st ed.). Brighton, UK: FDI World Dental Education Ltd & Myriad Editions.

Bennett, O. (2012). *Fluoridation*. (SN/SC/3135). London: House of Commons Libary Retrieved from: http://data.parliament.uk/briefingpapers/PublisherService.svc/briefingpapers/SN05689.pdf

Bernheimer, L.P., & Keogh, B.K. (1995). Weaving Interventions into the Fabric of Everyday Life: An Approach to Family Assessment. *Topics in Early Childhood Special Education, 15*(4), pp. 415-433.

Blair, Y., Macpherson, L.M., McCall, D.R., McMahon, A.D., & Stephen, K. W. (2004). Glasgow nursery-based caries experience, before and after a community development-based oral health programme's implementation. *Community Dental Health, 21*(4), pp. 291-298.

Blair, Y., Macpherson, L., McCall, D., & McMahon, A. (2006). Dental health of 5-year-olds following community-based oral health promotion in Glasgow, UK. *International Journal of Paediatric Dentistry, 16*(6), pp. 388-398.

Blas, E., & Kurup, A.S. (2010). *Equity, social determinants and public health programmes.* Geneva:World Health Organization (WA 525).

Blinkhorn, A.S. (1978). Influence of social norms on toothbrushing behavior of preschool children. *Community Dentistry and Oral Epidemiology, 6*(5), pp. 222-226.

Blumenshine, S. L., Vann, W. F., Jr., Gizlice, Z., & Lee, J. Y. (2008). Children's school performance: impact of general and oral health. *Journal of Public Health Dentistry, 68*(2), pp. 82-87.

BMA. (2012). *Behaviour change, public health and the role of the state - BMA position statement.* Reterived from: http://bma.org.uk/working-for-change/improving-and-protecting-health/behaviour-change

Bonetti, D., & Clarkson, J. E. (2010). The challenges of designing and evaluating complex interventions. *Community Dental Health, 27*, pp. 130-132.

Borgers, N., De Leeuw, E., & Hox, J. (2000). Children as respondents in survey research: Cognitive development and response quality 1. *Bulletin de methodologie Sociologique, 66*(1), pp. 60-75.

Bourgeois, D.M., & Llodra, J.C. (2004). *European Global Oral Health Indicators Development Project - 2003 Report Proceedings.* Paris: European Commission, Health and Consumer Protection Directorate-General, Community Action Programme on Health Monitoring.

Bourgeois, D.M., Phantumvanit, P., Llodra, J.C., Horn, V., Carlile, M., & Eiselé, J.L. (2014). Rationale for the prevention of oral diseases in primary health care: an international collaborative study in oral health education. *International Dental Journal, 64*(s2), pp. 1-11.

Bower, E., & Scambler, S. (2007). The contributions of qualitative research towards dental public health practice. *Community Dentistry and Oral Epidemiology, 35*(3), pp. 161-169.

Brannen, J. (2005). Mixing methods: The entry of qualitative and quantitative approaches into the research process. *International Journal of Social Research Methodology, 8*(3), pp. 173-184.

Brown, L.F. (1994). Research in Dental Health Education and Health Promotion: A Review of the Literature. *Health Education & Behavior, 21*(1), pp. 83-102.

Brown, T., & Summerbell, C. (2009). Systematic review of school-based interventions that focus on changing dietary intake and physical activity levels to prevent childhood obesity: an update to the obesity guidance produced by the National Institute for Health and Clinical Excellence. *Obesity reviews, 10*(1), pp. 110-141.

Brown, W.J., Trost, S.G., Bauman, A., Mummery, K., & Owen, N. (2004). Test-retest reliability of four physical activity measures used in population surveys. *Journal of Science and Medicine in Sport, 7*(2), pp. 205-215.

Bryman, A. (2007). Barriers to integrating quantitative and qualitative research. *Journal of mixed methods research*, *1*(1), pp.8-22.

Bryman, A. (2008). *Social research methods* (3rd Ed). Oxford: Oxford university press.

Bryman, A. (2012). *Social research methods* (4th Ed). Oxford: Oxford university press.

Burt, B.A., & Pai, S. (2001). Sugar consumption and caries risk: a systematic review. - *Journal of Dental Education, 65*(10), pp. 1017-1023.

Burt, B.A., Eklund, S.A., Morgan, K.J., Larkinm, F.E., Guire, K.E., Brown, L. O., & Weintraub, J.A. (1988). The Effects of Sugars Intake and Frequency of Ingestion on Dental Caries Increment in a Three-year Longitudinal Study. *Journal of Dental Research, 67*(11), pp. 1422-1429.

Busch, V., de Leeuw, J.R.J,, de Harder A, Schrijvers AJP. (2013). Changing multiple adolescent health behaviors through school-based interventions: a review of the literature. *Journal of School Health, 83*(7), pp. 514-523.

Buttriss, J. (2002). Nutrition, health and schoolchildren. *Nutrition Bulletin, 27*(4), pp. 275-316.

Campbell, M.K., Elbourne, D.R., & Altman, D.G. (2004). CONSORT statement: extension to cluster randomised trials. *British Medical Journal, 328*(7441), pp. 702-708.

Campbell, M., Fitzpatrick, R., Haines, A., Kinmonth, A. L., Sandercock, P., Spiegelhalter, D., & Tyrer, P. (2000). Framework for design and evaluation of complex interventions to improve health. *BMJ : British Medical Journal, 321*(7262), pp. 694–696.

Cancro, L.P., & Fischman, S.L. (1995). The emected effect on oral health of denid plaque control through mechanical removal. *Periodontology 2000, 8*, pp. 60-74.

Caraher, M., Crawley, H., & Lloyd, S. (2009). *Nutrition policy across the UK: Briefing Paper.* London: The Caroline Walker Trust.

Cartwright, N. (2007). Are RCTs the Gold Standard? *BioSocieties, 2*(1), pp. 11-20.

Carey, M.A., & Smith, M.W. (1994). Capturing the group effect in focus groups: A special concern in analysis. *Qualitative Health Research, 4*(1), pp123-127.

Cashmore, A.W., Phelan, C., & Blinkhorn, A.S. (2010). Dental caries in children. *N S W Public Health Bulletin, 21*(7-8), pp. 184-185.

Castilho, A.R.F.D., Mialhe, F.L., Barbosa, T.D.S., & Puppin-Rontani, R.M. (2013). Influence of family environment on children's oral health: a systematic review. *Jornal de Pediatria, 89*(2), pp.116-123.

Centers for Disease Control and Prevention. (2001). *Recommendations for Using Fluoride to Prevent and Control Dental Caries in the United States*. Atlanta, GA: U.S. Department of Health and Human Services (No. RR-14).

Chang, Y.-C., Lo, J.-L., Huang, C.-J., Hsu, N.-Y., Chu, H.-H., Wang, H.-Y., . . . Hsieh, Y.-L. (2008). *Playful Toothbrush: UbiComp Technology for Teaching Toothbrushing to Kindergarten Children.* Paper presented at the CHI '08: Proceeding of the twenty-sixth annual SIGCHI conference on Human factors in computing systems, Florence, Italy.

Chapman, A., Copestake, S.J., & Duncan, K. (2006). An oral health education programme based on the National Curriculum. *International Journal of Paediatric Dentistry, 16*, pp. 40-44.

Chapparo, C.J., & Hooper, E. (2005). Self-Care at School: Perceptions of 6-Year-Old Children. *American Journal of Occupational Therapy, 59*, pp. 67-77.

Chappuy, H., Doz, F., Blanche, S., Gentet, J.C., & Treluyer, J.M. (2008). Children's views on their involvement in clinical research. *Pediatric Blood and Cancer, 50*(5), pp. 1043-1046.

Chesters, R.K., Huntington, E., Burchell, C.K., & Stephen, K.W. (1992). Effect of Oral Care Habits on Caries in Adolescents. *Caries Research, 26*(4), pp. 299-304.

Chestnutt, I.G., Chadwick, B.L., Hutchings, S., Playle, R., Pickles, T., Lisles, C., ... & Hood, K. (2012). Protocol for “Seal or Varnish?”(SoV) trial: a randomised controlled trial to measure the relative cost and effectiveness of pit and fissure sealants and fluoride varnish in preventing dental decay. *BMC oral health, 12*(51), pp.1-12.

Chief Medical Officer Professor Sir Liam Donaldson, & The Chief Dental Officer Pofessor Rman Bedi. (2003). *What are the Chief Medical Officer's views on water fluoridation?* Constituency and Parliamentary Website: Retrieved from http://www.sir-george-young.org.uk/FAQ/newsitem.cfm?newsid=1545

Choo, A., Delac, D.M., & Messer, L.B. (2001). Oral hygiene measures and promotion: review and considerations. *Australian Dental Journal, 46*(3), pp. 166-173.

Christ, T.W. (2014). Scientific-Based Research and Randomized Controlled Trials, the “Gold” Standard? Alternative Paradigms and Mixed Methodologies. *Qualitative Inquiry, 20*(1), pp. 72-80.

Cinar, A.B. (2008). *Preadolescents and Their Mothers as Oral Health-Promoting Actors: Non-biologic Determinants of Oral Health among Turkish and Finnish Preadolescents.* (Doctoral dissertation). University of Helsinki. Retrieved from: https://helda.helsinki.fi/bitstream/handle/10138/20295/preadole.pdf?sequence=1

Cinar, A.B., & Murtomaa, H. (2011). Interrelation between obesity, oral health and life-style factors among Turkish school children. - *Clinical Oral Investigations, 15*(2), pp. 177-184.

Cioffi, I., & Farella, M. (2011). Quality of randomised controlled trials in dentistry. *International Dental Journal, 61*(1), pp. 37-42.

Claessen, J.-P., Bates, S., Sherlock, K., Seeparsand, F., & Wright, R. (2008). Designing interventions to improve toothbrushing. *International Dental Journal, 58*(S5), pp. 307-320.

Claessen, J.-P., Jones, T., Schafer, F., & Cox, T. (2011). *Effectiveness of an Oral Care Intervention Campaign on Brushing Habits*. Paper presented at the IADR/AADR/CADR 89th General Session and Exhibition, San Diego. Retrived from: http://iadr.confex.com/iadr/2011sandiego/preliminaryprogram/abstract_148186.htm

Claessen, J.-P., Seeparsand, F., & Wright, R.L. (2008). *Brushing Up on Behaviour Measurement: Validation Study of New Technology (0421)*. Paper

presented at the PEF IADR, London. Retrived from: http://iadr.confex.com/iadr/pef08/techprogram/abstract_110923.htm

Clarkson, J.E., Ellwood, R.P., & Chandler, R.E. (1993). A comprehensive summary of fluoride dentifrice caries clinical trials. - *American Journal of Dentistry, 6 Spec No*, pp. S59-106.

Claudio, L., & Stingone, J.A. (2008). Improving Sampling and Response Rates in Children's Health Research Through Participatory Methods. *Journal of School Health, 78*(8), pp. 445-451.

Cliff, D.P., Reilly, J.J., & Okely, A.D. (2009). Methodological considerations in using accelerometers to assess habitual physical activity in children aged 0-5 years. *Journal of Science and Medicine in Sport, 12*(5), pp. 557-567.

Clinical Affairs Committee - Behavior Management Subcommittee, & Council on Clinical Affairs. (2011). Guideline on behavior guidance for the pediatric dental patient. *Reference manual, 33*(9/14/2012), pp. 161-173. Retrived from: http://www.aapd.org/media/Policies_Guidelines/G_BehavGuide.pdf

Cohen, L., Manion, L., & Morrison, K. (2007). *Research Methods in Education* (6th ed.). London: Routledge-Falmer.

Colley, R., Gorber, S.C., & Tremblay, M.S. (2010). Quality control and data reduction procedures for accelerometry-derived measures of physical activity. *Health Reports, 21*(1), pp. 63-69.

Conrod, B. (2008). *On the occasion of the first World Oral Health Day Retrieved March, 2012* (Press Release). Retrived from: http://www.fdiworldental.org:8080/content/occasion-first-world-oral-health-day

Cooper, A.M., O'malley, L.A., Elison, S.N., Armstrong, R., Burnside, G., Adair, P., Dugdill, L., & Pine, C. (2013). Primary school-based behavioural interventions for preventing caries [Review]. *Cochrane Database of Systematic Reviews 2013*, *Issue 5*. Art. No.: CD009378. DOI: 10.1002/14651858.CD009378.pub2.

Coote, A. (2004). *Prevention Rather than Cure: Making the Case for Choosing Health*. London: King's Fund.

Craig, P., Dieppe, P., Macintyre, S., Michie, S., Nazareth, I., & Petticrew, M. (2008). Developing and evaluating complex interventions: the new Medical Research Council guidance. *British Medical Journal, 337*(sep29 1), pp. a1655-a1655.

Crawford, D., Jeffery, R.W., Ball, K., & Brug, J. (2010). *Obesity Epidemiology: From Aetiology to Public Health* (2nd ed.). Oxford: Oxford University Press.

Creswell, J.W., & Plano Clark, V.L. (2010). *Designing and Conducting Mixed Methods Research* (2nd ed.). London: Sage Publications Ltd.

Cruise, S.M., Lewis, C.A., & Guckin, C.M. (2006). Internal consistency, reliability, and temporal stability of the oxford happiness questionnaire short-form: test-retest data over two weeks. *Social Behavior and Personality: an International Journal, 34*(2), pp. 123-126.

CASP (Center for Substance Abuse Prevention). (1994). Conducting focus groups with young children requires special considerations and techniques. *Technical Assistance Bulletin*, pp. 1–11.

Currie, C., Gabhainn, S.N., Godeau, E., Roberts, C., Smith, R., Currie, D., . . . Barnekow Rasmussen, V. (2008). *Inequalities in young people's health: HBSC international report from the 2005/06 Survey. Health Policy for Children and Adolescents (No. 5)*. Denmark: WHO Regional Office for Europe.

Currie, C., Zanotti, C., Morgan, A., Currie, D., De Looze, M., Roberts, C., . . . Barnekow, V. (eds. 2012). *Social determinants of health and well-being among young people. Health Behaviour in School-aged Children (HBSC) study: international report from the 2009/2010 survey*. Copenhagen, WHO Regional Office for Europe, 2012 (Health Policy for Children and Adolescents, No. 6).

Curtis, V.A., Danquah, L.O., & Aunger, R.V. (2009). Planned, motivated and habitual hygiene behaviour: an eleven country review. *Health Education Research, 24*(4), pp. 655-673.

Dahlgren, G., & Whitehead, M. (1991). *Policies and Strategies to Promote Social 9.* Equity in Health. Stockholm: Institute for Future Studies. Retrieved from: http://www.iffs.se/wp-content/uploads/2011/01/20080109110739filmZ8UVQv2wQFShMRF6cuT.pdf

Daly, B., Clarke, W., McEvoy, W., Periam, K., & Zoitopoulos, L. (2010). Child oral health concerns amongst parents and primary care givers in a Sure Start local programme. *Community Dental Health, 27*(3), pp. 167-171.

Danner, U.N., Aarts, H., & De Vries, N.K. (2008). Habit vs. intention in the prediction of future behaviour: the role of frequency, context stability and mental

accessibility of past behaviour. - *British Journal of Social Psychology, 47*(Pt 2), pp. 245-265.

Darbyshire, P., MacDougall, C., & Schiller, W. (2005a). Multiple methods in qualitative research with children: more insight or just more? *Qualitative Research, 5*(4), pp. 417-436.

Darbyshire, P., Schiller, W., & MacDougall, C. (2005b). Extending new paradigm childhood research: meeting the challenges of including younger children. *Early Child Development and Care, 175*(6), pp. 467-472.

Darmon, N., & Drewnowski, A. (2008). Does social class predict diet quality? *The American Journal of Clinical Nutrition, 87*(5), pp. 1107-1117.

David, N., Newen, A., & Vogeley, K. (2008). The "sense of agency" and its underlying cognitive and neural mechanisms. *Consciousness and Cognition, 17*(2), pp. 523-534.

Davies, G.M., Worthington, H.V., Ellwood, R.P., Blinkhorn, A.S., Taylor, G.O., Davies, R.M., & Considine, J. (2003). An assessment of the cost effectiveness of a postal toothpaste programme to prevent caries among five-year-old children in the North West of England. *Community Dental Health, 20*(4), pp. 207-210.

Davies, G., & Bridgman, C. (2011). Improving oral health among schoolchildren - which approach is best? *British Dental Journal, 210*(2), pp. 59-61.

Davies, R.M., Davies, G.M., & Ellwood, R.P. (2003). Prevention. Part 4: Toothbrushing: what advice should be given to patients? *British Dental Journal, 195*(3), pp. 135-141.

de Leeuw, E.D., Borgers, N., & Smits, A. (2004). 'Pretesting questionnaires for children and adolescents'. In Presser, S., Couper, M.P., Lessler, J.T., Martin, E., Martin, J., Rothgeb, J.M., & Singer, E. (Eds.) *Methods for testing and evaluating survey questionnaires* (pp. 409-429). Hoboken: Wiley.

de Leeuw, E.D. (2011). Improving data quality when surveying children and adolescents: cognitive and social development and its role in questionnaire construction and pretesting [online report]. Available Online: http://www.aka.fi/Tiedostot/Tiedostot/LAPSET/Presentations%20of%20the%20annual%20seminar%2010-12%20May%202011/Surveying%20Children%20and%20adolescents_de%20Leeuw.pdf

De Silva-Sanigorski, A.M., Waters, E., Calache, H., Smith, M., Gold, L., Gussy, M., . . . Virgo-Milton, M. (2011). Splash!: a prospective birth cohort study of the impact of environmental, social and family-level influences on child oral health and obesity related risk factors and outcomes. *BMC Public Health, 11*, pp. 505.

De Winter, M. (1996). *Children as Fellow Citizens. Partcipation and Committment*. Oxford/New York: Radcliffe Medical Press.

De Winter, M., Baerveldt, C., & Kooistra, J. (1999). Enabling children: participation as a new perspective on child-health promotion. *Child: Care, Health and Development, 25*(1), pp. 15-23; discussion 23-15.

Defra. (2011). *Fluoridation of drinking water*. London: Drinking Water Inspectorate Retrived from: http://dwi.defra.gov.uk/consumers/advice-leaflets/fluoride.pdf

Denbesten, P., & Ko, H.S. (1996). Fluoride levels in whole saliva of preschool children after brushing with 0.25 g (pea-sized) as compared to 1.0 g (full-brush) of a fluoride dentifrice. *Pediatric Dentistry, 18*(4), pp. 277-280.

Dencker, M., & Andersen, L.B. (2008). Health-related aspects of objectively measured daily physical activity in children. *Clinical Physiology and Functional Imaging, 28*(3), pp. 133-144.

Department for Education. (2010). *The Importance of Teaching: The Schools White Paper 2010*. London: The Stationery Office (Cm 7980).

Department for Education. (2011). *A profile of pupil absence in England*. London:Education Standards Analysis and Research Division (DFE-RR171).

Department of Health and British Association for the Study of Community Dentistry. (2009). *Delivering Better Oral Health An evidence-based toolkit for prevention (Second Edition)*. London: Deportment of Health Dental updates (12231). Retrived from: http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_102331

Department of Health. (2004). *Choosing health: Making healthy choices easier*. (264741). London: Department of Health.

Department of Health. (2005a). *Choosing Better Oral Health: An Oral Health Plan for England*. London: Department of Health.

Department for Health. (2005b). National Health School Status: A guide for schools. London: Department of Health (270390)

Department of Health. (2005c). *Research governance framework for health and social care: Second edition* (4747). Retrived from: http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_4108962

Department of Health. (2010a). *Equity and excellence: Liberating the NHS*. London: The Stationery Office (Cm7881).

Department of Health. (2010b). *Healthy Lives, Healthy People: Our strategy for public health in England*. London: HMSO.

Department of Health (2011). *The NHS Outcomes Framework 2011/12*. London: Quality and Outcomes Policy (15264).

Department of Health. (2012). *Children and young people's health outcomes forum: Discussion Slidepack (1st version)*. Retrived from: http://healthandcare.dh.gov.uk/category/children/

Des Jarlais, D.C., Lyles, C., Crepaz, N., & The Trend Group. (2004). Improving the Reporting Quality of Nonrandomized Evaluations of Behavioral and Public Health Interventions: The TREND Statement. *American Journal of Public Health, 94*(3), pp. 361-365.

Deschesnes, M. (2003). Comprehensive approaches to school health promotion: how to achieve broader implementation? *Health Promotion International, 18*(4), pp. 387-396.

Diehnelt, D.E., & Kiyak, H.A. (2001). Socioeconomic factors that affect international caries levels. *Community Dentistry and Oral Epidemiology, 29*(3), pp. 226-233.

Dige, I., Schlafer, S., & Nyvad, B. (2012). Difference in initial dental biofilm accumulation between night and day. *Acta Odontologica Scandinavica, 70(6)*, pp. 441-447.

Director of Public Health, & Consultant in Dental Public Health. (2012). *Oral Health and Dentistry: Report for Information Item 5 Dental and Oral and Appendix*. Manchester City Council:Health Scrutiny Committee.

Director of Public Health. (2012). *Oral Health of Children: Manchester Health and Wellbeing Board Report for Resolution.* Manchester City Council: Health and Wellbeing Board.

Dombrowskia, S.U., Sniehottabd, F.F., Avenella, A., Johnstonc, M., Maclennana, G., & Araújo-Soaresb, V. (2012). Identifying active ingredients in

complex behavioural interventions for obese adults with obesity-related co-morbidities or additional risk factors for co-morbidities: a systematic review. *Health Psychology Review, 6*(Special Issue: Special Themed Issue: Theories and Techniques of Behaviour Change: Developing a Cumulative Science of Behaviour Change), pp. 7-32.

Donner, A., & Klar, N. (2004). Pitfalls of and controversies in cluster randomization trials. *American Journal of Public Health, 94*(3), pp. 416-422.

Dos Santos, A.P., Nadanovsky, P., & De Oliveira, B.H. (2011). Inconsistencies in recommendations on oral hygiene practices for children by professional dental and paediatric organisations in ten countries. *International Journal of Paediatric Dentistry, 21*(3), pp. 223-231.

Downer, M.C. (2006). A critique of the Brushing for Life programme. *Health Education Journal, 65*(1), pp. 84-92.

Droit-Volet, S. (2012). Children and time. *The Psychologist, 25*(8), pp. 586-589.

Dugdill, L., & Pine, C.M. (2011). Evaluation of international case studies within 'Live.Learn.Laugh.': a unique global public-private partnership to promote oral health. *International Dental Journal, 61 Suppl 2*, pp. 22-29.

Dugdill, L., Graham, R.C., & McNair, F. (2005). Exercise referral: the public health panacea for physical activity promotion? A critical perspective of exercise referral schemes; their development and evaluation. *Ergonomics, 48*(11-14), pp. 1390-1410.

Duhl, L.J., & Hancock, T. (1988). *A Guide to Assessing Healthy Cities from the WHO Series Healthy Cities Papers, No.3.* Copenhagen:WHO Healthy Cities Project Office.

Durlak, J.A., & DuPre, E.P. (2008). Implementation matters: A review of research on the influence of implementation on program outcomes and the factors affecting implementation. *American journal of community psychology,41*(3-4), pp.327-350.

Dzewaltowski, D.A., Estabrooks, P.A., Klesges, L.M., Bull, S., & Glasgow, R.E. (2004). Behavior change intervention research in community settings: how generalizable are the results? *Health Promotion International, 19*(2), pp. 235-245.

Eaton, K.A., & Carlile, M.J. (2008). Toothbrushing behaviour in Europe: opportunities for dental public health. *International Dental Journal, 58*(S5), pp. 287–293.

Eckersley, A.J., & Blinkhorn, F.A. (2001). Dental attendance and dental health behaviour in children from deprived and non-deprived areas of Salford, North-West England. *International Journal of Paediatric Dentistry, 11*, pp. 103-109.

Edelstein, B.L. (2006). The dental caries pandemic and disparities problem. *BMC Oral Health, 6 Suppl 1*, pp. S2.

Edmunds, L.D., & Ziebland, S. (2002). Development and validation of the Day in the Life Questionnaire (DILQ) as a measure of fruit and vegetable questionnaire for 7–9 year olds. *Health Education Research*, *17*(2), pp.211-220.

Edwards, P.J., Roberts, I., Clarke, M.J., DiGuiseppi, C., Wentz, R., Kwan, I., Cooper, R., Felix, L.M., Pratap, S. (2009). Methods to increase response to postal and electronic questionnaires. *Cochrane Database of Systematic Reviews 2009, Issue 3*. Art. No.: MR000008. DOI: 10.1002/14651858.MR000008.pub4.

Edwards, P., Roberts, I., Sandercock, P., & Frost, C. (2004). Follow-up by mail in clinical trials: does questionnaire length matter? *Controlled Clinical Trials, 25*(1), pp. 31-52.

Eichenbaum, I.W., & Dunn, N.A. (1971). Projective drawings by children under repeated dental stress. *ASDC Journal of Dentistry for Children, 38*(3), pp. 164-173.

Eldridge, S., & Kerry, S. (2012). *A practical guide to cluster randomised trials in health services research* (Vol. 120). Chichester: John Wiley & Sons.

Elmer, T.B., Langford, J.W., & Morris, A.J. (2014). An alternative marker for the effectiveness of water fluoridation: hospital extraction rates for dental decay, a two-region study. *British Dental Journal, 216*(5), E10.

Eng, J. (2003). Sample size estimation: how many individuals should be studied? *Radiology, 227*, pp. 309-313.

Evans, L., Hall, M., Jones, C.M., & Neiman, A. (2007). Did the Ottawa Charter play a role in the push to assess the effectiveness of health promotion? *Promotion & Education, 14*(Supp 2), pp. 28-30.

Fargas-Malet, M., McSherry, D., Larkin, E., & Robinson, C. (2010). Research with children: methodological issues and innovative techniques. *Journal of Early Childhood Research, 8*(2), pp. 175-192.

Farnsworth, J., & Boon, B. (2010). Analysing group dynamics within the focus group. *Qualitative Research, 10(5)*, pp. 605-624.

FDI. (1993). FDI Policy statement on fluorides and fluoridation for the prevention of dental caries. Fédération Internationale Dentaire. *Dental World, 2*(3), pp. 11-15, 17.

FDI. (2008). *Promoting dental health through water fluoridation*. Stockholm, Sweden.

Featherstone, J.D. (2000). The science and practice of caries prevention. *Journal of the Ameican Dental Association, 131*(7), pp. 887-899.

Feitosa, S., Colares, V., & Pinkham, J. (2005). The psychosocial effects of severe caries in 4-year-old children in Recife, Pernambuco, Brazil. *Cadernos de Saúde Pública [online], 21*(5), pp. 1550-1556.

Fielding, N., & Fielding, J. (1986). *Linking Data: the articulation of qualitative and quantitative methods in social research*. London and Beverly Hills: Sage.

Fischman, S.L. (1986). Current status of indices of plaque. *Journal of Clinical Periodontology, 13*(5), pp. 371-374.

Fisher-Owens, S.A., Barker, J.C., Adams, S., Chung, L.H., Gansky, S.A., Hyde, S., & Weintraub, J.A. (2008). Giving policy some teeth: routes to reducing disparities in oral health. *Health Affairs, 27*(2), pp. 404-412.

Fisher-Owens, S.A., Gansky, S.A., Platt, L.J., Weintraub, J.A., Soobader, M.J., Bramlett, M.D., & Newacheck, P.W. (2007). Influences on Children's Oral Health: A Conceptual Model. *Pediatrics, 120*(3), pp. e510-520. Retrieved from: http://pediatrics.aappublications.org/content/120/3/e510.full.pdf

Ford, T., Edwards, V., Sharkey, S., Ukoumunne, O., Byford, S., Norich, B., & Logan, S. (2012). Supporting teachers and children in schools: the effectiveness and cost-effectiveness of the incredible years teacher classroom management programme in primary school children: a cluster randomised controlled trial, with parallel economic and process evaluations. *BMC Public Health, 12*(1), pp. 719.

Forrestal, S.G. (2011). Energy intake misreporting among children and adolescents: a literature review. *Maternal & Child Nutrition, 7*(2), pp. 112-127.

Franck, L.S., Sheikh, A., & Oulton, K. (2008). What helps when it hurts: children's views on pain relief. *Child: care, health and development, 34*(4), pp.430-438.

Freeman, R., & Oliver, M. (2009). Do school break-time policies influence child dental health and snacking behaviours? An evaluation of a primary school programme. *Britsih Dental Journal, 206*(12), pp. 619-625; discussion 616.

Freeman, R., Whelton, H., & Gibson, B. (2010). Toothbrushing rules: power dynamics and toothbrushing in children. *Social Science and Dentistry, 1*(1), pp. 37-47.

French, D.P., & Hevey, D. (2008). What do people think about when answering questionnaires to assess unrealistic optimism about skin cancer? A think aloud study. *Psychology, Health & Medicine, 13*(1), pp. 63-74

Frencken, J., Holmgren, C., & Van Palenstein Helderman, W. (2002). *Basic Package of Oral Care.* The Netherlands:WHO Collaborating Centre for Oral Health Care Planning and Future Scenarios, College of Dental Science University of Nijmegen.

Galea, S., & Tracy, M. (2007). Participation rates in epidemiologic studies. *Annals of epidemiology, 17*(9), pp. 643-653.

Gallagher, A., Sowinski, J., Bowman, J., Barrett, K., Lowe, S., Patel, K., ... & Creeth, J.E. (2009). The effect of brushing time and dentifrice on dental plaque removal in vivo. *American Dental Hygienists Association, 83*(3), pp. 111-116.

Ganss, C., Schlueter, N., Preiss, S., & Klimek, J. (2009). Toothbrushing habits in uninstructed adults - frequency, technique, duration and force. *Clinical Oral Investigations, 13*(2), pp. 203-208.

Garcia, R.I., & Sohn, W. (2012). The Paradigm Shift to Prevention and Its Relationship to Dental Education. *Journal of Dental Education, 76*(1), pp. 36-45.

Gardner, B. and Tang, V. (2014), Reflecting on non-reflective action: An exploratory think-aloud study of self-report habit measures. *British Journal of Health Psychology, 19*(2), pp. 258–273

Gearing, R.E., El-Bassel, N., Ghesquiere, A., Baldwin, S., Gillies, J., & Ngeow, E. (2011). Major ingredients of fidelity: A review and scientific guide to improving quality of intervention research implementation. *Clinical psychology review, 31*(1), pp. 79-88.

Gibson, F. (2007). Conducting focus groups with children and young people: strategies for success. *Journal of Research in Nursing, 12*(5), pp. 473-483.

Gibson, J.E. (2012). Interviews and Focus Groups With Children: Methods That Match Children's Developing Competencies. *Journal of Family Theory & Review, 4*(2), pp. 148-159.

Gibson, S.A. (1997). Non-milk extrinsic sugars in the diets of pre-school children: association with intakes of micronutrients, energy, fat and NSP. *British Journal of Nutrition, 78*(3), pp. 367-378.

Gill, P., Chestnutt, I.G., & Channing, D. (2009). Opportunities and challenges to promoting oral health in primary schools. *Community Dental Health, 26*(3), pp. 188-192.

Gill, P., Stewart, K., Chetcuti, D., & Chestnutt, I.G. (2011). Children's understanding of and motivations for toothbrushing: a qualitative study. *International Jouornal of Dental Hygiene, 9*(1), pp. 79-86.

Gill, P., Stewart, K., Treasure, E., & Chadwick, B. (2008). Conducting qualitative interviews with school children in dental research. *British Dental Journal, 204*(7), pp. 371-374.

Goldman, A., Yee, R., Holmgren, C., & Benzian, H. (2008). Global affordability of fluoride toothpaste. *Global Health, 4*(1), pp. 7.

Golley, R.K., Hendrie, G.A., Slater, A., & Corsini, N. (2011). Interventions that involve parents to improve children's weight-related nutrition intake and activity patterns - what nutrition and activity targets and behaviour change techniques are associated with intervention effectiveness? *Obesity Reviews, 12*(2), pp. 114-130.

Grant, A., Treweek, S., Dreischulte, T., Foy, R., & Guthrie, B. (2013). Process evaluations for cluster-randomised trials of complex interventions: a proposed framework for design and reporting. *Trials, 14*(1), 15. Accessed online - http://www.trialsjournal.com/content/pdf/1745-6215-14-15.pdf

Greene, J.C., Benjamin, L., & Goodyear, L. (2001). The merits of mixing methods in evaluation. *Evaluation, 7*(1), pp. 25-44.

Greig, A.D., & Taylor, M.J., (1999). *Doing research with children*. London: Sage.

Guba, E.G., & Lincoln, Y.S. (1989). *Fourth Generation Evaluation*. California: Sage Publications

Guittet, L., Ravaud, P., & Giraudeau, B. (2006). Planning a cluster randomized trial with unequal cluster sizes: practical issues involving continuous outcomes. *BMC Medical Research Methodology, 6*, pp. 17.

Gussy, M.G., Waters, E.G., Walsh, O., & Kilpatrick, N.M. (2006). Early childhood caries: current evidence for aetiology and prevention. *Journal of Paediatrics and Child Health, 42*(1-2), pp. 37-43.

Hagquist, C., & Starrin, B. (1997). Health Education in Schools-From Information to Empowerment Models. *Health Promotion International, 12*(3), pp. 225-232.

Han, S.S., & Weiss, B. (2005). Sustainability of teacher implementation of school-based mental health programs. *Journal of abnormal child psychology,33*(6), pp. 665-679.

Hansen, E., Fonager, K., Freund, K.S., & Lous, J. (2014). The impact of non-responders on health and lifestyle outcomes in an intervention study. *BMC research notes, 7*(1), 632, pp.1-9.

Hansen, W.B., Pankratz, M.M., Dusenbury, L., Giles, S.M., Bishop, D.C., Albritton, J., Albritton, L.P., & Strack, J. (2013). Styles of adaptation: The impact of frequency and valence of adaptation on preventing substance use. *Health Education, 113*(4), pp. 345-363.

Harden, J., Scott, S., Backett-Milburn, K., & Jackson, S. (2000). Can't talk, won't talk? : methodological issues in researching children. *Sociological research online, 5*(2). Retrived from: http://www.socresonline.org.uk/5/2/harden.html

Hardman, M.C., Davies, G.M., Duxbury, J.T., & Davies, R.M. (2007). A cluster randomised controlled trial to evaluate the effectiveness of fluoride varnish as a public health measure to reduce caries in children. *Caries Research, 41*(5), pp. 371-376.

Harker, R., & Nuttall, N. (2004). *Impact of oral health: Children's Dental Health in the United Kingdom, 2003.* London:Office for National Statistics.

Harker, R., & Nuttall, N. (2005a). *Children's Dental Health in Northern Ireland 2003.* London:Office for National Statistics.

Harker, R., & Nuttall, N. (2005b). *Children's Dental Health in Wales 2003.* London:Office for National Statistics.

Haroun, D., Harper, C., Pearce, J., Wood, L., Sharp, L., Poulter, J., . . . Nelson, M. (Report revised 2012). *Primary School Food Survey 2009*. Sheffield:The School Food Trust.

Harrington, J., Friel, S., Hyland, B., Sadlier, D., Bradley, C., & Brady, A. (2001). *Oral Health in Disadvantaged Schools in the Eastern Region: report prepared by the National Nutrition Surveillance Centre, Department of Health Promotion, National University of Ireland, Galway.* Dublin:Dental Health Foundation, Ireland.

Harris, R., Nicoll, A.D., Adair, P.M., & Pine, C.M. (2004). Risk factors for dental caries in young children: a systematic review of the literature. *Community Dental Health, 21*(1 Suppl), pp. 71-85.

Hart, R.A. (1992). *Children's Participation: From tokenism to citizenship*. UNICEF Innocenti Research Centre.

Hawkins, R.J., Zanetti, D.L., Main, P.A., Jokovic, A., Dwyer, J.J., Otchere, D.F., & Locker, D. (2000). Oral hygiene knowledge of high-risk Grade One children: an evaluation of two methods of dental health education. *Community Dentistry and Oral Epidemiology, 28*(5), pp. 336-343.

Hayes, R.J., & Bennett, S. (1999). Simple sample size calculation for cluster-randomized trials. *International journal of epidemiology, 28*(2), pp. 319-326.

Healthy Schools. (2007a). *Whole School Approach to the NHSP.* London: Department of Health and Department for Children, Schools and Families initiative.

Healthy Schools. (2007b). *Introduction to the NHSP.* London: Department of Health and Department for Children, Schools and Families initiative.

Hemming, K., Girling, A.J., Sitch, A.J., Marsh, J., & Lilford, R.J. (2011). Sample size calculations for cluster randomised controlled trials with a fixed number of clusters. *BMC Medical Research Methodology, 11*, pp. 102.

Hemming, P.J. (2008). Mixing qualitative research methods in children's geographies. *Area, 40*(2), pp. 152-162.

Henderson, J.A., Barry, T.D., Bader, S.H., & Jordan, S.S. (2011). The relation among sleep, routines, and externalizing behavior in children with an autism spectrum disorder. *Research in Autism Spectrum Disorders, 5*(2), pp. 758-767.

Hickman, J., Millett, D.T., Sander, L., Brown, E., & Love, J. (2002). Powered vs manual toothbrushing in fixed appliance patients: a short term randomized clinical trial. *The Angle Orthodontist, 72*(2), pp. 135-140.

Hobbs, G., & Vignoles, A. (2007). *Is free school meal status a valid proxy for socio-economic status (in schools research)?* London:Centre for the Economics of Education, London School of Economics and Political Science.

Hobbs, G., & Vignoles, A. (2010). Is children's free school meal 'eligibility' a good proxy for family income? *British Educational Research Journal, 36*(4), pp. 673-690.

Hodges, C.A., Bianco, J.G., & Cancro, L.P. (1981). The removal of dental plaque under timed intervals of tooth-brushing. *Journal of Dental Research, 60*(425 (abstract#460).

Hofferth, S. (2000). *Family Reading to Young Children: Social Desirability and Cultural Biases in Reporting*. Paper presented at the Time-Use Measurement and Research: Report of a Workshop, Washington, DC.

Holtzman, J. (2009). Simple, Effective--and Inexpensive-- Strategies to Reduce Tooth Decay in Children. *ICAN: Infant, Child, & Adolescent Nutrition, 1*(4), pp. 225-231.

Horowitz, J.A., Vessey, J.A., Carlson, K.L., Bradley, J.F., Montoya, C., & McCullough, B. (2003). Conducting school-based focus groups: lessons learned from the CATS project. *Journal of Pediatric Nursing, 18*(5), pp. 321-331.

Horn, V., & Phantumvanit, P. (2014). Oral health promotion and education messages in Live. Learn. Laugh. projects. *International Dental Journal, 64*(s2), pp. 12-19.

House of Lords Science and Technology Sub-Committee I. (2011). *Behaviour Change: 2nd Report of Session 2010–12.* London:Science and Technology Select Committee.HL Paper 179.

Howe, A., Keogh-Brown, M., Miles, S., & Bachmann, M. (2007). Expert consensus on contamination in educational trials elicited by a Delphi exercise. *Medical Education, 41*(2), pp. 196-204.

Huang, T.T.K., Howarth, N.C., Lin, B.H., Roberts, S.B., & McCrory, M.A. (2004). Energy intake and meal portions: associations with BMI percentile in US children. *Obesity research, 12*(11), pp. 1875-1885.

Huang, X., O'Connor, M., Ke, L.S., & Lee, S. (2014). Ethical and methodological issues in qualitative health research involving children: A systematic review. *Nursing ethics, Online ahead of print,* doi:10.1177/0969733014564102.

Hughes, B.R., Wktton, N., Collins, M., & Bishop, J.N. (1996). Health education about sun and skin cancer: language, ideas and perceptions of young children. *British Journal of Dermatology, 134*(4), pp. 624-629.

Hurling, R., Claessen, J-P., Nicholoson, J., Schafer, F., Tomlin, C.C., & Lowe., C.F. (2013). Automated coaching to help parents increase tehir children's brushing frequency: an exploratory trail. *Community Dentalal Health*, 30, pp.88-93.

Iheozor-Ejiofor, Z., O'Malley, L.A., Glenny, A.M., Macey, R., Alam, R., Tugwell, P., Walsh, T., Welch, V., Worthington, H.V. (2013). Water fluoridation for the prevention of dental caries (Protocol). *Cochrane Database of Systematic Reviews 2013, Issue 12.* Art. No.: CD010856. DOI: 10.1002/14651858.CD010856.

Irwin, L.G., & Johnson, J. (2005). Interviewing young children: Explicating our practices and dilemmas. *Qualitative health research, 15*(6), pp. 821-831.

Itthagarun, A., Verma, S., Lalloo, R., King, N.M., Wefel, J.S., & Nair, R.G. (2011). Effects of fluoridated milk on artificial enamel carious lesions: a pH cycling study. *Journal of Dentistry, 39*(12), pp. 817-824.

Jacobs, A.D., Ammerman, A.S., Ennett, S.T., Campbell, M.K., Tawney, K.W., Aytur, S.A., . . . Rosamond, W.D. (2004). Effects of a tailored follow-up intervention on health behaviors, beliefs, and attitudes. *Journal of Women's Health, 13*(5), pp. 557-568.

Jansson, L., Lavstedt, S., Frithiof, L., & Theobald, H. (2001). Relationship between oral health and mortality in cardiovascular diseases. *Journal –f Clinical Periodontology, 28*(8), pp. 762-768.

Jepson, R., Harris, F., Macgillivray, S., Kearney, N., & Rowa-Dewar, N. (2006). *A review of the effectiveness of interventions, approaches and models at individual, community and population level that are aimed at changing health outcomes through changing knowledge attitudes and behaviour.* NICE (National Institute for Health and Clinical Excellence). Retrived from: http://www.nice.org.uk/nicemedia/live/11868/44521/44521.pdf

Johnson, R.B., & Onwuegbuzie, A.J. (2004). Mixed Methods Research: A Research Paradigm Whose Time Has Come. *Educational Researcher, 33*(7), pp. 14-26.

Johnson, R.B., Onwuegbuzie, A.J., & Turner, L.A. (2007). Toward a Definition of Mixed Methods Research. *Journal of Mixed Methods Research, 1*(2), pp. 112-133.

Jokovic, A., Locker, D., & Guyatt, G. (2004). How well do parents know their children? Implications for proxy reporting of child health-related quality of life. *Quality of Life Research, 13*(7), pp. 1297-1307.

Jokovic, A., Locker, D., Tompson, B., & Guyatt, G. (2004). Questionnaire for measuring oral health-related quality of life in eight- to ten-year-old children. *Pediatric Dentistry, 26*(6), pp. 512-518.

Jon Prosser (Editor). (1998). *Image-based Research: A Sourcebook for Qualitative Researchers*. London: Routledge.

Jonassen, D.H. (1991). Objectivism versus constructivism: Do we need a new philosophical paradigm? *Educational technology research and development, 39*(3), pp. 5-14.

Jones, R.A., Sinn, N., Campbell, K.J., Hesketh, K., Denney-Wilson, E., Morgan, P.J., . . . Magarey, A. (2011). The importance of long-term follow-up in child and adolescent obesity prevention interventions. *International Journal of Pediatric Obesity, 6*(3-4), pp. 178-181.

Jones, S., Burt, B.A., Petersen, P.E., & Lennon, M.A. (2005). The effective use of fluorides in public health. *Bulletin of the World Health Organization, 83*, pp. 670-676.

Jordan, S.S. (2003). *Further Validation of the Child Routines Inventory (CRI): Relationship to Parenting Practices, Maternal Distress, and Child Externalizing Behavior.* (Ph.D), Louisiana State University and Agricultural and Mechanical College. Retrived from: http://etd.lsu.edu/docs/available/etd-0612103-213510/

Kalnins, I., McQueen, D.V., Backett, K.C., Curtice, L., & Currie, C.E. (1992). Children, empowerment and health promotion: some new directions in research and practice. *Health Promotion International, 7*(1), pp. 53-59.

Kay, E.J., & Locker, D. (1996). Is dental health education effective? A systematic review of current evidence. *Community Dentistry and Oral Epidemiology, 24*(4), pp. 231-235.

Kay, E.J., & Locker, D. (1998). A systematic review of the effectiveness of health promotion aimed at improving oral health. *Community Dental Health, 15*(3), pp. 132-144.

Kellett, M. (2005). *Children as active researchers: a new research paradigm for the 21st century?* UK:ESRC.

Kemm, J. (2006). The limitations of 'evidence-based' public health. *Journal of Evaluation in Clinical Practice, 12*(3), pp. 319-324.

Kennedy, C., Kools, S., & Krueger, R. (2001). Methodological considerations in children's focus groups. *Nursing Research, 50*(3), pp. 184-187.

Keogh-Brown, M.R., Bachmann, M.O., Shepstone, L., Hewitt, C., Howe, A., Ramsay, C.R., . . . Campbell, M.J. (2007). Contamination in trials of educational interventions. *Health Technology Assessment 11*(43), pp. iii, ix-107.

Kerry, S.M., & Bland, J.M., (2001). Unequal cluster sizes for trials in English and Welsh general practice: implications for sample size calculations. *Statistics in medicine, 20*(3), pp. 377-390.

Kim, K.S., Yoon, T.H., Lee, J.W., & Kim, D.J. (2009). Interactive toothbrushing education by a smart toothbrush system via 3D visualization. *Computer Methods and Programs in Biomedicine, 96*(2), pp. 125-132.

King, K., Meader, N., Wright, K., Graham, H., Power, C., Petticrew, M., …Sowden, A.J. (2015) Characteristics of Interventions Targeting Multiple Lifestyle Risk Behaviours in Adult Populations: A Systematic Scoping Review. *PLoS ONE 10*(1): e0117015.

King, L. (1998). The settings approach to achieving better health for children. *New South Wales Public Health Bulletin, 9*(11), pp. 128-129.

Kirby, P. (2004). *A Guide to Actively Involving Young People in Research*: *For Researchers, Research Commissioners and Managers*. Eastleigh, Hamphires: INVOLVE Support Unit.

Kirkwood, B. (2004). Making public health interventions more evidence based. *British Medical Journal, 328*(7446), pp. 966-967.

Kitzinger, J., & Barbour, R.S. (1999). Introduction: the challenge and promise of focus groups. *Developing focus group research: Politics, theory and practice*, 1-20.

Klatsky, A.L., Udaltsova, N., Li, Y., Baer, D., Tran, H.N., & Friedman, G.D. (2014). Moderate alcohol intake and cancer: the role of underreporting. *Cancer Causes & Control, 25*(6), pp. 693-699.

Knighting, K., Rowa-Dewar, N., Malcolm, C., Kearney, N., & Gibson, F. (2011). Children's understanding of cancer and views on health-related behaviour: a 'draw and write' study. *Child: Care, Health and Development, 37*(2), pp. 289-299.

Koivusilta, L., Honkala, S., Honkala, E., & Rimpela, A. (2003). Toothbrushing as part of the adolescent lifestyle predicts education level. *Journal of Dental Research, 82*(5), pp. 361-366.

Krefting, L. (1991). Rigor in qualitative research: The assessment of trustworthiness. *American Journal of Occupational Therapy, 45*(3), pp. 214-222.

Krippendorff, K. (2004). *Content Analysis: An Introduction to Its Methodology* (2nd ed.). London: Sage Publications, Inc.

Krueger, R.A. (1998). *Analyzing and reporting focus group results: Focus Group Kit 6*. London: Sage.

Kuusela, S., Honkala, E., & Rimpelä, A. (1996). Toothbrushing frequency between the ages of 12 and 18 years-- longitudinal prospective studies of Finnish adolescents. *Community Dental Health, 13*(1), pp. 34-39.

Kwan, S.Y., Petersen, P.E., Pine, C.M., & Borutta, A. (2005). Health-promoting schools: an opportunity for oral health promotion. *Bulletin of the World Health Organization, 83*(9), pp. 677-685.

Kwan, S., & Petersen, P.E. (2003). *Oral Health Promotion: An Essential Element of a Health-Promoting School*. Geneva:WHO (WHO/NMH/NPH/ORH/School/03.3).

La Greca, A.M. (1990). *Through the eyes of the child: obtaining self-reports from children and adolescents*. Boston: Allyn and Bacon.

Lader, D., Chadwick, B., Chestnutt, I., Harker, R., Morris, J., Nuttall, N., . . . White, D. (2005). *Children's Dental Health in the United Kingdom, 2003: Summary Report.* London:Office for National Statistics.

Lally, P., Van Jaarsveld, C.H.M., Potts, H.W.W., & Wardle, J. (2010). How are habits formed: Modelling habit formation in the real world. *European Journal of Social Psychology, 40*(6), pp. 998-1009.

Langford, R., Bonell, C.P., Jones, H.E., Pouliou, T., Murphy, S.M., Waters, E., Komro, K.A., Gibbs, L.F., Magnus, D., Campbell, R. (2014). The WHO Health Promoting School framework for improving the health and well-being of students and their academic achievement. *Cochrane Database of Systematic Reviews 2014, Issue 4*. Art. No.: CD008958. DOI: 10.1002/14651858.CD008958.pub2.

Laverack, G., & Labonte, R. (2000). A planning framework for community empowerment goals within health promotion. *Health Policy and Planning, 15*(3), pp. 255-262.

Law, C., Cole, T., Cummins, S., Fagg, J., Morris, S., Roberts, H. (2014). A pragmatic evaluation of a family-based intervention for childhood overweight and obesity. Public Health Research, 2(5). Retrieved from: http://www.journalslibrary.nihr.ac.uk/__data/assets/pdf_file/0006/126780/FullReport-phr02050.pdf

Lee, J.-W., Lee, K.-H., Kim, K.-S., Kim, D.-J., & Kim, K. (2006). *Development of Smart Toothbrush Monitoring System for Ubiquitous Healthcare.* Paper presented at the Engineering in Medicine and Biology Society, 2006. EMBS '06. 28th Annual International Conference of the IEEE.

Lee, K.-H., Lee, J.-W., Kim, K.-S., Kim, D.-J., Kim, K., Yang, H.-K., . . . Lee, B. (2007). *Toothbrushing Pattern Classification using Three-Axis Accelerometer and Magnetic Sensor for Smart Toothbrush.* Paper presented at the Engineering in Medicine and Biology Society, 2007. EMBS 2007. 29th Annual International Conference of the IEEE.

Lee, Y. J., Lee, P. J., Kim, K. S., Park, W., Kim, K. D., Hwang, D., & Lee, J. W. (2012). Toothbrushing region detection using three-axis accelerometer and magnetic sensor. *IEEE Transactions on Biomedical Engineering, 59*(3), pp. 872-881.

Lee, P.H., Macfarlane, D.J., Lam, T.H., & Stewart, S.M. (2011). Validity of the international physical activity questionnaire short form (IPAQ-SF): A systematic. *International Journal of Behavioral Nutrition and Physical Activity,8*(115), pp. 1-11.

Lencová, E., Pikhart, H., Broukal, Z., & Tsakos, G. (2008). Relationship between parental locus of control and caries experience in preschool children - cross-sectional survey. *BMC Public Health, 8*, pp. 208.

Lenth, R.V. (2001). Some practical guidelines for effective sample size determination. *The American Statistician, 55*(3), pp.187-193.

Levin, K.A., & Currie, C. (2009). Inequalities in toothbrushing among adolescents in Scotland 1998–2006. *Health Education Research, 24*(1), pp. 87-97.

Levine, R.S. (2001). Caries experience and bedtime consumption of sugar-sweetened food and drinks--a survey of 600 children. *Community Dental Health, 18*(4), pp. 228-231.

Levine, R.S., & Stillman-Lowe, C.R. (2004). *The Scientific Basis of Oral Health Education* (5th ed.). London: BDJ Books.

Lewin, S., Glenton, C., & Oxman, A.D. (2009). Use of qualitative methods alongside randomised controlled trials of complex healthcare interventions: methodological study. *British Medical Journal, 339*:b3496.

Lewis, C.A., McCollum, M.A., & Joseph, S. (1999). The depression-happiness scale: test-retest data over two weeks. *Psychological Reports, 85*(3), pp. 889-892.

Linnan, L., & Steckler, A. (2002). Process Evaluation for Public Health Interventions and Research: An Overview. In A. Steckler & L. Linnan. (Eds.). *Process Evaluation for Public Health Interventions and Research* (pp. 1-23). San Francisco, Calif: Jossey-Bass.

Lioret, S., Touvier, M., Balin, M., Huybrechts, I., Dubuisson, C., Dufour, A., ... & Lafay, L. (2011). Characteristics of energy under-reporting in children and adolescents. *British Journal of Nutrition, 105*(11), pp. 1671-1680.

Lister-Sharp, D., Chapman, S., Stewart-Brown, S., & Sowden, A. (1999). Health promoting schools and health promotion in schools: two systematic reviews. *Health Technology Assessment, 3*(22), pp. 1-207.

Local Futures. (2009) *District Profile: A Deprivation Profile of Salford.* London: The Local Futures Group.

Locker, D. (2000). Deprivation and oral health: a review. *Community dentistry and oral epidemiology, 28*(3), pp. 161-169.

Lowdell, C., Bardsley, M., & Morgan, D. (1999). *Acheson Report. The inquiry into inequalities in health - Implications for London: A discussion paper.* London Health of Londoners Project.

MacGregor, A.S.T., Currie, C.E., & Wetton, N. (1998). Eliciting the Views of Children About Health in Schools Through the Use of the Draw and Write Technique. *Health Promotion International, 13*(4), pp. 307-318.

MacGregor, I.D.M., Rugg-Gunnand, A.J., & Gordon, P.H. (1986). Plaque levels in relation to the number of toothbrushing strokes in uninstructed English schoolchildren. *Journal of Periodontal Research, 21*(6), pp. 577-582.

MacGregor, I.D., & Rugg-Gunn, A.J. (1979). Survey of toothbrushing duration in 85 uninstructed English schoolchildren. *Community Dentistry and Oral Epidemiology, 7*(5), pp. 297-298.

Mackenzie, M., O'donnell, C., Halliday, E., Sridharan, S., & Platt, S. (2010). Do health improvement programmes fit with MRC guidance on evaluating complex interventions? *British Medical Journal, 340*, c185.

Maes, L., Vereecken, C., Vanobbergen, J., & Honkala, S. (2006). Toothbrushing and social characteristics of families in 32 countries. *International Dental Journal, 56*(3), pp. 159-167.

Marinho, V.C. (2009). Cochrane reviews of randomized trials of fluoride therapies for preventing dental caries. *European Archives of Paediatric Dentistry, 10*(3), pp. 183-191.

Marinho, V.C., Higgins, J.P., Sheiham, A., & Logan, S. (2003). Fluoride toothpastes for preventing dental caries in children and adolescents. *Cochrane Database of Systematic Reviews 2003, Issue 1*. Art. No.: CD002278. DOI: 10.1002/14651858.CD002278.

Marmot, M., Allen, J., Goldblatt, P., Boyce, T., McNeish, D., Grady, M., & Geddes, I. (2010). Fair Society, Healthy Lives: The Marmot Review. 2010. *Strategic Review of Health Inequalities in England post-2010*.

Marshall, T.A., Levy, S.M., Broffitt, B., Warren, J.J., Eichenberger-Gilmore, J.M., Burns, T.L., & Stumbo, P.J. (2003). Dental Caries and Beverage Consumption in Young Children. *Pediatrics, 112*(3), pp. e184-e191.

Marshman, Z., & Hall, M.J. (2008). Oral health research with children. *International Journal of Paediatric Dentistry, 18*(4), pp. 235-242.

Marshman, Z., Gibson, B. J., Owens, J., Rodd, H.D., Mazey, H., Baker, S. R., . . . Robinson, P.G. (2007). Seen but not heard: a systematic review of the place of the child in 21st-century dental research. *International Journal of Paediatric Dentistry, 17*(5), pp. 320-327.

Marthaler, T.M., & Petersen, P.E. (2005). Salt fluoridation – an alternative in automatic prevention of dental caries. *International Dental Journal, 55*(6), pp. 351-358.

Martins, C., Oliveira, M., Pordeus, I., & Paiva, S. (2011). Comparison between observed children's toothbrushing habits and those reported by mothers. *BMC Oral Health, 11*(1), pp. 22.

Marx, R.G., Menezes, A., Horovitz, L., Jones, E.C., & Warren, R.F. (2003). A comparison of two time intervals for test-retest reliability of health status instruments. *Journal of Clinical Epidemiology, 56*(8), pp. 730-735.

Mason, J. (2006). Mixing methods in a qualitatively driven way. *Qualitative Research, 6*(1), pp. 9-25.

Masse, L.C., Fuemmeler, B.F., Anderson, C.B., Matthews, C.E., Trost, S. G., Catellier, D.J., & Treuth, M. (2005). Accelerometer Data Reduction: A Comparison of Four Reduction Algorithms on Select Outcome Variables. *Medicine & Science in Sports & Exercise, 37*(Supplement), pp. S544-S554.

Mattheus, D.J. (2010). Vulnerability related to oral health in early childhood: a concept analysis. *J Adv Nurs, 66*(9), pp. 2116-2125.

Mattila, M.L., Rautava, P., Ojanlatva, A., Paunio, P., Hyssala, L., Helenius, H., & Sillanpaa, M. (2005). Will the role of family influence dental caries among seven-year-old children? *Acta Odontologica Scandinavica, 63*(2), pp. 73-84.

Mattila, M.-L., Rautava, P., Sillanpää, M., & Paunio, P. (2000). Caries in Five-year-old Children and Associations with Family-related Factors. *Journal of Dental Research, 79*(3), pp. 875-881.

Mauthner, M. (1997). Methodological aspects of collecting data from children: lessons from three research projects. *Children & Society, 11*(1), pp. 16-28.

Mayall, B. (1993). Keeping healthy at home and school: ‘it's my body, so it's my job‘. *Sociology of Health & Illness, 15*(4), pp. 464-487.

McCracken, G.I., Janssen, J., Steen, N., Dejager, M., & Heasman, P.A. (2002). A clinical evaluation of a novel data logger to determine compliance with

the use of powered toothbrushes. *Journal of Clinical Periodontology, 29*(9), pp. 838-843.

McCracken, G.I., Preshaw, P.M., Steen, I.N., Swan, M., Dejager, M., & Heasman, P.A. (2006). Measuring plaque in clinical trials: index or weight? *Journal of Clinical Periodontology, 33*(3), pp. 172-176.

McCracken, G., Janssen, J., Heasman, L., Stacey, F., Steen, N., Dejager, M., & Heasman, P. (2005). Assessing adherence with toothbrushing instructions using a data logger toothbrush. *Britsish Dental Journal, 198*(1), pp. 29-32; discussion 24.

McDonagh, M.S., Whiting, P.F., Wilson, P.M., Sutton, A.J., Chestnutt, I., Cooper, J., . . . Kleijnen, J. (2000). Systematic review of water fluoridation. *Bristish Medical Journal, 321*(7265), pp. 855-859.

McGrady, M.G., Ellwood, R.P., Maguire, A., Goodwin, M., Boothman, N., & Pretty, I.A. (2012). The association between social deprivation and the prevalence and severity of dental caries and fluorosis in populations with and without water fluoridation. *BMC Public Health, 12*(1), 1122, pp.1-17.

Medical Research Council. (2000). *A framework for development and evaluation of RCTs for complex interventions to improve health.* London:MRC.

Medical Research Council. (2008). *Developing and evaluating complex interventions: new guidence.* London:MRC.

Michie, S. (2008). Designing and implementing behaviour change interventions to improve population health. *Journal of Health Services Research and Policy, 13*(Suppl 3), pp. 64-69.

Michie, S., & Abraham, C. (2004). Interventions to change health behaviours: evidence-based or evidence-inspired? *Psychology & Health, 19*(1), pp. 29-49.

Michie, S., Atkins, L., & West, R. (2014). *The Behaviour Change Wheel: A Guide to Designing Interventions*. Great Britian: Silverback Publishing

Michie, S., Fixsen, D., Grimshaw, J.M., & Eccles, M.P. (2009). Specifying and reporting complex behaviour change interventions: the need for a scientific method. *Implementation Science, 4*(1), pp. 40.

Michie, S., Johnston, M., Francis, J., Hardeman, W., & Eccles, M. (2008). From Theory to Intervention: Mapping Theoretically Derived Behavioural

Determinants to Behaviour Change Techniques. *Applied Psychology, 57*(4), pp. 660-680.

Milgrom, P. (2001). The impact of behavioral technology on dental caries. *Journal of Dental Education, 65*(10), pp. 1102-1105.

Miller-Day, M., Pettigrew, J., Hecht, M.L., Shin, Y., Graham, J., & Krieger, J. (2013). How prevention curricula are taught under real-world conditions: Types of and reasons for teacher curriculum adaptations. *Health Education, 113*(4), pp. 324-344.

Miller, P.H., Baxter, S.D., Hitchcock, D.B., Royer, J.A., Smith, A.F., & Guinn, C.H. (2014). Test-Retest Reliability of a Short Form of the Children's Social Desirability Scale for Nutrition and Health-related Research. *Journal of Nutrition Education and Behavior, 46*(5), pp. 423-428.

Milsom, K.M., Tickle, M., Humphris, G.M., & Blinkhorn, A.S. (2003). The relationship between anxiety and dental treatment experience in 5-year-old children. *Bristish Dental Journal, 194*(9), pp. 503-506; discussion 495.

Mitchell, P.F. (2011). Evidence-based practice in real-world services for young people with complex needs: New opportunities suggested by recent implementation science. *Children and Youth Services Review, 33*(2), pp. 207-216.

Mobley, C., Marshall, T.A., Milgrom, P., & Coldwell, S.E. (2009). The contribution of dietary factors to dental caries and disparities in caries. *Academic Pediatrics, 9*(6), pp. 410-414.

Moffatt, S., White, M., Mackintosh, J., & Howel, D. (2006). Using quantitative and qualitative data in health services research–what happens when mixed method findings conflict? *BMC Health Services Research,6*(28), pp. 1-10.

Moles, D.R., & Ashley, P. (2009). Hospital admissions for dental care in children: England 1997-2006. *British Dental Journal, 206*(7), pp. E14; discussion 378-379.

Mond, J.M., Rodgers, B., Hay, P.J., Owen, C., & Beumont, P.J.V. (2004). Mode of delivery, but not questionnaire length, affected response in an epidemiological study of eating-disordered behavior. *Journal of Clinical Epidemiology, 57*(11), pp. 1167-1171.

Monse, B., Benzian, H., Naliponguit, E., Belizario, V., Schratz, A., & van Palenstein Helderman, W. (2013). The Fit for School health outcome study-a

longitudinal survey to assess health impacts of an integrated school health programme in the Philippines. *BMC public health, 13*(1), 256, pp.1-10.

Morgan, D.L. (1998). Practical strategies for combining qualitative and quantitative methods: Applications to health research. *Qualitative health research, 8*(3), pp. 362-376.

Morgan, M., Gibbs, S., Maxwell, K., & Britten, N. (2002). Hearing children's voices: methodological issues in conducting focus groups with children aged 7-11 years. *Qualitative Research, 2*(1), pp. 5-20.

Mouradian, W. (2001). The face of a child: children's oral health and dental education. *Journal of Dental Education, 65*(9), pp. 821-831.

Mouradian, W.E., Huebner, C.E., Ramos-Gomez, F., & Slavkin, H.C. (2007). Beyond access: the role of family and community in children's oral health. *Journal of Dental Education, 71*(5), pp. 619-631.

Mowbray, C.T., Holter, M.C., Teague, G.B., & Bybee, D. (2003). Fidelity criteria: Development, measurement, and validation. *American Journal of Evaluation, 24*(3), pp. 315-340.

Moynihan, P.J. (2005). The role of diet and nutrition in the etiology and prevention of oral diseases. *Bulletin of the World Health Organization, 83*(9), pp. 694-699.

Moynihan, P.J., & Kelly, S.A.M. (2013). Effect on caries of restricting sugars intake systematic review to inform WHO guidelines. *Journal of Dental Research, 93*(1), pp. 8-18.

Moynihan, P., & Petersen, P.E. (2004). Diet, nutrition and the prevention of dental diseases. *Public Health Nutrition, 7*(1A), pp. 201-226.

Muirhead, V., & Marcenes, W. (2004). An ecological study of caries experience, school performance and material deprivation in 5-year-old state primary school children. *Community Dentistry and Oral Epidemiology, 32*(4), pp. 265-270.

Mulvihill, C., Rivers, K., & Aggleton, P. (2000). A qualitative study investigating the views of primary-age children and parents on physical activity. *Health Education Journal, 59*(2), pp. 166-179.

Murray, C.J., Lopez, A.D., & Wibulpolprasert, S. (2004). Monitoring global health: time for new solutions. *British Medical Journal, 329*(7474), pp. 1096-1100.

Naidoo, S., & Myburgh, N. (2007). Nutrition, oral health and the young child. *Maternal and Child Nutrition, 3*, pp. 312-321.

Nakash, R.A., Hutton, J.L., Jørstad-Stein, E.C., Gates, S., & Lamb, S.E. (2006). Maximising response to postal questionnaires–a systematic review of randomised trials in health research. *BMC medical research methodology, 6*(5), pp. 1-9.

National Institute of Health and Clinical Excellence. (2007). *Behaviour change at population, community and individual levels (Public Health Guidance 6).* London:NICE.

Neal, D.T., Wood, W., & Quinn, J.M. (2006). Habits—A Repeat Performance. *Current Directions in Psychological Science, 15*(4), pp. 198-202.

Neale, R.J., Otte, S., & Tilston, C.H. (1995). Fruit: comparisons of consumption, attitudes, knowledge and preferences of primary school children in England and Germany. *Journal of Consumer Studies & Home Economics, 19*(3), pp. 261-276.

Newbrun, E. (2010). What we know and do not know about fluoride. *Journal of Public Health Dentistry, 70*(3), pp. 227-233.

Newton, J.T., & Scambler, S. (2010). Use of qualitative data in oral health research. *Community Dental Health, 27*(2), pp. 66-67.

NHS Bolton. (2011). Bolton Health & Wellbeing survey 2010 – Main results and background. *PHIT Reports Issue 5, Public Health Intelligence Team*. Retrieved from: http://www.boltonshealthmatters.org/sites/default/files/PHIT-Issue5-Bolton-Health-Wellbeing-Survey.pdf

NHS Choices. (2011). *Children's Teeth.* Retrieved from: http://www.nhs.uk/Livewell/dentalhealth/Pages/Careofkidsteeth.aspx

NHS Salford. (2010). *Tooth Extractions for patient 16 and under.* Data provided by NHS Salford.

Nishtar, S. (2004). Public–private 'partnerships' in health–a global call to action. *Health Research Policy and Systems, 2*(1), 5, pp.1-7

Noyes, J.P., Williams, A., Allen, D., Brocklehurst, P., Carter, C., Gregory, J. W., . . . Whitaker, R. (2010). Evidence into practice: evaluating a child-centred intervention for diabetes medicine management. The EPIC Project. *BMC Pediatrics, 10*, pp. 70.

Nuffield Council on Biothics. (2007). *Public Health: Ethical Issues.* Cambridge: Cambridge Publishers ltd. Retrived from: http://nuffieldbioethics.org/project/public-health/

Nyandindi, U., Milén, A., Palin-Palokas, T., & Robison, V. (1996). Impact of oral health education on primary school children before and after teachers' training in Tanzania. *Health Promotion International, 11*(3), pp. 193-201.

Nyandindi, U., Milén, A., Palin-Palokas, T., Mwakasagule, S., & Mbiru, F. (1995). Training teachers to implement a school oral health education programme in Tanzania. *Health Promotion International, 10*(2), pp. 93-100.

Oakley, A. (1994). Women and Children First and Last: Parallels and Differences between Children's and Women's Studies. In B. Mayall (Ed.), *Children's childhoods observed and experienced* (pp. 13-33).

O'Cathain, A., Murphy, E., & Nicholl, J. (2007). Why, and how, mixed methods research is undertaken in health services research in England: a mixed methods study. *BMC Health Servics Research, 7*, pp. 85.

O'Cathain, A., Murphy, E., & Nicholl, J. (2010). Three techniques for integrating data in mixed methods studies. *British Medical Journal, 341*(sep17 1), c4587.

Office of National Statistics. (2004). *Executive Summary of preliminary findings 2003 Children's Dental Health Survey.* London:Office of National Statistics.

Okada, M., Kawamura, M., Kaihara, Y., Matsuzaki, Y., Kuwahara, S., Ishidori, H., & Miura, K. (2002). Influence of parents' oral health behaviour on oral health status of their school children: an exploratory study employing a causal modelling technique. *International Journal of Paediatric Dentistry, 12*(2), pp. 101-108.

Olson, L.M., Radecki, L., Frintner, M.P., Weiss, K.B., Korfmacher, J., & Siegel, R.M. (2007). At what age can children report dependably on their asthma health status? *Pediatrics, 119*(1), pp. e93-102.

O'Mullane, D.M., Kavanagh, D., Ellwood, R.P., Chesters, R. K., Schafer, F., Huntington, E., & Jones, P.R. (1997). A Three-year Clinical Trial of a Combination of Trimetaphosphate and Sodium Fluoride in Silica Toothpastes. *Journal of Dental Research, 76*(11), pp. 1776-1781.

Onwuegbuzie, A.J., & Leech, N.L. (2004). Enhancing the interpretation of “significant” findings: The role of mixed methods research. *The Qualitative Report, 9*(4), pp. 770-792.

Onwuegbuzie, A.J., Dickinson, W.B., Leech, N.L., & Zoran, A.G. (2009). A Qualitative Framework for Collecting and Analyzing Data in Focus Group Research. *International Journal of Qualitative Methods*, *8*(3), pp. 1-21

Oshikanlu, S. (2006). Teaching Healthy Habits to Young Children: Handwashing, Toileting and Toothbrushing. *Exchange: The Early Childhood Leaders' Magazine Since 1978*, *n169,* pp.28-30.

Padgett, D.K. (2012). *Qualitative and mixed methods in public health*. Sage.

Page, L.A., Boyd, D., & Thomson, W.M. (2013). Do we need more than one Child Perceptions Questionnaire for children and adolescents?. *BMC oral health*, *13*(1), 26.

Palmer, C.A., Burnett, D.J., & Dean, B. (2010). It's More Than Just Candy: Important Relationships Between Nutrition and Oral Health. *Nutrition Today, 45*(4), pp. 154-164.

Passalacqua, A., Reeves, A.O., Newton, T., Hughes, R., Dunne, S., Donaldson, N., & Wilson, N. (2012). An assessment of oral health promotion programmes in the United Kingdom. *Journal of Dental Education,16*(1), e19-e26.

Patrick, D.L., Lee, R.S., Nucci, M., Grembowski, D., Jolles, C.Z., & Milgrom, P. (2006). Reducing oral health disparities: a focus on social and cultural determinants. *BMC Oral Health, 6 Suppl 1*, pp. S4.

Peat, J. (2001). *Health science research: A handbook of quantitative methods*. London: Sage.

Personal and Health Services Scrutiny Panel. (2005). *Dental Provision in Tameside - April 2005.* Tameside:Tameside Metropolitan Borough.

Peters, L.W., Kok, G., Ten Dam, G.T., Buijs, G.J., & Paulussen, T.G. (2009). Effective elements of school health promotion across behavioral domains: a systematic review of reviews. *BMC Public Health, 9*, pp. 182.

Petersen, P.E. (2003). The World Oral Health Report 2003: contunuous improvement of oral health in the 21st century - an approch of the WHO Global Oral Health Programme. *Community Dentistry and Oral Epidemiology, 33*(Suppl. 1), pp. 3-24.

Petersen, P.E. (2005). Sociobehavioural risk factors in dental caries – international perspectives. *Community Dentistry and Oral Epidemiology, 33*(4), pp. 274-279.

Petersen, P.E. (2008). World Health Organization global policy for improvement of oral health - World Health Assembly 2007. *International Dental Journal, 58*(3), pp. 115-121.

Petersen, P.E., Bourgeois, D., Ogawa, H., Estupinan-Day, S., & Ndiaye, C. (2005). The global burden of oral diseases and risks to oral health. *Bulletin of the World Health Organization, 83*(9), pp. 661-669.

Peterson-Sweeney, K., & Stevens, J. (2010). Optimizing the health of infants and children: their oral health counts! *Journal of Pediatric Nursing, 25*(4), pp. 244-249.

Petticrew, M., Eastmure, E., Mays, N., Knai, C., Durand, M.A., & Nolte, E. (2013). The Public Health Responsibility Deal: how should such a complex public health policy be evaluated?. *Journal of Public Health, 35*(4), pp. 495-501.

Piko, B.F., & Bak, J. (2006). Children's perceptions of health and illness: images and lay concepts in preadolescence. *Health Education Research, 21*(5), pp. 643-653.

Pine, C.M. (2007). Designing school programmes to be effective vehicles for changing oral hygiene behaviour. *International Dental Journal, 57*(S5), pp. 377-381.

Pine, C.M., & Dugdill, L. (2011). Analysis of a unique global public-private partnership to promote oral health. *International Dental Journal, 61*(Suppl 2), pp. 11-21.

Pine, C.M., Adair, P.M., Nicoll, A.D., Burnside, G., Petersen, P.E., Beighton, D., . . . Whelton, H. (2004). International comparisons of health inequalities in childhood dental caries. *Community Dental Health, 21*(1 Suppl), pp. 121-130.

Pion, I.A., Kopf, A.W., Hughes, B.R., Wetton, N.M., Collins, M., & Newton Bishop, J.A. (1997). Teaching children about skin cancer: the draw-and-write technique as an evaluation tool. *Pediatric Dermatology, 14*(1), pp. 6-12.

Piscopo, S. (2004). *Socio-ecological factors influencing food choices and behaviours of Maltese primary schoolchildren.* PhD thesis. University of Birmingham [Online]. Retrived from: http://etheses.bham.ac.uk/861/

Pitts, N.B., Boyles, J., Nugent, Z.J., Thomas, N., & Pine, C.M. (2007). The dental caries experience of 5-year-old children in Great Britain (2005/6). Surveys co-ordinated by the British Association for the study of community dentistry. *Community Dental Health, 24*(1), pp. 59-63.

Pizzo, G., Piscopo, M.R., Pizzo, I., & Giuliana, G. (2007). Community water fluoridation and caries prevention: a critical review. *Clinical Oral Investigations, 11*(3), pp. 189-193.

Pleasant, A., & Kuruvilla, S. (2008). A tale of two health literacies: public health and clinical approaches to health literacy. *Health Promotion International, 23*(2), pp. 152-159.

Poland, B., Krupa, G., & McCall, D. (2009). Settings for health promotion: an analytic framework to guide intervention design and implementation. *Health Promotion Practice, 10*(4), pp. 505-516.

Popay, J., & Williams, G. (1994). *Researching the people's health*. London: Psychology Press.

Popay, J., & Williams, G. (1996). Public health research and lay knowledge. *Social Science and Medicine, 42*(5), pp. 759-768.

Porcellato, L. (1998). *Perspectives on smoking of Liverpool primary schoolchildren in their early years.* PhD thesis: Liverpool John Moores University.

Porcellato, L., Dugdill, L., & Springett, J. (2002). Using focus groups to explore children's perceptions of smoking: reflections on practice. *Health Education*,102(6), pp. 310-320

Porcellato, L., Dugdill, L., Springett, J., & Sanderson, F.H. (1999). Primary schoolchildrens' perceptions of smoking: implications for health education. *Health Educucation Research, 14*(1), pp. 71-83.

Pourat, N., & Nicholson, G. (2009). Unaffordable dental care is linked to frequent school absences. *Policy Brief UCLA Cent Health Policy Res* (PB2009-10), pp. 1-6.

Pretty, Bridgman, & Haley. (2007). *Healthier mouths and happier smiles: An oral health strategy for people IN Salford.* Salford:Salford Primary Care Trust.

Prochaska, J.O. (2008). Multiple health behavior research represents the future of preventive medicine. *Preventive medicine, 46*(3), pp. 281-285.

Public Health England. (2014). *Delivering better oral health: an evidnce-based toolkit for prevention* (3rd Edition). London: Public Health Engalnd

(2014126). Retrived from: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/319471/DBOHv3JUNE2014.pdf

Public Health England. (2014). *Local authorities improving oral health: commissioning better oral health for children and young people: An evidence-informed toolkit for local authorities*. London: Public Health Engalnd (2014147). Retrived from: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/321503/CBOHMaindocumentJUNE2014.pdf

Public Health England. (2014). Water fluoridation: health monitiring report for England 2014. London: Public Health England (2013547). Retrived from: https://www.gov.uk/government/publications/water-fluoridation-health-monitoring-report-for-england-2014

Puffer, S., Torgerson, D., & Watson, J. (2003). Evidence for risk of bias in cluster randomised trials: review of recent trials published in three general medical journals. *Bmj, 327*(7418), pp. 785-789.

Punch, S. (2002). Research with Children: The Same or Different from Research with Adults? *Childhood, 9*(3), pp. 321-341.

Ramfjord, S.P. (1967). The Periodontal Disease Index (PDI). *Journal of Periodontology, 38*(6), pp. Suppl:602-610.

Ramsay, D.S. (2000). Patient compliance with oral hygiene regimens: a behavioural self-regulation analysis with implications for technology. *International Dental Journal, 50(S6_Part1),* pp. 304-311.

Rebok, G., Riley, A., Forrest, C., Starfield, B., Green, B., Robertson, J., & Tambor, E. (2001). Elementary school-aged children's reports of their health: A cognitive interviewing study. *Quality of Life Research, 10*(1), pp. 59-70.

Redmond, C.A., Blinkhorn, F.A., Kay, E.J., Davies, R.M., Worthington, H. V., & Blinkhorn, A.S. (1999). A Cluster Randomized Controlled Trial Testing the Effectiveness of a School-based Dental Health Education Program for Adolescents. *Journal of Public Health Dentistry, 59*(1), pp. 12-17.

Reich, M.R. (2000). Public-private partnerships for public health. *Natural Medicine, 6*(6), pp. 617-620.

Richman, W.L., Kiesler, S., Weisband, S., & Drasgow, F. (1999). A meta-analytic study of social desirability distortion in computer-administered

questionnaires, traditional questionnaires, and interviews. *Journal of Applied Psychology, 84*(5), pp. 754-775.

Ridgers, N.D., Fairclough, S.J., & Stratton, G. (2010). Twelve-month effects of a playground intervention on children's morning and lunchtime recess physical activity levels. *Journal of Physical Activity and Health, 7*(2), pp. 167-175.

Riedy, C.A., Weinstein, P., Milgrom, P., & Bruss, M. (2001). An ethnographic study for understanding children's oral health in a multicultural community. *International Dental Journal, 51*(4), pp. 305-312.

Riley, A.W. (2004). Evidence that school-age children can self-report on their health. *Ambulatory Pediatrics, 4*(4 Suppl), pp. 371-376.

Roberts, H. (2012). *What works in reducing inequalities in child health?* (2nd ed.). Bristol: The Policy Press.

Robinson, M. (2008). *Child development from birth to eight: A journey through the early years*. Maidenhead: Open University Press.

Rodd, H.D., Abdul-Karim, A., Yesudian, G., O'mahony, J., & Marshman, Z. (2011). Seeking children's perspectives in the management of visible enamel defects. *International Journal of Paediatric Dentistry, 21*(2), pp. 89-95.

Rolstad, S., Adler, J., & Rydén, A. (2011). Response Burden and Questionnaire Length: Is Shorter Better? A Review and Meta-analysis. *Value in Health, 14*(8), pp. 1101-1108.

Rossiter, J.R., & Robertson, T.S. (1975). Children's Television Viewing: An Examination of Parent-Child Consensus. *Sociometry, 38*(3), pp. 308-326.

Ruckert, A., & Labonté., R. (2014) Public–private partnerships (ppps) in global health: the good, the bad and the ugly, *Third World Quarterly, 35*:9, pp. 1598-1614,

Rychetnik, L., Frommer, M., Hawe, P., & Shiell, A. (2002). Criteria for evaluating evidence on public health interventions. *Journal of Epidemiology and Community Health, 56*(2), pp. 119-127.

Sabatier, P.A. (1986). Top-Down and Bottom-Up Approaches to Implementation Research: a Critical Analysis and Suggested Synthesis. *Journal of Public Policy, 6*(01), pp. 21-48.

Sadler, G.R., Ko, C.M., Alisangco, J., Rosbrook, B.P., Miller, E., & Fullerton, J. (2007). Sample size considerations when groups are the appropriate unit of analysis. *Applied Nursing Research, 20*(3), pp. 152-157.

Sahlqvist, S., Song, Y., Bull, F., Adams, E., Preston, J., & Ogilvie, D. (2011). Effect of questionnaire length, personalisation and reminder type on response rate to a complex postal survey: randomised controlled trial. *BMC medical research methodology, 11*(1), 62.

Saks, M., & Allsop, J. (Eds.). (2007). *Researching health: Qualitative, quantitative and mixed methods* (1st Edition). London: Sage.

Saks, M., & Allsop, J. (Eds.). (2013). *Researching health: Qualitative, quantitative and mixed methods* (2nd Edition). London: Sage.

Sale, J.E., Lohfeld, L.H., & Brazil, K. (2002). Revisiting the quantitative-qualitative debate: Implications for mixed-methods research. *Quality and quantity, 36*(1), pp. 43-53.

Sandström, A., Cressey, J., & Stecksén-Blicks, C. (2011). Tooth-brushing behaviour in 6-12 year olds. *International Journal of Paediatric Dentistry, 21*(1), pp. 43-49.

Sanson-Fisher, R., Redman, S., Hancock, L., Halpin, S., Clarke, P., Schofield, M., . . . Green, S. (1996). Developing methodologies for evaluating community-wide health promotion. *Health Promotion International, 11*(3), pp. 227-236.

Scheinin, A., Miikinen, K.K., & Ylitalo, K. (1976). Turku sugar studies. V. Final report on the effect of sucrose, fructose and xylitol diets on the caries incidence in man. *Acta Odontologica Scandinavica, 34*(4), pp. 179-216.

Schwarzer, R. (2001). Social-Cognitive Factors in Changing Health-Related Behaviors. *Current Directions in Psychological Science, 10*(2), pp. 47-51.

Sechrest, L., & Figueredo, A.J. (1993). Program Evaluation. *Annual Review of Psychology, 44*(1), pp. 645-674.

Shapiro, D.N. (1967). Reactions of children to oral surgery experience. *Journal of Dentistry for Children, 34*(2), pp. 97-107.

Sharp, L., Cochran, C., Cotton, S.C., Gray, N.M., Gallagher, M.E. (2006). Enclosing a pen with a postal questionnaire can significantly increase the response rate. *Journal of Clinical Epidemiology, 59*(7), pp. 747-754.

Shaw, C., Brady, L.-M., & Davey, C. (2011). *Guidelines for Research with Children and Young People.* London:NCB Research Centre.

Sheiham, A. (2005). Oral health, general health and quality of life. *Bulletin of the World Health Organization, 83*(9), pp. 644.

Sheiham, A., & James, W.P.T. (2014). A reappraisal of the quantitative relationship between sugar intake and dental caries: the need for new criteria for developing goals for sugar intake. *BMC public health, 14*(1), 863, pp.1-8.

Sheiham, A., & Watt, R.G. (2000). The Common Risk Factor Approach: a rational basis for promoting oral health. *Community Dentistry and Oral Epidemiology, 28*(6), pp. 399-406.

Shenton, A.K. (2004). Strategies for ensuring trustworthiness in qualitative research projects. *Education for information*, *22*(2), pp. 63-75.

Sherifali, D., & Pinelli, J. (2007). Parent as proxy reporting: implications and recommendations for quality of life research. *Journal of Family Nursing, 13*(1), pp. 83-98.

Sheskin, R.B., Klein, H., & Lowental, U. (1982). Assessment of children's anxiety throughout dental treatment by their drawings. *ASDC Jounal of Dentistry for Children, 49*(2), pp. 99-106.

Silness, J., & Löe, H. (1964). Periodontal Disease in Pregnancy II. Correlation Between Oral Hygiene and Periodontal Condition. *Acta Odontologica Scandinavica, 22*(1), pp. 121-135.

Singal, A.G., Higgins, P.D., & Waljee, A.K. (2014). A Primer on Effectiveness and Efficacy Trials. *Clinical and translational gastroenterology, 5*(1), e45. Retrieved from: http://www.nature.com/ctg/journal/v5/n1/full/ctg201313a.html

Singer, E., & Ye, C. (2013). The use and effects of incentives in surveys. *The ANNALS of the American Academy of Political and Social Science, 645*(1), pp. 112-141.

Slade, G.D. (2001). Epidemiology of dental pain and dental caries among children and adolescents. *Community Dental Health, 18*(4), pp. 219-227.

Slater, A., & Bremner, J.G. (2003). *An Introduction to Developmental Psychology* (Illustrated edition ed.). Oxford: John Wiley & Sons.

Smith, L., & Callery, P. (2005). Children's accounts of their preoperative information needs. *Journal of Clinical Nursing, 14*(2), pp. 230-238.

Smith, P.A., & Freeman, R. (2009). Living in a sweetie culture: Scottish parents' difficulties in maintaining their children's oral health. *Health Education Journal, 68*(4), pp. 255-265.

Smithson, J. (2000). Using and analysing focus groups: limitations and possibilities. *International Journal of social research methodology, 3*(2), pp. 103-119.

Soanes, L., Hargrave, D., Smith, L., & Gibson, F. (2009). What are the experiences of the child with a brain tumour and their parents?. *European Journal of Oncology Nursing, 13*(4), pp. 255-261.

Splieth, C.H., Steffen, H., Welk, A., & Schwahn, C. (2005). Responder and nonresponder analysis for a caries prevention program. *Caries Research, 39*(4), pp. 269-272.

Springett, J. (2001). *Participatory approaches to evaluation in health promotion*. Retrived from: http://www.euro.who.int/en/what-we-publish/abstracts/evaluation-in-health-promotion.-principles-and-perspectives

Sprod, A.J., Anderson, R., & Treasure, E.T. (1996). *Effective oral health promotion: literature review.* Cardiff:Dental Public Health Unit, Health Promotion Wales.Technical report (201996).

Sreebny, L.M. (1982). Sugar availability, sugar consumption and dental caries. *Community Dentistry and Oral Epidemiology, 10*(1), pp. 1-7.

St Leger, L. (2000). Reducing the barriers to the expansion of health-promoting schools by focusing on teachers. *Health Education, 100*(2), pp. 81-87.

St Leger, L. (2001). Schools, health literacy and public healt: possibilities and challenges. *Health Promotion International, 16*(2), pp. 197-205.

St Leger, L. (2004). What's the place of schools in promoting health? Are we too optimistic? *Health Promotion International, 19*(4), pp. 405-408.

St Leger, L.H. (1999). The opportunities and effectiveness of the health promoting primary school in improving child health— a review of the claims and evidence. *Health Educucation Research, 14*(1), pp. 51-69.

Starkey, F., & Orme, J. (2001). Evaluation of a primary school drug drama project: methodological issues and key findings. *Health Education Research, 16*(5), pp. 609-622.

Statutory Instruments. (2007). *The Education (Nutritional Standards and Requirements for School Food) (England) Regulations 2007*. London: TSO (No. 2359).

Steele, J., & Lader, D. (2004). *Social factors and oral health in children: Children's Dental Health in the United Kingdom, 2003*. London:Office for National Statistics.

Stewart, D., & McWhirter, J. (2007). Thinking positive: The importance of resilience and listening to children and young people. *Health Education, 107*(6), pp. 489-493.

Stillman-Lowe, C. (2008). Oral Health Education: What lessons have we learned? *Oral Health Report* (2), pp. 9-13.

Stokes, E., Pine, C.M., & Harris, R.V. (2009). The promotion of oral health within the Healthy School context in England: a qualitative research study. *BMC Oral Health, 9*, pp. 3.

Strange, V., Forest, S., Oakley, A., & Ripple Study Team. (2003). Using research questionnaires with young people in schools: the influence of the social context. *International Journal of Social Research Methodology, 6*(4), pp. 337-346.

Sturgess, J., Rodger, S., & Ozanne, A. (2002). A review of the use of self-report assessment with young children. *The British Journal of Occupational Therapy,65*(3), pp. 108-116.

Sytsma, S., Kelley, M., & Wymer, J. (2001). Development and Initial Validation of the Child Routines Inventory. *Journal of Psychopathology and Behavioral Assessment, 23*(4), pp. 241-251.

Tahmassebi, J.F., Duggal, M.S., Malik-Kotru, G., & Curzon, M.E. (2006). Soft drinks and dental health: a review of the current literature. *Journal of Dentistry, 34*(1), pp. 2-11.

Tai, B.J., Jiang, H., Du, M. Q., & Peng, B. (2009). Assessing the effectiveness of a school-based oral health promotion programme in Yichang City, China. *Community Dentistry and Oral Epidemiology, 37*(5), pp. 391-398.

Taraldsen, K., Chastin, S.F., Riphagen, I I., Vereijken, B., & Helbostad, J.L. (2012). Physical activity monitoring by use of accelerometer-based body-worn sensors in older adults: a systematic literature review of current knowledge and applications. *Maturitas, 71*(1), pp. 13-19.

Taylor, D., Bury, M., Campling, N., Carter, S., Garfied, S., Newbould, J., & Rennie, T. (2006). *A Review of the use of the Health Belief Model (HBM), the Theory of Reasoned Action (TRA), the Theory of Planned Behaviour (TPB) and the Trans-Theoretical Model (TTM) to study and predict health related behaviour*

change. NICE (National Institute for Health and Clinical Excellence). Retrived from: http://www.nice.org.uk/nicemedia/live/11868/44524/44524.pdf

Taylor, D., Roth, G., & Mayberry, W. (1976). Children's drawings about dentistry. *Community Dentistry and Oral Epidemiology, 4*(1), pp. 1-6.

Teddlie, C., & Tashakkori, A. (2009). *Foundations of Mixed Methods Research*. California: Sage Publications

The British Dental Association. (2009). *The British Dental Association Oral Health Inequalities Policy*. London: BDA.

The British Psychological Society. (2011). *Code of Human Research Ethics*. Leicester: The British Psychological Society.

The National Healthy School Standard. (2004). *Promoting emotional health and wellbeing through the National Healthy School Standard.* Wetherby, UK: Health Development Agency.

Thomas, C. (No Date). *Judaism and the Practice of Dentistry*. Unpublished.

Threlfall, A.G., Milsom, K., Catleugh, M., Kearney-Mitchell, P., Blinkhorn, A., & Tickle, M. (2006). A survey of school dental screening practise in community dental services of England and Wales in 2003. *Community Dental Health, 23*(4), pp. 236-238.

Thurmond, V.A. (2001). The Point of Triangulation. *Journal of Nursing Scholarship, 33*(3), pp. 253-258.

Tickle, M., Milsom, K.M., Buchanan, K., & Blinkhorn, A.S. (2006). Dental screening in schools: the views of parents, teachers and school nurses. *British Dental Journal, 201*(12), pp. 769-773; discussion 767.

Tolvanen, M., Lahti, S., & Hausen, H. (2010). Changes in toothbrushing frequency in relation to changes in oral health-related knowledge and attitudes among children - a longitudinal study. *European Journal of Oral Sciences, 118*(3), pp. 284-289.

Torgerson, D.J. (2001). Contamination in trials: is cluster randomisation the answer? *British Medical Journal, 322*(7282), pp. 355-357.

Torgerson, D., & Bland, M. (2009). *Increasing Response Rates to Postal Questionnaires. Resource document,* Department of Health Sciences, University of York. Available from: http://www-users. york. ac. uk/~ mb55/msc/clinimet/week6/response_text.pdf

Touger-Decker, R., & Van Loveren, C. (2003). Sugars and dental caries. *The American Journal of Clinical Nutrition, 78*(4), pp. 881S-892S.

Treasure, E. (2004). The TREND Statement, Evidence-Based Dentistry, 5, pp.88-91.

Treuth, M.S., Catellier, D.J., Schmitz, K.H., Pate, R.R., Elder, J.P., McMurray, R. G., . . . Webber, L. (2007). Weekend and Weekday Patterns of Physical Activity in Overweight and Normal-weight Adolescent Girls. *Obesity, 15*(7), pp. 1782-1788.

Trost, S.G., McIver, K.L., & Pate, R.R. (2005). Conducting Accelerometer-Based Activity Assessments in Field-Based Research. *Medicine & Science in Sports & Exercise, 37*(Supplement), pp. S531-S543.

Trost, S.G., Pate, R.R., Freedson, P.S., Sallis, J.F., & Taylor, W.C. (2000). Using objective physical activity measures with youth: how many days of monitoring are needed? *Medicine & Science in Sports & Exercise, 32*(2), pp. 426-431.

Trubey, R.J., Moore, S.C., & Chestnutt, I.G.. (2014) Parents' reasons for brushing or not brushing their child's teeth: a qualitative study. *International Journal of Paediatric Dentistry, 24*(2), pp. 104-112.

Trubey, R.J., Moore, S.C., & Chestnutt, I.G. (2015). Children's Toothbrushing Frequency: The Influence of Parents' Rationale for Brushing, Habits and Family Routines. *Caries research, 49*(2), pp. 157-164.

Tsakos, G., Blair, Y.I., Yusuf, H., Wright, W., Watt, R.G., & Macpherson, L.M. (2012). Developing a new self-reported scale of oral health outcomes for 5-year-old children (SOHO-5). *Health and Quality of life outcomes*, *10*(62). Available from: http://www.hqlo.com/content/pdf/1477-7525-10-62.pdf

Turner, S.A. (1997). Children's understanding of food and health in primary classrooms. *International Journal of Science Education, 19*(5), pp. 491-508.

Twetman, S., Axelsson, S., Dahlgren, H., Holm, A.K., Kallestal, C., Lagerlof, F., . . . Soder, B. (2003). Caries-preventive effect of fluoride toothpaste: a systematic review. *Acta Odontologica Scandinavica, 61*(6), pp. 347-355.

U.S. Department of Health and Human Services. (2000). O*ral Health in America: A Report of the Surgeon General*. Rockville, MD:U.S. Department of Health and Human Services, National Institute of Dental and Craniofacial Research, National Institutes of Health.

Unilever. (2013). *Health & Hygiene*. Retrived from: http://www.unilever.com/sustainable-living/healthandhygiene/

Unilever. (2015). Targets & Performance. Retrived from: http://www.unilever.com/sustainable-living-2014/improving-health-and-wellbeing/health-and-hygiene/targets-and-performance/index.aspx#13-385596

Unkel, J.H., Fenton, S.J., Hobbs, G., Jr., & Frere, C.L. (1995). Toothbrushing ability is related to age in children. *ASDC Journal of Dentistry for Children, 62*(5), pp. 346-348.

Valentine, G. (1999). Being seen and heard? The Ethical complexities of working with children and young people at home and at school. *Philosophy & Geography, 2*(2), pp. 141-155.

Van Coevering, P., Harnack, L., Schmitz, K., Fulton, J. E., Galuska, D.A., & Gao, S. (2005). Feasibility of Using Accelerometers to Measure Physical Activity in Young Adolescents. *Medicine & Science in Sports & Exercise, 37*(5), pp. 867-871.

Vandelanotte, C., Reeves, M.M., Brug, J., & De Bourdeaudhuij, I. (2008). A randomized trial of sequential and simultaneous multiple behavior change interventions for physical activity and fat intake. *Preventive medicine, 46*(3), pp. 232-237.

Van Loveren, C., & Duggal, M.S. (2004). Experts' opinions on the role of diet in caries prevention. *Caries Research, 38 Suppl 1*, pp. 16-23.

van Teijlingen, E., & Hundley, V. (2001). The importance of pilot studies. *Social research update*, (35), pp. 1-4.

Vanobbergen, J., Declerck, D., Mwalili, S., & Martens, L. (2004). The effectiveness of a 6-year oral health education programme for primary schoolchildren. *Community Dentistry and Oral Epidemiology, 32*(3), pp. 173-182.

Verplanken, B. (2006). Beyond frequency: habit as mental construct. *British Journal of Social Psychology, 45*(Pt 3), pp. 639-656.

Verplanken, B., & Aarts, H. (1999). Habit, Attitude, and Planned Behaviour: Is Habit an Empty Construct or an Interesting Case of Goal-directed Automaticity? *European Review of Social Psychology, 10*(1), pp. 101-134.

Verplanken, B., & Orbell, S. (2003). Reflections on Past Behavior: A Self-Report Index of Habit Strength1. *Journal of Applied Social Psychology, 33*(6), pp. 1313-1330.

Victora, C.G., Habicht, J.P., & Bryce, J. (2004). Evidence-based public health: moving beyond randomized trials. *American Journal of Public Health, 94*(3), pp. 400-405.

Von Elm, E., Altman, D.G., Egger, M., Pocock, S.J., Gøtzsche, P.C., & Vandenbroucke, J. P. (2007). The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement: guidelines for reporting observational studies. *Bulletin of the World Health Organization, 85*(11), pp. 867-872.

Walsh, T., Worthington, H.V., Glenny, A.M., Appelbe, P., Marinho, V.C., & Shi, X. (2010). Fluoride toothpastes of different concentrations for preventing dental caries in children and adolescents. *Cochrane Database Syst Reviews*, *Issue 1.* Art. No.: CD007868. DOI: 10.1002/14651858.CD007868.pub2.

Ward, D.S., Evenson, K.R., Vaughn, A., Rodgers, A.B., & Troiano, R.P. (2005). Accelerometer Use in Physical Activity: Best Practices and Research Recommendations. *Medicine & Science in Sports & Exercise, 37*(Supplement), pp. S582-S588.

Warwick, I., Mooney, A., & Oliver, C. (2009). *National Healthy Schools Programme: Developing the Evidence Base.* London:Thomas Coram Research Unit, Institute of Education University of London.

Watson, P.M., Dugdill, L., Pickering, K., Bostock, S., Hargreaves, J., Staniford, L., & Cable, N. T. (2011). A whole family approach to childhood obesity management (GOALS): relationship between adult and child BMI change. *Annals of Human Biology, 38*(4), pp. 445-452.

Watson, P., Dugdill, L., Murphy, R., Knowles, Z., & Cable, N. (2012). Moving forward in childhood obesity treatment: A call for translational research. *Health Education Journal*, *72*. pp. 230-239.

Watt, R.G. (2001). Oral health promotion evaluation – time for development. *Community Dentistry and Oral Epidemiology, 29*, pp. 161-166.

Watt, R.G. (2005). Strategies and approaches in oral disease prevention and health promotion. *Bulletin of the World Health Organization, 83*, pp. 711-718.

Watt, R.G. (2007). From victim blaming to upstream action: tackling the social determinants of oral health inequalities. *Community Dentistry and Oral Epidemiology, 35*(1), pp. 1-11.

Watt, R.G., & Fuller, S.S. (1999). Oral health promotion — opportunity knocks! *British Dental Journal, 186*(1), pp. 3-6.

Watt, R.G., McGlone, P., & Kay, E.J. (2003). Prevention. Part 2: Dietary advice in the dental surgery. *British Dental Journal, 195*(1), pp. 27-31.

Watt, R., & Sheiham, A. (1999). Inequalities in oral health: a review of the evidence and recommendations for action. *British Dental Journal, 187*(1), pp. 7-12.

Watt, R., Harnett, R., Nowjack-Raymer, R.E., Treasure, E., Kay, E.J., Daly, B., . . . Morgan, A. (2003). *A Review and Assessment of Oral Health Promotion Outcome Evaluation Measures (2715)*. Paper presented at the The 81st General Session of the International Association for Dental Research, Goteborg, Sweden. Retrived from: http://iadr.confex.com/iadr/2003Goteborg/techprogram/abstract_32551.htm

Wetton, N., & Collins, M. (1996). *Healthy teeth in healthy mouths: a dental health education resource for children aged seven to nine years*. Edinburgh: Health Education Board for Scotland.

Wetton, N., & McWhirter, J. (1995). *Health for Life. A Guide for Health Promoting Schools*. London: Forbes.

Widdus, R. (2001). Public–private partnerships for health: their main targets, their diversity, and their future directions. *Bulletin of the World Health Organization, 79*(8), pp. 713-720.

Wiefferink, C.H., Peters, L., Hoekstra, F., Ten Dam, G., Buijs, G.J., & Paulussen, T.G. (2006). Clustering of health-related behaviors and their determinants: possible consequences for school health interventions .*Prevention Science, 7*(2), pp. 127-149.

Wilkinson, R., & Pickett, K. (2010). The Spirit Level: Why Equality is Better for Everyone (pp. 370). [Kindle Edition]:Penguin.

Wilkinson, S. (2011). Analysing focus group data. *Qualitative research*, 168-184. Accessed online - http://www.sagepub.com/upm-data/11007_Chapter_7.pdf

Williams, D.T., Wetton, N., & Moon, A. (1989a). *A Picture of Health: What do you do that Makes you Healthy and Keeps you Healthy?* London: Health Education Authority.

Williams, D.T., Wetton, N., & Moon, A. (1989b). *A Way In: Five Key Areas of Health Education*. London: Health Education Authority.

Williams, N.J., Whittle, J.G., & Gatrell, A.C. (2002). The relationship between socio-demographic characteristics and dental health knowledge and attitudes of parents with young children. *Br Dent J, 193*(11), pp. 652-654.

Wilson, A.M., Magarey, A.M., & Mastersson, N. (2008). Reliability and relative validity of a child nutrition questionnaire to simultaneously assess dietary patterns associated with positive energy balance and food behaviours, attitudes, knowledge and environments associated with healthy eating. *International Journal of Behavioral Nutrition and Physical Activity*, *5*(1), 5, pp. 1-12.

Wind, M., Kremers, S., Thijs, C., & Brug, J. (2005). Toothbrushing at school: Effects on toothbrushing behaviour, cognitions and habit strength. *Health Education, 105*(1), pp. 53-61.

Winston, A.E., & Bhaskar, S.N. (1998). Caries preventionin the 21st century. *The Journal of the American Dental Association, 129*(November), pp. 1579-1587.

Wong, M.C., Clarkson, J., Glenny, A.M., Lo, E.C., Marinho, V.C., Tsang, B. W., . . . Worthington, H.V. (2011). Cochrane reviews on the benefits/risks of fluoride toothpastes. *Journal of Dental Research, 90*(5), pp. 573-579.

Wood, W., & Neal, D.T. (2007). A New Look at Habits and the Habit–Goal Interface. *Psychological Review, 114*(4), pp. 843-863.

World Health Organisaion. (1996). *The Status of School Health.*Geneva:Health Education and Health Promotion Unit. Division of Health promotion, Education and Communication (WHO/HPR/HEP/96.1).

World Health Organisaion. (1998). *Health promoting schools: A healthy setting for living, learning and working.* Geneva:Division of Health promotion, Education and Communication. Health Education and Health Promotion Unit (WHO/HPR/HEP/98.4).

World Health Organisaion. (2010). *Global school health initiative.* Retrived from: http://www.who.int/school_youth_health/gshi/en/

World Health Organisation. (1994). *Fluorides and Oral Health.* Geneva: World Health Organisaion (846).

World Health Organization. (1986). *Ottawa Charter for Health Promotion.* Geneva: World Health Organization.

Worthington, H.V., Hill, K.B., Mooney, J., Hamilton, F.A., & Blinkhorn, A.S. (2001). A Cluster Randomized Controlled Trial of a Dental Health Education

Program for 10-year-old Children. *Journal of Public Health Dentistry, 61*(1), pp. 22-27.

Wyatt, T.H., Krauskopf, P.B., & Davidson, R. (2008). Using Focus Groups for Program Planning and Evaluation. *The Journal of School Nursing, 24*(2), pp. 71-82.

Yardley, L. (2000). Dilemmas in qualitative health research. *Psychology and Health, 15*(2), pp. 215-228.

Yee, R., & Sheiham, A. (2002). The burden of restorative dental treatment for children in Third World countries. *International Dental Journal, 52*(1), pp. 1-9.

Yeung, C.A., Hitchings, J.L., Macfarlane, T.V., Threlfall, A.G., Tickle, M., & Glenny, A.M. (2005). Fluoridated milk for preventing dental caries. *Cochrane Database of Systematic Reviews 2005, Issue* 3. Art. No.: CD003876. DOI: 10.1002/14651858.CD003876.pub2.

Yevlahova, D., & Satur, J. (2009). Models for individual oral health promotion and their effectiveness: a systematic review. *Australian Dental Journal, 54*(3), pp. 190-197.

Yusuf, H., Gherunpong, S., Sheiham, A., & Tsakos, G. (2006). Validation of an English version of the Child-OIDP index, an oral health-related quality of life measure for children. *Health and Quality of Life Outcomes, 4*, pp. 38.

Zaborskis, A., Milciuviene, S., Narbutaite, J., Bendoraitiene, E., & Kavaliauskiene, A. (2010). Caries experience and oral health behaviour among 11 -13-year-olds: an ecological study of data from 27 European countries, Israel, Canada and USA. *Community Dental Health, 27*(2), pp. 102-108.

Zaura, E., & Ten Cate, J.M. (2004). Dental plaque as a biofilm: a pilot study of the effects of nutrients on plaque pH and dentin demineralization. *Caries Research, 38 Suppl 1*, pp. 9-15.

Zero, D.T., Creeth, J.E., Bosma, M.L., Butler, A., Guibert, R.G., Karwal, R., . . . Kelly, S.A. (2010). The Effect of Brushing Time and Dentifrice Quantity on Fluoride Delivery in vivo and Enamel Surface Microhardness in situ. *Caries Research, 44*(2), pp. 90-100.

Zillmer, R. (2011). Measurement of toothbrushing behaviour in a natural environment. *Personal and Ubiquitous Computing, Online First*. Retrived from: http://www.springerlink.com/content/d124782105803746/

Appendix

Section 1: '*Brush Day & Night*' materials – described in chapter 2 and evaluated in chapter 6 & 7

1. **'*Brush Day & Night*' school programme introduction for teachers**
2. **Teaching Sheet 1 – The mouth, The teeth and their roles**
3. **Teaching Sheet 2 – Main teeth problems: Germs and cavities**
4. **Teaching Sheet 3 – Brushing Day & Night with a fluoride toothpaste**
5. **School Poster 1 & 2**
6. **Teachers power point slides (following *study 1* additions)**
7. **'*Brush Day & Night*' Letter to mother (following changes from *study 1*)**
8. **Tips to '*Brush Day & Night*' with Pablo & Oliver**
9. **Home information leaflet – Your kid is 0 – 3 years old**
10. **Home information leaflet – Your kid is 3 – 6 years old**
11. **Home information leaflet – Your kid is 6 – 12 years old**
12. **Example sheets from children's Brushing Calendar**

Section 2: Pilot study – Chapter 5

13. **Information sheet and consent form for research in school**
14. **Information sheet and consent form for Teachers and Healthy School personnel**
15. **Teachers and Healthy School personnel programme introduction and focus group schedule**
16. **Example of D&W operational coding sheet**
17. **FG analysis theme definition sheet**

Section 3: SOHP Evaluation – Chapter 6 & 7

18. **Your child's oral health: a report for parents (developed as a result of *study 1*)**
19. **Intervention schools: Parent letter, Information sheet and consent form**
20. **Control schools: Parent letter, Information sheet and consent form**
21. **SOHP material distribution information in relation to consent and group**
22. **Teachers: Information sheet and consent form**
23. **Letter to teachers explain confidentiality of the programme during the evaluation – intervention schools**

24. **Teachers letter to explain teachers role and children's folders (highlighted sections) – intervention schools**
25. **Dental hygienist plaque recording sheet**
26. **Children plaque exam recording sheet**
27. **Parent letter enclosed with parent pack and initial evaluation materials – intervention schools**
28. **SOHP parent questionnaire for baseline, post-intervention and follow-up**
29. **SOHP evaluation blog screen shots for teachers and parents feedback – intervention schools**
30. **Post-intervention control group letter**
31. **Post-intervention teacher's questionnaire – intervention schools**
32. **Post-intervention parent's letter and questionnaire – intervention schools**
33. **Follow-up parent letter – pre visit**
34. **Follow-up parent letter – intervention schools**
35. **Follow-up parent letter – control schools**
36. **Summary of main areas relating to toothbrushing and nighttime sugar-snacking for parents who returned the questionnaire at baseline, post-intervention and follow-up**
37. **Example of school feedback**

Section 4: Questionnaire validation – Chapter 8

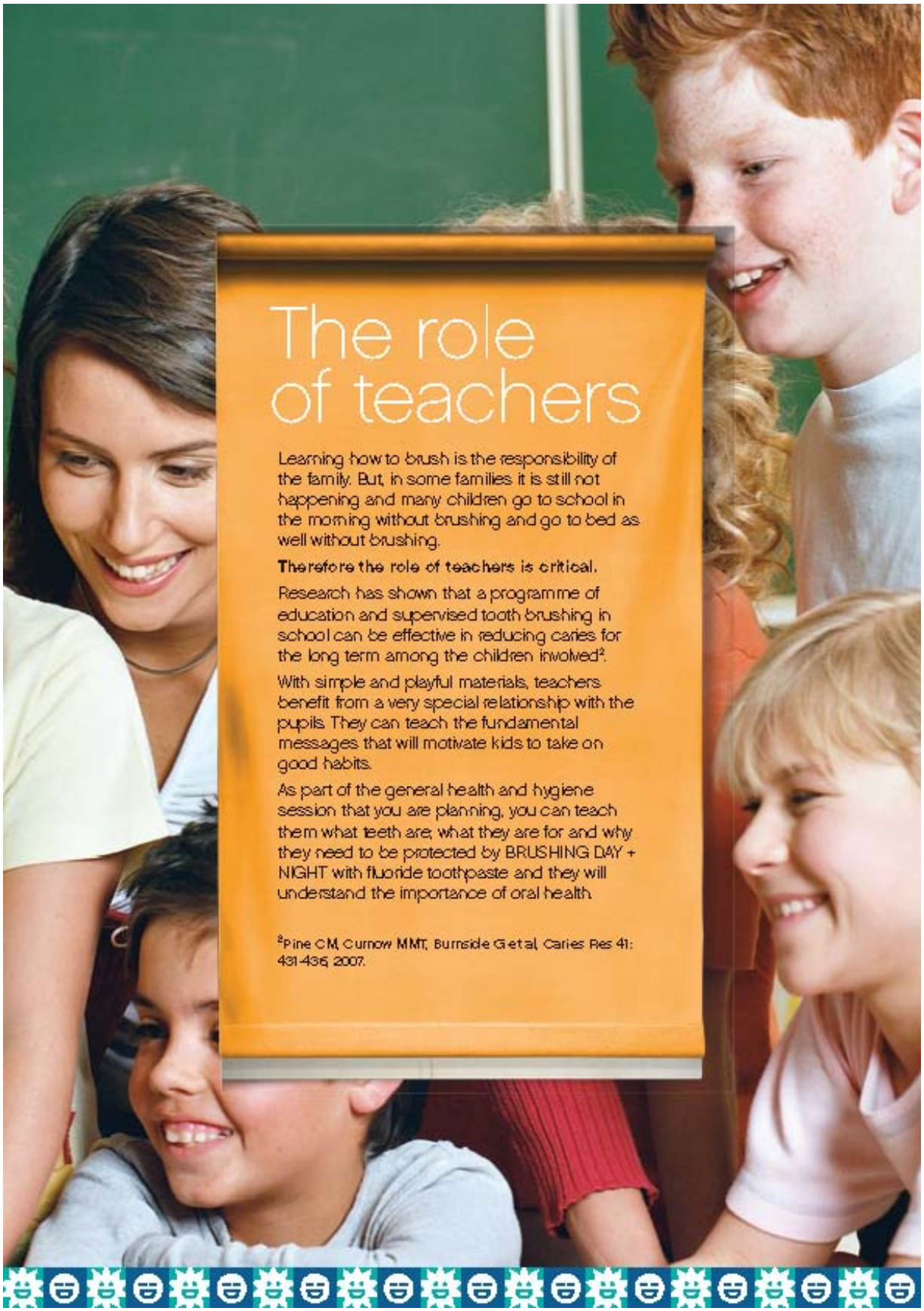
38. **Pilot – Information sheet and consent form**
39. **Pilot – Instructions and toothbrushing recording sheet**
40. **Pilot – Example of participant feedback**
41. **Evaluation phases – Letter to parent, information sheet and consent form**
42. **Evaluation phases – Collection letter and demographic questionnaire for parents**

Section 5: Other

43. **Literature review search strategy details**

Section 1: '*Brush Day & Night*' materials – described in chapter 2 and evaluated in chapter 6 & 7

1. **'*Brush Day & Night*' school programme introduction for teachers**



The role of teachers

Learning how to brush is the responsibility of the family. But, in some families it is still not happening and many children go to school in the morning without brushing and go to bed as well without brushing.

Therefore the role of teachers is critical.

Research has shown that a programme of education and supervised tooth brushing in school can be effective in reducing caries for the long term among the children involved[2].

With simple and playful materials, teachers benefit from a very special relationship with the pupils. They can teach the fundamental messages that will motivate kids to take on good habits.

As part of the general health and hygiene session that you are planning, you can teach them what teeth are, what they are for and why they need to be protected by BRUSHING DAY + NIGHT with fluoride toothpaste and they will understand the importance of oral health.

[2]Pine CM, Curnow MMT, Burnside G et al, Caries Res 41: 431-436, 2007.

6 Years old: when new teeth arrive

The first primary school year is critical for dental prevention.

Indeed, at 6 y.o, milk teeth start falling out and the first permanent molars erupt. It marks the beginning of a period of mixed dentition with both primary and permanent teeth in the mouth. The growing teeth are at that moment not yet mature and therefore vulnerable.

Beside, at 6, kids become more independent, this is why it is crucial that they pick at this age the habit for themselves.

Day + Night School Programs

A school program has been designed by the Brush Day+Night team, with dentists and professors. It provides thousands of teachers with free pedagogical tools that are best suited to the 6 year old.

Experts have identified a few critical factors for the habit to be picked up by pupils:

1. The message needs to be simple and focused. Therefore all the materials developed focus on TWICE DAILY BRUSHING with a fluoride toothpaste, as it has been recognised by the experts as the most important behaviour that has the greatest impact on oral health.

2. The role of teachers is significant, as the message needs to be repeated for greater impact, at least 3 times a year. This is why we have developed 3 activity sheet for kids, so that you can repeat the message in an entertaining way at key moments of the year.

3. The involvement of the parents so that the behaviour happens at home. You will find in this kit some materials for kids to bring back home to their parents.

4. Rewarding and reminding kids to brush day+night is critical. Therefore we suggest you keep a track of them brushing.

5. We recognise that brushing can be a tedious activity for kids. You can help them with entertaining assignments to change their perception of the brushing moment and show them it can be a fun moment. This is why we are suggested in the kids activity sheet that you assign them to a creative exercise asking them either draw, write about, take a picture or make a video of their best brushing moment shared with one or more members of their families.

What does this kit contain?

All the materials in the school kit focus on one single message, tailored to be understood by 6 y.o. kids: I BRUSH DAY+NIGHT.

The kit contains:

1. **THIS INTRODUCTORY PAPER**
2. 3 **TEACHING SHEETS** that will enable you to answer kids questions on all the topics raised in the flipcharts/episodes
   - SHEET 1: The mouth, the teeth and their role
   - SHEET 2: The main teeth problems: Germs & Cavities
   - SHEET 3: The main solution: Brush day+night with a fluoridated TP (& brushing technique)
3. A **FEW SLIDES/FLIPCHARTS** to be used in the classroom to explain the main messages to kids
4. 3 **ACTIVITY SHEETS** for the kids that enable you to repeat the message at least 3 times a year
5. **MORNING AND NIGHT STICKERS AND STICKER BOOK**
6. A **KIT** to deliver to the parents
7. **POSTERS** to hang in the class room to remind kids around the year of brushing morning and evening

2. Teaching Sheet 1 – The mouth, The teeth and their roles

BAUSH DAY+NIGHT

SHEET 1

THE MOUTH, THE TEETH AND THEIR ROLES

What type of teeth do we have?

1. The incisors: 4 on top, 4 at the bottom. These are first permanent teeth that come out after milk teeth fall out. They are used to grab and cut food
2. The canines: 2 on top, 2 at the bottom. Sharp, they can tear the food. For carnivores, canines are very prominent and also called "fangs"
3. Pre-molars: 4 on top and 4 at the bottom, after the canines. The replace the primary molars when they fall out from 9 y.o. onwards. Premolars are square and crush food.
4. Molars: the first molars come out at around 6 y.o., the other 4 come out at around 12 y.o. Finally the 4 wisdom teeth come out during adolescence. Molars are large square chewing teeth at the back of the mouth

What are our teeth for?

Teeth's main mission is to grab, cut tear and crush food. By mixing it with saliva, they prepare food for digestion that continues in the stom ach and intestine

Teeth are also used to speak. Teeth enable clear articulation

Teeth play a key role in a beautiful smile and face. When people don't have any teeth, especially (very) old people, the chin becomes more prominent and wrinkles deepen

Teeth are alive

The tooth is made up of 2 distinct parts: the crown that is the visible part and the root that stick the teeth to the jaw

Teeth are composed of three key materials:

• Enamel covers the crown of the tooth. It is a white, very hard mineral substance made primarily from calcium and phosphate. Enamel needs to be extremely hard to withstand the forces you exert in biting and chew ing as well as changes in temperature between hot and cold foods or drink. In fact, not only is it the hardest substance in your body, but enamel is one of the hardest naturally occurring substances on earth.

• Dentin makes up the bulk of the tooth and lies just under the enamel. It is a yellowish tissue and is made of similar materials to enamel, although it is not as hard. It is protected by the enamel, and in turn protects the pulp of the tooth (see below). The dentin is sensitive. When tooth decay reaches the dentin, this starts causing pain.

• The Pulp forms the core of the tooth and contains all the nerves and blood supply to nourish the dentin. If tooth decay reaches the pulp of a tooth, it can result in a nasty infection and absess.

From milk teeth to permanent teeth

Human beings have two dentitions: the primary dentition, i.e. the milk teeth and the permanent dentition (adult teeth) that appears between 6 and 18 years old

Primary Teeth

There are 20 primary teeth, which are much smaller than the 32 adult permanent teeth. These primary teeth are also called 'milk teeth'. The primary dentition is made up of 4 incisors, 2 canines, 4 molars by arch.

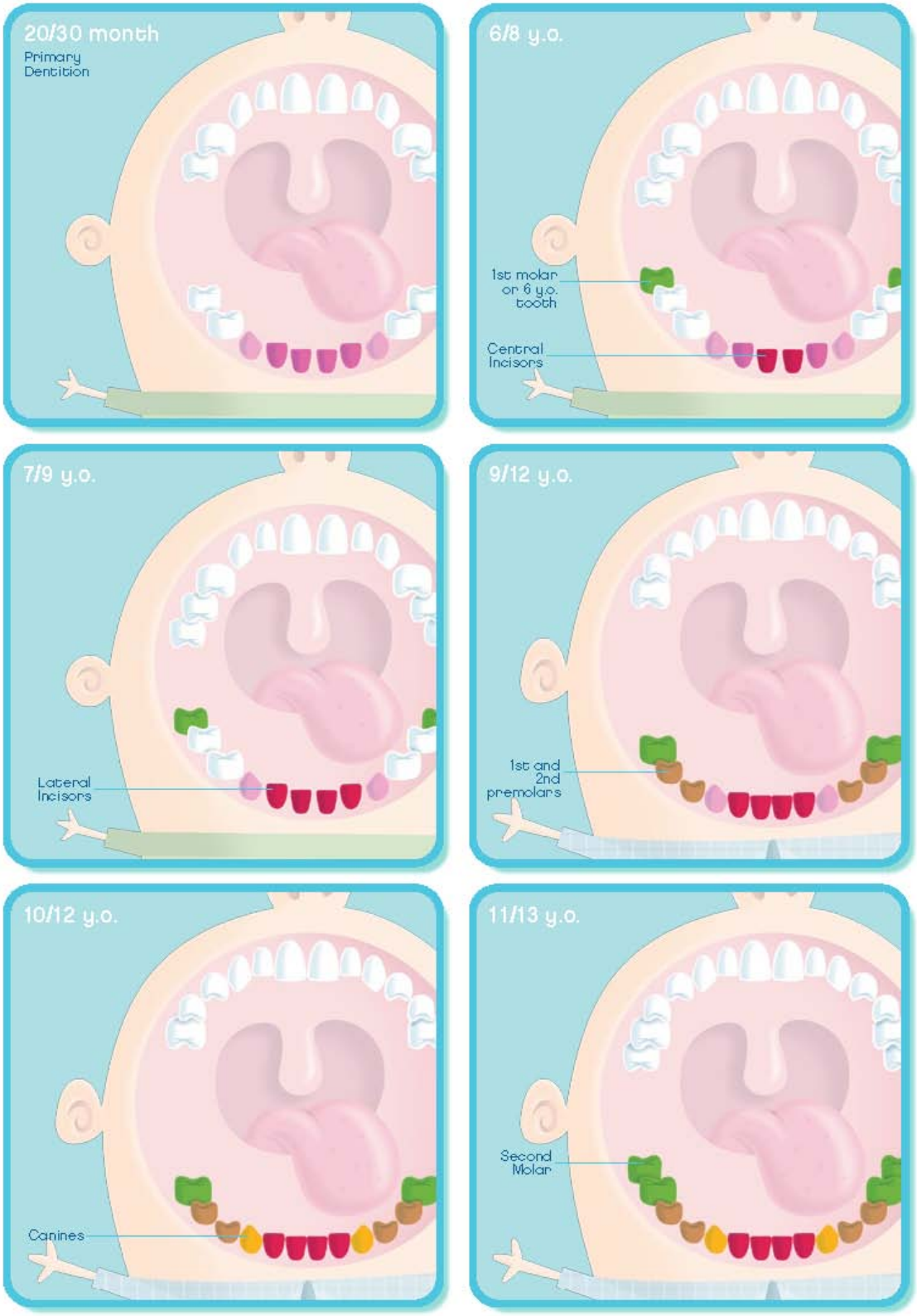
The teeth start forming in the womb and first come through into the mouth somewhere between five and eight months of age, although this can vary. The last of these primary teeth normally come through when a child is between two and three years old.

Mixed Dentition

At around 6 years old and up to 12 years old in average, milk teeth start falling out. On each arch, the 4 primary incisors are replaced by the 4 permanent incisors, the 2 primary canines are replaced by the 2 permanent canines and the 4 primary molars are replaced by 4 permanent pre molars.

At around 6 years old as well, the 4 first permanent molars appear at the back of the mouth. They do not have milk teeth "equivalents".

By the age of thirteen, a child should not have any primary teeth left, and have 28 of the 32 permanent adult teeth in their mouths. The final permanent teeth to erupt are usually the third molars or wisdom teeth (see above) which can come through any time from late teens to early or even mid twenties, if at all.


20/30 month
Primary Dentition
6/8 y.o.
1st molar or 6 y.o. tooth
Central Incisors
7/9 y.o.
Lateral Incisors
9/12 y.o.
1st and 2nd premolars
10/12 y.o.
Canines
11/13 y.o.
Second Molar

Why are primary teeth important?

As primary teeth fall out, it is a common misconception that they do not matter. The primary teeth have a number of important roles to play:

- Primary teeth are essential **in the first step** of digesting food: chewing, biting and grinding.
- Primary teeth act as **guides** for the permanent teeth; by keeping proper spaces in the mouth, they help ensure permanent teeth enter the mouth in the correct places. If primary teeth are lost early through decay there is more chance of permanent teeth entering in the wrong place and becoming crooked or even blocked by other teeth.
- Primary teeth influence the development and growth of the face and jaw muscles.
- Tooth decay and disease present in primary teeth, can be easily passed on to permanent teeth as they erupt. **Primary molars remain in the mouth for around 10 to 12 years with lots of opportunity to pass decay on to their new neighbours.**
- If spread to the root, an infection in a primary tooth can actually damage the permanent tooth lying directly underneath.

Why to watch out for the mixed dentition?

From 6 year old starts the beginning of a mixed dentition with both primary and permanent teeth in the mouth:

- The new permanent teeth are not fully mature. The first few years in the mouth are critical as the teeth are **weaker and more vulnerable to tooth decay**
- **The 6 Year Molar is particularly prone to caries** it is the first permanent tooth to arrive in the mouth and erupts at the back behind the primary teeth, so it's is easy to forget about it.
- The unevenness of the mixed milk and permanent teeth make them also more difficult to clean and protect.

3. Teaching Sheet 2 – Main teeth problems: Germs and cavities

BRUSH DAY+NIGHT

SHEET 2

MAIN TEETH PROBLEMS
GERMS AND CAVITIES

Germs' attack!

What are germs? It is certainly quite difficult for kids to understand a concept that they cannot see

There are a few things you could do to bring the concept of bacteria to life:

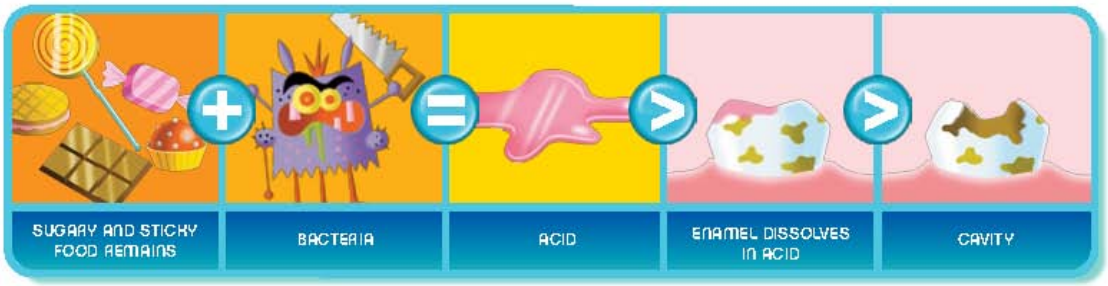
- Use a microscope to compare the size of the bacteria with other organisms (very small insect, dust, hair)
- Or use a photograph showing large scale micro-organisms
- Or use disclosing tablets

For kids, seeing is believing.

How do cavities happen?

Dental decay occurs when sugars in food are turned into acid by particular bacteria on the teeth. The acid attack can last up to 1 hour and calcium is lost from the teeth. Saliva is the mouth's natural protection and can give back some calcium to the teeth - so in the very early stages, decay can be reversed. But frequent acid attacks can weaken the enamel so much that the damage is permanent and a cavity forms.

Once through the enamel to the softer dentin, the decay starts causing pain. When it reaches the pulp, it can lead to an abscess infection and even tooth loss.



STAGE 1 The enamel is attacked

STAGE 2 The dentine is affected

STAGE 3 The pulp is affected and the pain is intense

STAGE 4 The cavity progresses and might lead to an infection

What happens at night?

At night, teeth are even more vulnerable as there is less saliva in the mouth and therefore teeth have less protection from acid attack

The importance of food

It is particularly recommended:

- To avoid snacking in between meals
- To avoid to eat too much sugars and starches and watch out for "hidden" sugars in savoury food like crisps for instance
- To favour a varied diet containing calcium and vitamins, which are good for teeth

4. Teaching Sheet 3 – Brushing Day & Night with a fluoride toothpaste

BRUSH DAY+NIGHT

SHEET 3

BRUSHING DAY+NIGHT WITH A FLUORIDE TOOTHPASTE

Preventing cavities: the importance of brushing DAY+NIGHT with a fluoride toothpaste

Cavities are irreversible. But it is possible to prevent them. Experts recognize that brushing twice a day with fluoride toothpaste is the single most important thing that children can do to help prevent cavities.

Brushing day and night with fluoride toothpaste can cut tooth decay by up to 50% for children, compared with just brushing once[1].

[1]Pine et al. Int Dent J 2000; 50: 312 - 323

Fluoride protects and strengthens teeth

Fluoride is added to toothpastes to provide protection against tooth decay. It works in two ways:

- It encourages calcium uptake by the enamel, to repair minor damage (remineralisation)
- It strengthens tooth enamel, to resist further calcium loss (demineralisation)

So fluoride has a double action against the acid attacks from bacteria

Turning brushing into a fun shared moment

It can be difficult to get kids to brush day+night, especially at night when they have to stop playing and get ready to go to bed.
You can help them through with entertaining assignments to see brushing not as difficult moment but as an enjoyable moment they can share with any member of their families. In the activity sheet you will find some suggestions on how to do it.


The importance of night brushing
At the night, Bacteria do not sleep!
This is why, fluoride delivery to the teeth is extremely important at night when the level of saliva in the mouth drops and leaves teeth vulnerable to acid attacks.

Brushing technique

It has been recognised that for kids to brush day+night, demonstrating the brushing behaviour is critical. Therefore we recommend you organise a brushing session at school and if not possible at least demonstrate the brushing technique on a model.

The following brushing technique is recommended

Use a toothbrush with soft or medium bristles: replace it when the bristles get splayed and out of shape.
For children under 7, use a pea-sized amount of fluoride toothpaste.

1. You start at the bottom, brushing the outer (front) surfaces of teeth. Begin on one side at the back and work round to the other side, brushing each tooth with short strokes as you go. Don't use too much force, just a gentle scrub over the tooth and gumline. Then do the same for the upper teeth.

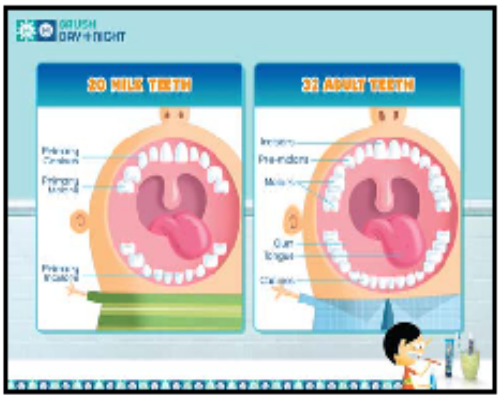
2. Now brush the inner surfaces, behind the teeth (closer to the tongue). This can be tricky: start on one side of the mouth and work round slowly to the other side, making sure you don't miss any teeth. Do the same for both upper and lower teeth.

3. Then you brush the chewing (flat) surfaces of the teeth, gently scrubbing back and forth, turning the brush head to to clean first the lower teeth, then the upper ones.

4. And don't forget the new teeth at the back of the mouth!

5. School Poster 1 & 2

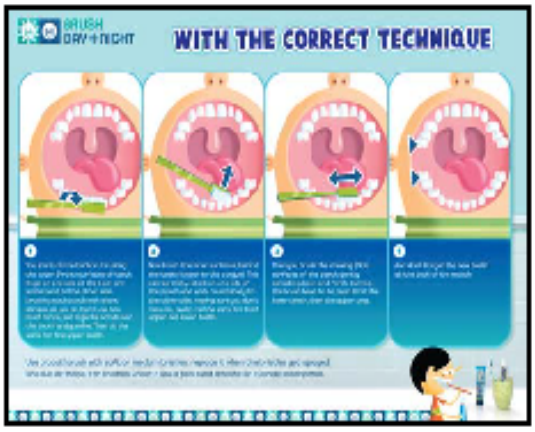
6. Teachers power point slides following *study 1*




BRUSH DAY+NIGHT
BRUSH DAY+NIGHT
TOOTH BRUSH AND TOOTHPASTE
REMOVE GERMS
MAKE TEETH STRONGER

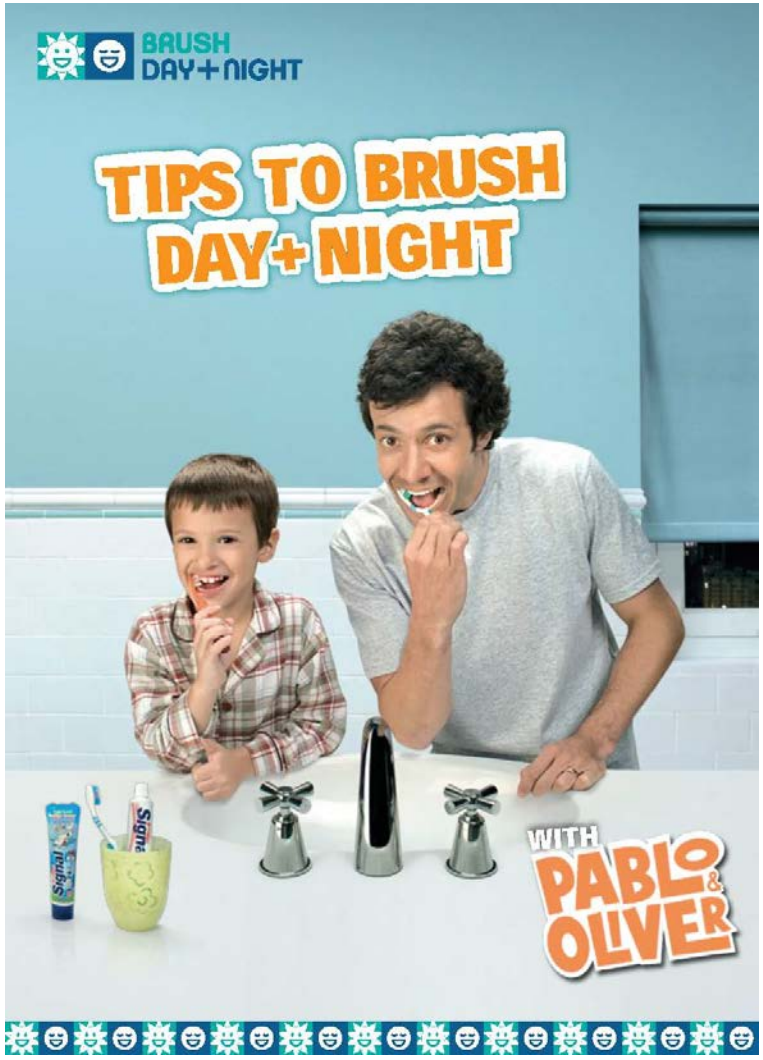

BRUSH DAY+NIGHT
IN THE MORNING BEFORE SCHOOL


BRUSH DAY+NIGHT
GERMS NEVER SLEEP
DON'T FORGET TO BRUSH AT NIGHT


BRUSH DAY+NIGHT
WITH THE CORRECT TECHNIQUE

7. '*Brush Day & Night*' Letter to mother (following changes from *study 1*)

8. Tips to '*Brush Day & Night*' with Pablo & Oliver (with example page)



BRUSH DAY+NIGHT TO WIN THE BATTLE AGAINST CAVITIES

- In just 1g of plaque there can be a whopping 500 million bacteria, ready to damage your children's teeth[2]
- Brushing morning only, and not at night means two times more bacteria will be present in your kid's mouth over night[3]
- Brushing day + night with a fluoride toothpaste can cut tooth decay in children by up to 50% compared to brushing once[4]

SOME TIPS AND TRICKS TO BRUSH DAY+NIGHT

Your role in encouraging your child to adopt the day+night brushing habit is critical. However, we all know this can be tricky:

- Kids don't understand the importance of brushing and they can see no benefit from doing it. For them brushing doesn't make any difference
- Brushing teeth signifies that bedtime is approaching and that they have to stop playing. This can often cause tears or tantrums!

Brushing day+night doesn't have to be a battleground. In this leaflet you will find some tips and tricks on how to get your child brushing with smiles instead of tears.

2 (source: Growing Up Cavity Free, Stephen J. Moss (1993). P. 82)
3 Data on file
4 Pine et al. Int Dent J. 2000; 50: 312 323

TIP 1 TOOTHLESS

Children lose their milk teeth and new ones immediately replace them, so they can find it hard to understand the importance of day+night brushing. Losing their teeth through decay is as mystifying to them as applying for a mortgage.

Hide your teeth with your lips to imitate a toothless old man saying how he wished he brushed twice a day. This visual aid will help them see the importance of brushing twice a day and they'll probably find you hilarious.

TIP 6 INVENTING A STORY

Taking it in turns to tell a story while one of you brushes their teeth is a hugely effective way of turning a boring exercise into an enjoyable time. Your child will be happy to brush as he or she listens to your part of the tale and then can have some fun in adding to the story. You can keep with the same story for a few days or start a new one everyday.

TIP 7 RACE

Making a car like noise whilst brushing will inject some fun into brushing. Just make sure the rules are who ever finishes last wins!

TIP 8 LA CUCARACHA

Pick your child's favourite song and sing it to them while they brush. Make a game of it, you can have a lot of fun using this tip and it's a great way to increase the length of brushing time.

TIP 9 SPACE

Pretend you are both in space on a spaceship and can only move in slow motion. Brush slowly as if you were an astronaut, this will be lots of fun plus you can demonstrate clearly the correct brushing technique and check that your child is cleaning each tooth.


BRUSH DAY+NIGHT CHECKLIST
If you and your family follow these basics steps everyday you will increase your chance of staying cavity and disease free. Plus you will all have lovely smiles!
Brush day+night as soon as first tooth comes through
Never forget to brush at night. Germs never sleep and will cause damage while you snooze
Brush every single tooth dentists recommend brushing for two minutes as this gives you enough time to reach each and every one.
Don't forget the back teeth. This is where most cavities form!
Use a suitable toothbrush for kids: they tend to have a small head, easy to grip handle and soft bristles. Choose the brush with your child so they can pick their favourite colour and are more likely to get excited about brushing
Start using fluoride toothpaste by the time your child is two years old. Buy toothpaste with a nice flavour as you will have more luck getting them to brush day+night if they like the taste. A toothpaste aimed directly at children will often have a more gentle taste
Replace your child's brush every three months. When it is worn it is no longer effective. A "splayed brush" means "change your brush!"
Explain to your children that a toothbrush is not shared, even between brothers and sisters, in order to stop gems spreading.
Take your children to the dentist every six months if possible, even if their teeth don't hurt. This will help avoid development of decay and gum problems.
Try to avoid sugary snacks in between meals whenever possible.


TO FIND OUT MORE TIPS OR TO SHARE YOURS WITH OTHER PARENTS:
WWW.BRUSHDAYANDNIGHT.COM

9. Home information leaflet – Your kid is 0–3 years old

For appendix 9 – 11, following study 2 it is suggested to change 'kid' to 'child'. This is in line with feedback from intervention group parents.

BRUSH DAY+NIGHT

YOUR KID IS 0 TO 3 YEARS OLD

What is happening in their mouth?

Babies' first teeth usually erupt sometime between **five and eight months**. Teeth will continue to erupt until the child is around three years old and all **20 primary teeth are in place.**

What to do?

1. You should start to clean your baby's teeth and gums even before **the first tooth starts to show in the mouth**. Not only does this remove food debris and bacteria, but it also helps to establish DAY+NIGHT tooth brushing as a normal part of your child's daily routine.

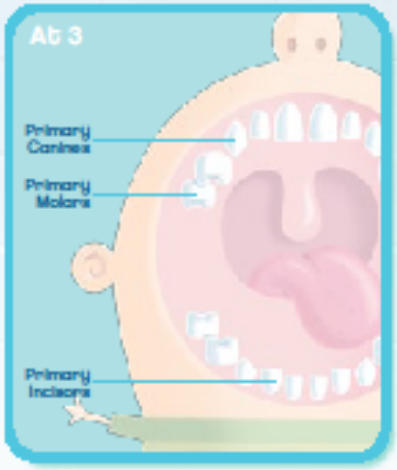
2. Gently clean your baby's teeth and gums **morning and night**, using a moist cloth or soft baby toothbrush, paying particular attention at **bedtime** to ensure the teeth are not left dirty overnight.

3. Avoid putting your child to bed with a bottle of milk or juice, as this leads to **serious decay**. The teeth are bathed in the liquid overnight, allowing the decay-causing bacteria on the teeth to feast all night long. The best solution to this **is not to use a feeding bottle as a pacifier or allow children to go to bed with anything but water in a bottle.**

10. Home information leaflet – Your kid is 3–6 years old

BRUSH DAY+NIGHT

YOUR KID IS 3 TO 6 YEARS OLD



What is happening in their mouth?

Your child should now have the full set of **20 primary teeth.**

Your child's teeth are particularly **vulnerable** to decay as the enamel on milk teeth is not as hard as adult teeth. Tooth decay and disease present in primary teeth can be passed on to the permanent teeth as they erupt.

This is why, even though they fall out **milk teeth are important:**

- Primary teeth are essential in the first step of digesting food; chewing, biting and grinding.
- Primary teeth act as guides for the permanent teeth; by keeping proper spaces in the mouth, they help ensure permanent teeth enter the mouth in the correct places. If primary teeth are lost early through decay there is more chance of permanent teeth entering in the wrong place and becoming crooked (and therefore more cavity-prone) or even blocked by other teeth.
- Primary teeth influence the development and growth of the face and jaw muscles.

What to do?

1. By this age, children are generally able to grasp their own toothbrush and participate in brushing. However, they don't have the dexterity to clean their teeth effectively so will still need your help.

2. The most important thing to do is to brush their teeth DAY+NIGHT, the morning after the breakfast and at night after the last meal of the day.

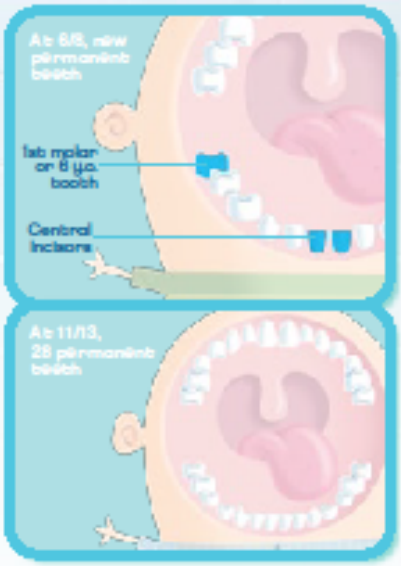
3. You can help your child with a small soft toothbrush, specifically designed for children as they have a smaller head to fit in your child's mouth.

4. By 2, start using fluoride toothpaste. It is best to use toothpaste specifically designed for children as it contains the appropriate amount of fluoride and will have an appealing, gentle taste. Children aged 6 years and under should use only a pea-sized amount of fluoride toothpaste and be encouraged to spit it out after brushing.

11. Home information leaflet – Your kid is 6–12 years old

BRUSH DAY+NIGHT

YOUR KID IS 6 TO 12 YEARS OLD



What is happening in their mouth?

These following 6 years mark a period of mixed tooth sizes with both primary and permanent teeth in the mouth together.

- Primary teeth will loosen and fall out throughout this period. The roots are gradually reabsorbed until the tooth is loose enough to fall out (or be gently pulled out)
- Permanent teeth will arrive in the mouth throughout this period. It is very important that these new teeth are kept as clean as possible as they are not fully mature and more vulnerable to decay.
- The '6 year Molar' is the first permanent tooth to arrive. It erupts at the back, behind the baby teeth, so its more difficult to reach and easier to ignore! It is vital that this tooth is kept clean and healthy, as it is the one most likely to suffer from cavities.
- By the age of 12, the last primary tooth has usually been lost and from this point on children have a set of 28 adult permanent teeth. The final 4 teeth, also known as 'wisdom' teeth, may come through sometime between the ages of 18 and 25 (if at all).

What to do?

1. By this age, children are capable of brushing on their own; although you might not be actually brushing their teeth, they still need your help to establish the brushing habit for a life.

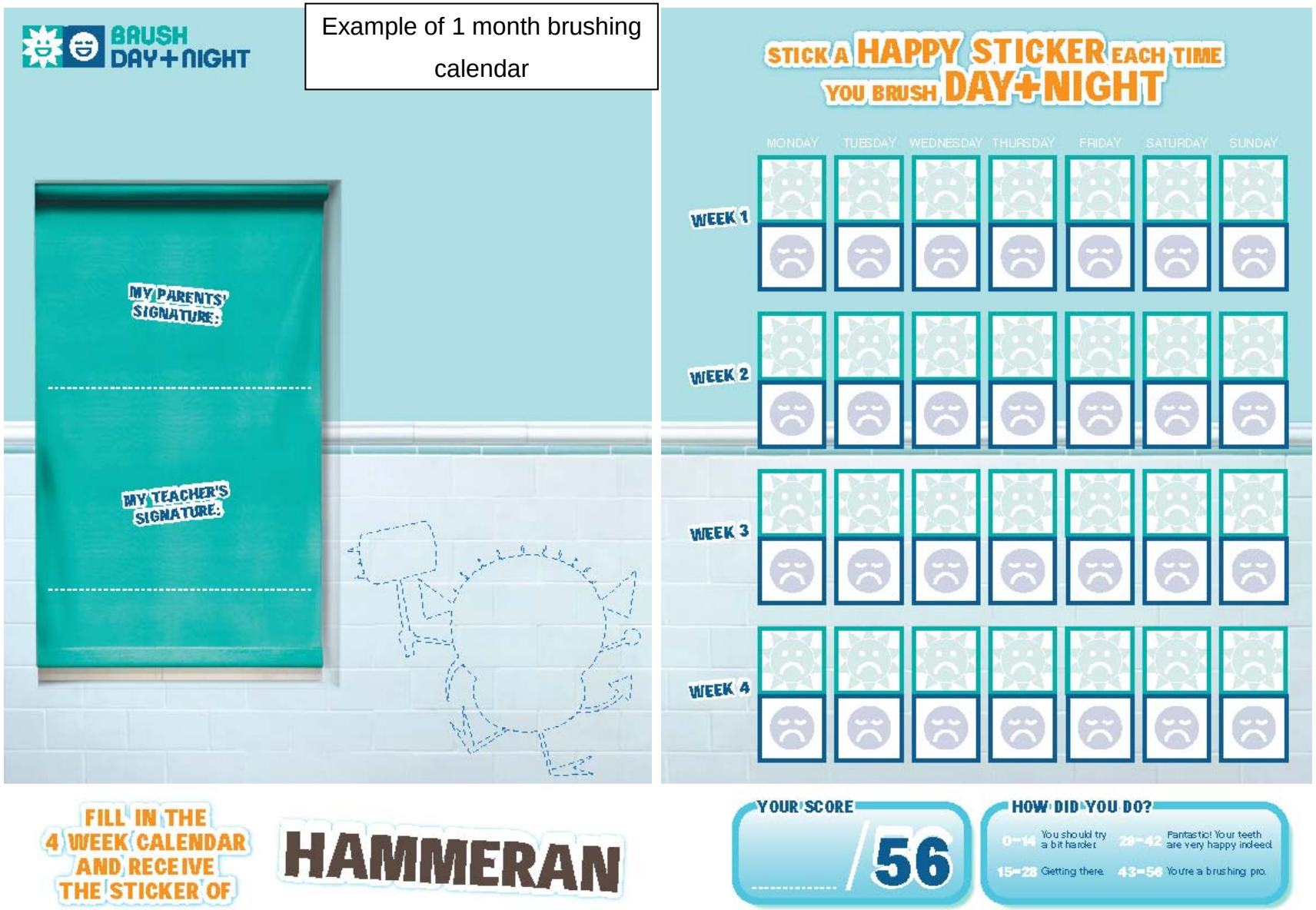
2. You should encourage your children to brush their teeth morning and night, as it is particularly vital to keep the mouth clean and healthy during this age. **The irregular mix of primary and permanent teeth in the mouth** makes children's teeth at this age particularly vulnerable. Decay is particularly likely if the child is eating sweet and sticky foods.

3. Use a toothbrush especially designed for children as they will have a smaller head to fit in a child's mouth.

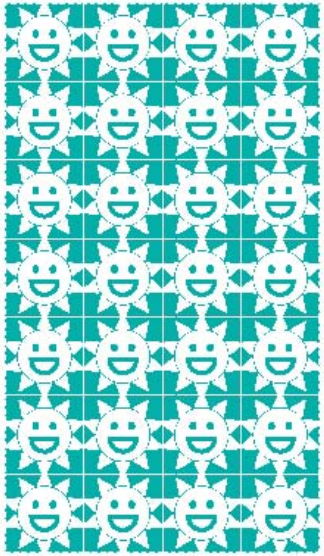
4. Use a normal sized amount of toothpaste. You can now use an adult toothpaste, however if your child doesn't like the taste of adult toothpaste, you can use toothpaste designed specifically for children as this will not only contain the appropriate amount of fluoride but also have an appealing gentle taste.

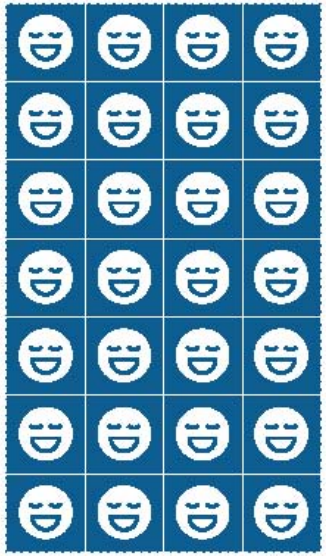
12. Example sheets from children's Brushing Calendar

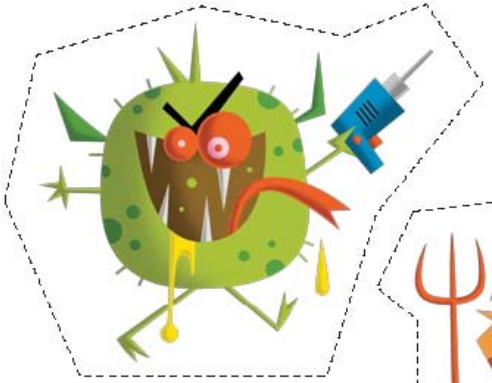
Example of 1 month brushing calendar



Example of daily stickers and year end sticker







Example of monthly reward stickers


OFFICIAL
DAY + NIGHT
BRUSHER
STICKER
BRUSH
DAY+NIGHT
CONGRATS!
YOU REACHED THE END
OF THIS CALENDAR AND
DESERVE A GREAT REWARD.
ENJOY!
Signal
Signal

Section 2: Pilot study – Chapter 5

13. Information sheet and consent form for research in school

University of Salford
A Greater Manchester University

Information Sheet:

Effectiveness of a Global Oral Health Campaign as applied to populations in NW England, UK

Children's Focus Groups, interviews and questionnaires

Introduction

We would like to invite you and your child to take part in a research study. Please take the time to read the following information to understand why and how the research will be conducted.

What is the Purpose of the Study?

Good oral health is essential for all. Dental caries (tooth decay and cavities) is one of the most common diseases in childhood around the world. There are simple ways that dental caries can be reduced which include brushing twice-a-day with fluoridated toothpaste. School programmes have been used to help teach children about the importance of looking after their teeth and teaching them how to brush their teeth effectively. This study is aiming to improve understanding of 6 year olds knowledge, beliefs and current behaviour relating to toothbrushing and oral health.

Why have I been invited?

Many schools in the Salford area are currently taking part in a school programme organised by the Oral Health Improvement team. This trial will be in selected school in the Salford area and the head teacher at your child's school has agreed to be part of the study.

We would like to ask all parents to complete questionnaires and ask permission for your child to be involved in a focus group and individual interviews to ask about their thoughts on teeth and toothbrushing. The focus groups will be videoed for analysis but will be kept securely and confidentially. We would also like to invite

you to take part in a focus group to discuss oral health to understand how it affects you and your child.

Do I have to take part?

It is up to you to decide if you and your child take part in the research. If you would like to ask further questions before deciding we would be happy to discuss anything on the phone. You are free to withdraw from the study at anytime, up until publication of findings. Please return the form indicating if you agree to take part, and if you give permission for your child to take part in the study.

What will happen if I take part?

1. If you wish to take part in the study you will be sent a questionnaire for parents/carers. This will take at most 20 – 30 minutes to complete, and can be done at home. We will provide envelopes for their return. We would ask that the questionnaires relating to the children are completed with them if possible.
2. We are also asking for your consent for your child to take part in a videoed group and interview at their school to find out their opinions on teeth and toothbrushing. This will be with the permission of the school in a safe setting. It will be interactive with activities, drawing tasks.
3. We would also invite you to take part in a short focus group about your and your child's oral health and also about aspects of diet. If you are willing we will also be asking a small group of you to take part in short 10 minute in-depth interviews.

What are the benefits of taking part?

Oral health promotion is a key government target for the NHS and as such one that this programme is aiming to have an impact on. The focus groups and interviews with children will help to give a valuable and not previously sought insight into what children aged 6 – 7 think about teeth and toothbrushing which will help influence programmes in the future. *The information gained from this study will help provide fresh knowledge on the topic of oral hygiene but may not provide any specific individual benefit to yourself or your child.*

Will my taking part in this study be kept confidential?

Yes. We will follow all ethical and legal guidelines for working with children throughout the study. All information will be handled in confidence and stored securely. The information will only be viewed by staff involved in the study.

What will happen to the results of the research study?

We will be using the result as part of an evaluation for a PhD study at the University of Salford. The finding will be written up and some will be included in publications to help inform others about what has been learnt from this study. You and your child will not be identified in any of the reports. If you would like a copy of any results please feel free to request them.

Who is organising the study?

The study is being organised through the University of Salford in partnership with Unilever and NHS Salford it is run through the Faculty of Health and Social Care. All those taking part in the research have gone through enhanced criminal record check to work with children. Ethical approval has been sought through the university. Permissions of the school and consultation with them prior to commencement with the study has been gained.

Please note there are no financial incentives or expenses available for taking part in this study

Further information and contact details

If you have any questions about the study, or wish to discuss any part further please feel free to contact me. Anna Cooper, Faculty of Health & Social Care, Allerton Building, University of Salford, Salford, Greater Manchester, M5 4WT. Tel: 0161 295 3103 Email: a.m.cooper@salford.ac.uk

If you have any concerns about this project please contact Dr Lindsey Dugdill or Professor Cynthia Pine who are supervising the study via the administrator. Tel: 0161 295 2292

Finally many thanks for reading the information sheet and considering taking part. Please keep this for you records.

University of Salford
A Greater Manchester University

Participant Identification for study:

Ethics reference code:

Consent form

Title of Project: Effectiveness of a Global Oral Health Campaign as applied to populations in NW England, UK.
Exploration of children's perspective on oral health
Children's Focus Groups, individual interviews and Questionnaires

Name of Researcher: Anna Cooper

Supervisors: Dr Lindsey Dugdill and Professor Cynthia Pine

Please initial the boxes you consent to:

1. I confirm that I have read and understood the information sheet provided for the above study and have had the opportunity to ask further questions. ☐
2. I agree for myself and my child to take part in this study. ☐
3. I agree that the focus group and interviews can be videoed and sound recorded for future analysis and that I may be contacted for quotes to be used. ☐
4. I fully understand that my participation in this study is voluntary and that I am free to withdraw at any time, without providing a reason, and without this affecting any rights. ☐
5. *I give permission for information given by myself, my child or on behalf of my child to be used in written reports as a result of this investigation and understand publications will be anonymised.* ☐

Name of Parent/guardian	Date	Signature

Please return signed form to researcher

14. Information sheet and consent form for Teachers and Healthy School personnel

University of Salford
A Greater Manchester University

Information Sheet:

Effectiveness of a Global Oral Health Campaign as applied to populations in NW England, UK

Key Stakeholder Focus groups

Introduction

We would like to invite you to take part in a research study. Please take the time to read the following information to understand why and how the research will be conducted. We aim to run the focus groups within the next month.

What is the Purpose of the Study?

Good oral health is essential for all. Dental caries (tooth decay and cavities) is one of the most common diseases in childhood around the world. There are simple ways that dental caries can be reduced which include brushing twice-a-day with fluoridated toothpaste. Many school programmes have been used to help teach children about the importance of looking after their teeth and teaching them how to brush their teeth effectively. The overall aim of the study is to improve understanding of 6 year olds knowledge, beliefs and current behaviour relating to toothbrushing and oral health, and also understand how those around them perceive the oral health and nutrition of the target population.

Why have I been invited?

We are asking key stakeholders (dentist and teachers) in the Salford area to take part in separate focus groups as you will have both contact with the 6 year olds that are the focus of the study as well as knowledge about the area and current topics around oral health. This local knowledge is important to aid greater understanding of the issues affecting local children.

Do I have to take part?

It is up to you to decide if you would like to take part in the research. If you would like to ask further questions before deciding we would be happy to discuss anything on the phone. You are free to withdraw from the study at anytime, up until publication of findings. Please return the form indicating if you agree to take part, and if you give permission for your child to take part in the study.

What will happen if I take part?

1. We are asking for your consent to take part in a videoed focus group that will be held at the University of Salford and last approximately 1-2 hours.

What are the benefits of taking part?

Oral health promotion is a key government target for the NHS and as such one that this programme is aiming to have an impact on. The focus groups and will help to give a valuable insight into views of those who work with and treat the problems around oral health and nutrition in 6-year-olds. The information will also help to inform the final design of a school programme that will be trialled in the Salford area in order to try and maximise its effectiveness.

Will my taking part in this study be kept confidential?

Yes. We will follow all ethical and legal guidelines during this study. All information will be handled in confidence and stored securely. The information will only be viewed by researchers involved in the study.

What will happen to the results of the research study?

We will be using the result as part of an evaluation for a PhD study at the University of Salford. The finding will be written up and some will be included in publications to help inform others about what has been learnt from this study. You will not be identified in any of the reports. If you would like a copy of any results please feel free to request them.

Who is organising the study?

The study is being organised through the University of Salford in partnership with a company and NHS Salford it is run through the Faculty of Health and Social Care.

All those taking part in the research have gone through enhanced criminal record check to work with children. Ethical approval has been gained through the University of Salford.

Please note there are no financial incentives available for taking part in this study

Further information and contact details

If you have any questions about the study, or wish to discuss any part further please feel free to contact me.

Anna Cooper, Faculty of Health & Social Care, Allerton Building, University of Salford, Salford, Greater Manchester, M5 4WT.

Tel: 0161 295 3103 Email: a.m.cooper@salford.ac.uk

If you have any concerns about this project please contact Dr Lindsey Dugdill or Professor Cynthia Pine who are supervising the study via the administrator. Tel: 0161 295 2292

Finally many thanks for reading the information sheet and considering taking part. Please keep this for you records.

University of Salford
A Greater Manchester University

Participant Identification for study:

Ethics reference code:

Consent form

Title of Project: Effectiveness of a Global Oral Health Campaign as applied to populations in NW England, UK.

Exploration of children's perspective on oral health

Key Stakeholder Focus Groups

Name of Researcher: Anna Cooper

Supervisors: Dr Lindsey Dugdill and Prof Cynthia Pine

Please initial the boxes you consent to:

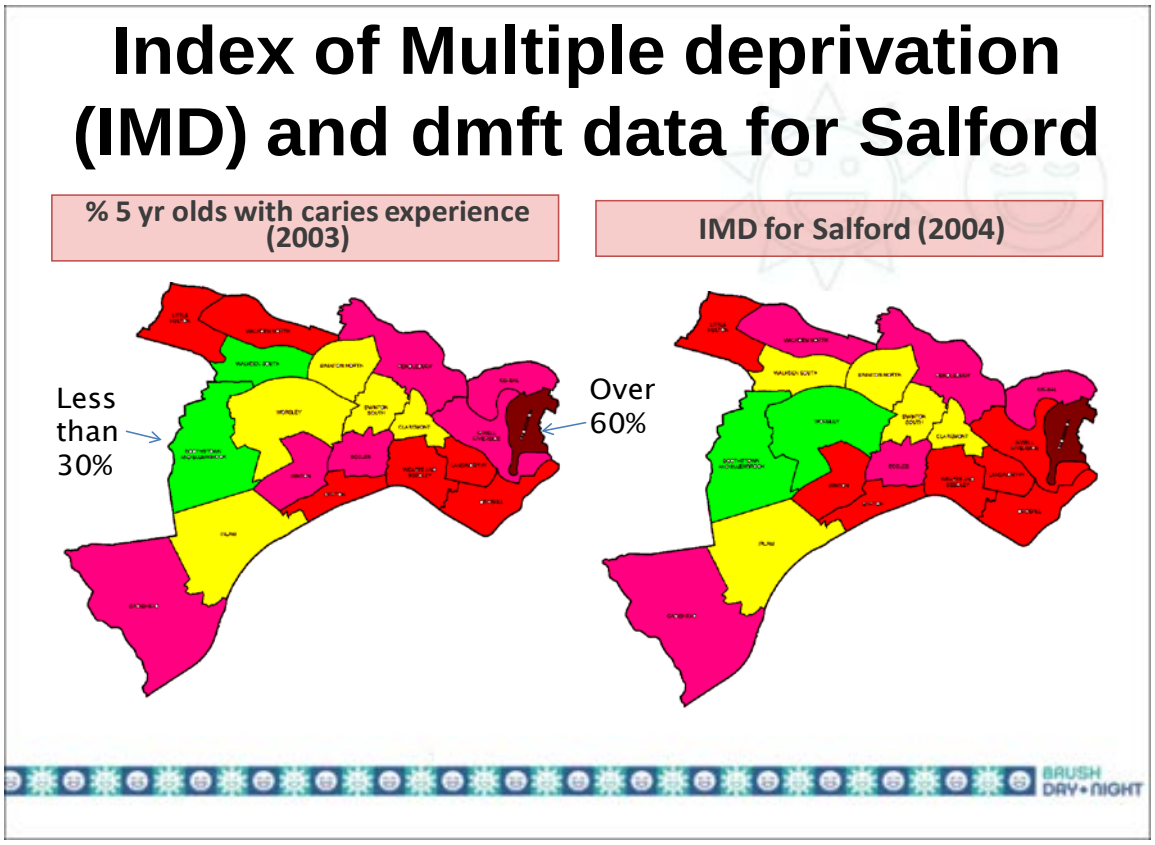
1. I confirm that I have read and understood the information sheet provided for the above study and have had the opportunity to ask further questions. ☐
2. I agree to take part in the focus group. ☐
3. I agree that the focus group can be videoed and sound recorded for future analysis and that I may be contacted for quotes to be used. ☐
4. I fully understand that my participation in this study is voluntary and that I am free to withdraw at any time, without providing a reason, and without this affecting any rights. ☐
5. I give permission for information given by myself to be used in written reports as a result of this investigation and understand publications will be anonymised. ☐

_____ _____ _____

Name of Stakeholder Date Signature

Please return signed form. Thank you

15. **Teachers and Healthy School personnel programme introduction and focus group schedule**



BRUSH DAY+NIGHT IN ONE PAGE

8.6. SCHOOL PROGRAM: MATERIALS AVAILABLE

KIT CONTENT

All the materials in the school kit focus on one single message, tailored to be understood by 6 yo kids : BRUSH DAY-NIGHT

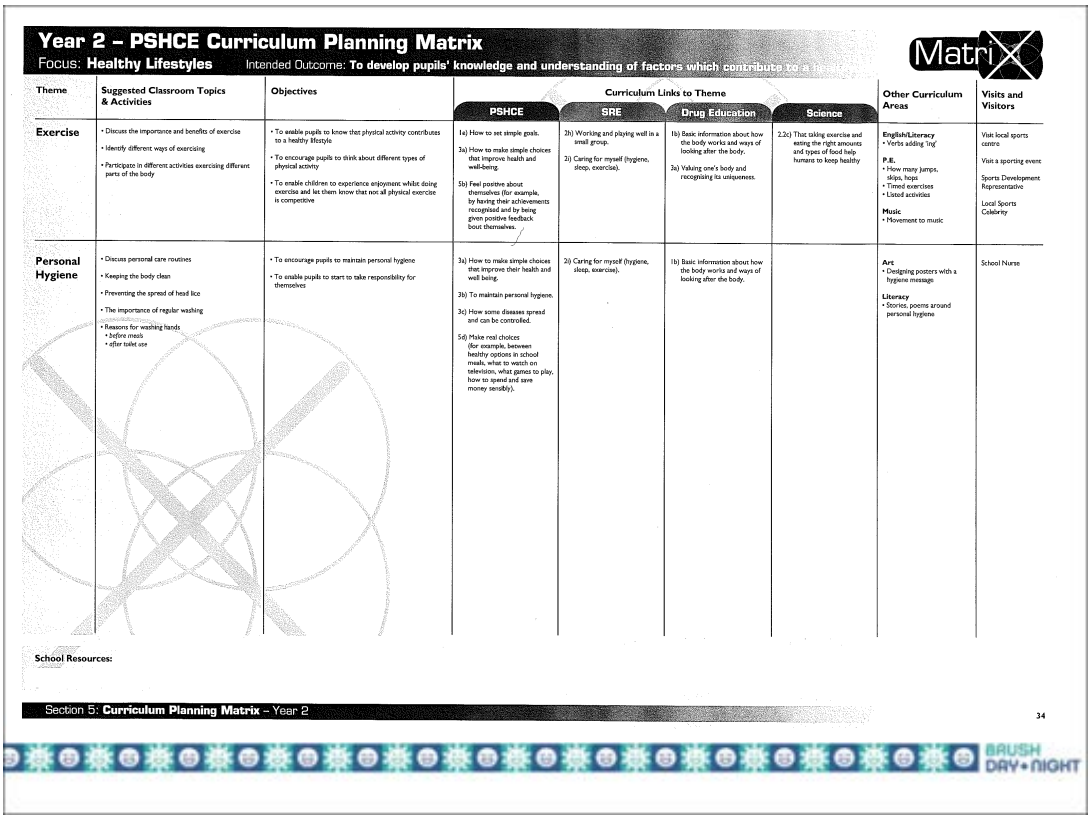
The kit contains:

1. **THIS INTRODUCTORY PAPER**
2. **3 TEACHING SHEETS** that will enable you to answer kids questions on all the topics raised in the flipcharts/episodes
   - SHEET 1: The mouth, the teeth and their role
   - SHEET 2: The main teeth problems: Germs & Cavities
   - SHEET 3: The main solution: Brush day-night with a fluoridated TP (& brushing technique)
3. **A FEW SLIDES/FLIPCHARTS** to be used in the classroom to explain the main messages to kids

5. **3 ACTIVITY SHEET** for the kids that enable you to repeat the message at least 3 times a year
6. **MORNING AND NIGHT STICKERS AND STICKER BOOK** <to check everyday or once a month depending on school programme local mechanics>
7. **A KIT** to deliver to the parents
8. **POSTERS** to hang in the class room to remind kids around the year of brushing morning and evening

A. **A BRUSHING MODEL** for brushing demonstration

11. **SAMPLES** for the kids <toothpaste and toothbrushes when available locally>



Year 2 – PSHCE Curriculum Planning Matrix

Focus: **Healthy Lifestyles** Intended Outcome: **To develop pupils' knowledge and understanding of factors which contribute to a h**

Theme	Suggested Classroom Topics & Activities	Objectives	Curriculum Links to Theme: PSHCE	SRE	Drug Education	Science	Other Curriculum Areas	Visits and Visitors
Exercise	• Discuss the importance and benefits of exercise • Identify different ways of exercising • Participate in different activities exercising different parts of the body	• To enable pupils to know that physical activity contributes to a healthy lifestyle • To encourage pupils to think about different types of physical activity • To enable children to experience enjoyment whilst doing exercise and let them know that not all physical exercise is competitive	1a) How to set simple goals. 3a) How to make simple choices that improve health and well-being. 5b) Feel positive about themselves (for example, by having their achievements recognised and by being given positive feedback bout themselves.	2h) Working and playing well in a small group. 2i) Caring for myself (hygiene, sleep, exercise).	1b) Basic information about how the body works and ways of looking after the body. 2e) Valuing one's body and recognising its uniqueness.	2.2c) That taking exercise and eating the right amounts and types of food help humans to keep healthy	**English/Literacy** • Verbs adding 'ing' **P.E.** • How many jumps, skips, hops • Timed exercises • Listed activities **Music** • Movement to music	Visit local sports centre Visit a sporting event Sports Development Representative Local Sports Celebrity

Personal Hygiene	• Discuss personal care routines
	• Keeping the body clean
	• Preventing the spread of head lice
	• The importance of regular washing
	• Reasons for washing hands
	  • *before meals*
	  • *after toilet use*
		• To encourage pupils to maintain personal hygiene
		• To enable pupils to start to take responsibility for themselves
			3a) How to make simple choices that improve their health and well being.
			3b) To maintain personal hygiene.
			3c) How some diseases spread and can be controlled.
			5d) Make real choices (for example, between healthy options in school meals, what to watch on television, what games to play, how to spend and save money sensibly).
				2i) Caring for myself (hygiene, sleep, exercise).	1b) Basic information about how the body works and ways of looking after the body.		**Art**
							• Designing posters with a hygiene message
							Literacy
							• Stories, poems around personal hygiene
								School Nurse

School Resources:

Section 5: **Curriculum Planning Matrix** – Year 2

34

BRUSH DAY • NIGHT

Key questions to have obtained answers to by end of FG:

1.How could the literature be modified to best achieve behaviour change (to twice daily brushing) in 6 year old children?

2.How could the literature be modified to be more relevant to families' thus increasing engagement of parents and other family members?

3.How could the literature be modified to increase engagement of teachers and school "system" (decision makers who can champion or block uptake of the programme)?

4.How could the website be modified to increase potential effectiveness of behaviour change?

BRUSH DAY • NIGHT

Teachers Focus Group – Facilitators guide

1. What is currently in place in school around oral health?
    a. What priority is given to oral health/hygiene promotion in school?
    b. Do you have any other interventions generally or aimed at improving the health of the children that ruin in schools and are delivered predominantly by teachers but supplied by outside organisations.
2. How well do you think any current interventions work, and how is this judged?
3. What sort of parental engagement happens at the school, do they support any interventions, how do they work?
4. What are you views on teachers being asked to deliver health messages.

Break here to introduce the pack and explain components and how they fit together.

5. What are you opinions on the components of the pack for the programme?
    a. Are there any obvious missing components?
6. How do you feel the proposed lessons fit with the NC and working across subjects?
    a. Are these appropriately well-designed
7. What are your initial opinions on the website and how it could add to reinforcing and aiding the programme?
    a. Do families currently use websites in the home to reinforce work going on in school?
8. What are your opinions on the packs that will be sent home; do you think they will engage parents to be active in encouraging their children?
9. What are your opinions on the worksheets at the end of the lesson, do you think they are aimed at the right level and help reinforce the lessons?
10. How do you feel the pack and the school oral health programme will work in general?
    a. Do you think there are any barriers or facilitators to the programme increasing children's habits to *twice-daily* brushing?
    b. Do you think teacher training would be necessary, useful and/or feasible in delivering the programme?

c. How do you feel it would be best to facilitate the programme in schools?
d. How do you think it would be best to run the school oral health programme condensed over a term or over a year?
    i. How do you feel you would reinforce the message in-between lessons, or could you bring it into other lessons?
e. What are your opinions on how the current school oral health programme fitting in to the NC?

Key questions to have obtained answers to by end of FG:

1. How could the literature be modified to best achieve behaviour change (to *twice-daily* brushing) in 6 year old children?
2. How could the literature be modified to be more relevant to families' thus increasing engagement of parents and other family members?
3. How could the literature be modified to increase engagement of teachers and school "system" (decision makers who can champion or block uptake of the programme)?
4. How could the website be modified to increase potential effectiveness of behaviour change?

16. Example of D&W operational coding sheet

Operational Coding sheet

- Participant ID number 1.1
- Q1 – Keep Healthy
    - Toothbrush
    - Toothpaste
    - Mouthwash
    - 5 a-day
    - Milk
    - Water
    - Twice day
    - Morning
    - Night
    - Other –
- Q1 – Know Healthy
    - Mirror
    - Clean
    - Sparkle
    - No germs
    - White
    - Other –
    - Not draw/write relating to
- Q2 – Good food affect teeth
    - 5 a-day
    - Milk
    - Water
    - No sweets/fizzy drinks
    - Not draw/write relating to
    - Other –
- Q2 – Bad food affect teeth
    - Sweets
    - Fizzy drinks
    - Chocolate
    - Crisps/cake
    - Night Sugar-snacking
    - Other – not brush
    - Not draw/write relating to
- Q3 – What like problems teeth
    - Black teeth/Yellow teeth/Green teeth
    - Fall out
    - Taken out
    - Rot
    - Germs
    - Bad tooth attacking
    - Other – wobbly tooth
    - Not draw/write relating to
- Q3 – Who can help
    - Primary care giver(s)
    - Dentist
    - Doctor
    - Teacher
    - Other
    - Not draw/write relating to

- Q3 – What might be done to help
    - Taken out
    - Go dentist
    - Go doctor
    - Medicine
    - Brush
    - Not draw/write relating to
- Q4 – Routine Drawn
    - Yes
    - No
- Q4 - Time
    - Morning
    - Evening
    - Not draw/write relating to
- Q4 – Help
    - Mum
    - Dad
    - Other
    - Not draw/write relating to
- Q4 – Order
    - Food
    - Night Sugar-snacking
    - Change
    - Teeth (1)
    - Bed (2)
    - Wash
    - Other
    - Not draw relating to
- Q4 – Include Toothbrushing
    - Yes
    - No
    - No of items not code able 0
    - Drawing/ writing mix
- Q1
    - Drawing
    - Writing
    - Both
- Q2
    - Drawing
    - Writing
    - Both
- Q3
    - Drawing
    - Writing
    - Both
- Q4
    - Drawing
    - Writing
    - Both

17. Focus group analysis theme definition sheet

Code	Definitions
Extractions	Talking about teeth being removed other than those falling out naturally
Negative experiences	Negative experiences relation to OH both in relation to the dentist and as a result of issues with dental health
Dentist	Reference to dentist and dental surgeries
Protect germs	References to how we can protect our teeth from germs
Germ impact	Reference to the impact that germs can have on our oral health
Lack of brushing impact	Reference to the impact that not brushing can have on our oral health
Use when brush	What children used when they brush their teeth (toothbrush, toothpaste, mouthwash, floss)
When brush	References to times when brush and frequency
Why brush	Reference to why we brush our teeth
Type of brush	References to what type of brush the children have
Feeling of brush/toothpaste/mouthwash	Comments around the feeling of the brush in their mouth, the feeling of the toothpaste and mouthwash and any impact this has
Technique	Children talking about or where it refers to them demonstrating technique
Sugar behaviour	Talking about their behaviour in relation to sugary snacks and drinks
Sugar impact	Talking about the impact that sugar can have on our oral health
Snacking	Children reference to their snacking behaviour both food and drink
Knowledge diet	Children's comments that demonstrates their knowledge of the impact diet has
Knowledge oral health	Children's comments that demonstrates their knowledge of oral health topics
Parent behaviour	References to parents behaviour in relation to oral health or snacking
Lost teeth	Reference to a loss of teeth through natural or accidental reasons
Unexpected comments	Comments that were not expected in relation to literature, previous research and also the context of the questions
5 A-day	Reference to 5 a-day (fruit or vegetable)
Attitude brush	Children's comments that demonstrate their attitude to brushing and oral health
Family behaviour	References to behaviour in the wider family in relation to oral health and snacking
Parent's Oral health	Reference to their parents oral health status
Attitude diet	Children's comments that demonstrate their attitude towards diet, sugar and snacking
support/taught	Reference to support with oral health issues and also who taught them about oral health
School environment	Impact of the school environment on their comments
Issues tools for oral health	Comments made by the children that refer to any issues, problems or difficulties that have in relation to brushing and oral health practices

Section 3: SOHP Evaluation – Chapter 6 & 7

18. Your child's oral health: a report for parents (developed as a result of study 1)

Your Child's Oral Health
A Report for Parents

Forward: Written by Prof Cynthia Pine
NHS consultant in dental public health

Few of us think about the impact oral disease can have on the lives of our children. It is very hard to concentrate at school if you have pain in your mouth, it can also be difficult to eat, speak or sleep properly - all of which are vital to the healthy growth and development of our children.

Almost all oral disease is preventable if we take care of our teeth from a young age; by brushing twice a day with fluoride toothpaste, especially at night just before bed. If we start establishing and rewarding good habits such as brushing their teeth twice a day and avoiding between meal snacks and drinks containing sugar, when children are young, we can help them to have a healthy mouth for life.

That's why I am supporting this **Brush Day and Night** school programme to improve oral health through encouraging children and families to brush their teeth twice a day, everyday, from when the child's first tooth emerges. In fact, brushing day and night with fluoride toothpaste can cut tooth decay in children by up to 50% (Pine et al. Int Dent J 2000; 50: 312-323). Children's teeth are more vulnerable to decay than adults' teeth because the enamel is not as hard.

It has been proved that brushing day and night with fluoride toothpaste will leave up to 50% fewer bacteria in your child's mouth overnight, meaning less tooth decay.

- Decay and the loss of milk teeth can have a direct impact on the health of your child's permanent teeth. It can even lead to disfigurement;
- Poor oral health is unsightly as well as very painful: bad breath, yellowing or blackened teeth with red inflamed gums or even gaps where teeth should be are not appealing. Visible oral disease can knock people's confidence;

- Establishing healthy habits at a young age provides the foundation for good oral health for life.

The Facts:

1. By the time children start school in Salford, over half will have experienced dental decay (NHS Salford Statistic, 2007).

2. Sugar snacking at night greatly increases the risk of dental disease in children.

3. On average 8 children a week have between 6 – 12 teeth extracted due to oral disease and decay in Salford, costing around £350,000 in total a year.

Checklist for action:

- Brush Day and Night as soon as the first tooth appears.
- Brush every surface of every tooth…. this is why dentists recommend brushing for 2 minutes, it takes this long to clean properly around all your teeth.
- Don't forget the back teeth…this is where most cavities form.
- Use a toothbrush suitable for children: small head, easy to grip handle and soft bristles. Choosing it with them will help them to feel more involved and excited about brushing.
- Start using fluoride toothpaste by 2 years old (600 – 1000ppm fluoride).
- Replace your child's tooth brush every three months. When it is worn, it is no longer effective.
- Take your child to the dentist every six months, if possible, even if their teeth don't hurt. This will help pick up any problems early, and put things right before there is permanent damage.
- Try to avoid sugary snacks in between meals whenever possible and at night time.

BRUSHING NEEDN'T BE A BATTLEGROUND. TRY BRUSHING WITH YOUR CHILDREN TO MAKE IT MORE ENJOYABLE FOR THEM. PLAY GAMES, EXPERIMENT AND HAVE FUN!

Visit www.brushdayandnight.com for more information on how to keep your children's teeth happy as well as handy hints and tips on how to make brushing fun.

19. Intervention schools: Parent letter, Information sheet and consent form

Anna Cooper,
PhD Research Student,
Faculty of Health & Social Care,
The University of Salford
Allerton Building,
Fredrick Rd Campus,
Salford,
Greater Manchester
M6 6PU.
T: +44 (0)161 295 5094
E-mail: a.m.cooper@salford.ac.uk

Dear Parent or Guardian,

Re: Effectiveness of a Global Oral Health programme as applied to populations in NW England, UK

I am conducting a research project as part of my PhD which aims to improve the dental health of year 2 children in Salford. The research is being conducted through the University of Salford and in close partnership with the NHS Healthy Schools Team. Oral health in Salford is among the worst in the North West of England and the UK. We are hoping a programme like this one can help to tackle the increasing problem of dental decay in children.

Your child's school has agreed for the year 2 class to be part of the school oral health programme and the evaluation which will take place during the summer term, 2010.

Your child will not be involved in the research unless you fill in and sign the consent form provided and return it to your child's teacher, but they will be allowed to take part in the school lessons run by the teacher. It is really important that as many parents and children take part in this important research project which is the first of its kind in the UK.

Yours Sincerely,

Anna Cooper

Principle Supervisor: Dr Lindsey Dugdill, Co-Supervisor: Professor Cynthia Pine

University of Salford
A Greater Manchester University

Information Sheet

Effectiveness of a Global Oral Health Campaign as applied to populations in NW England, UK

Introduction

We would like to invite you and your child to take part in a research study. Please take the time to read the following information to understand why and how the research will be conducted.

What is the Purpose of the Study?

Good oral health is essential for all. Dental caries (tooth decay and cavities) is one of the most common diseases in childhood in Salford. There are simple ways that dental caries can be reduced which include brushing twice-a-day with fluoridated toothpaste. School programmes have frequently been used to help teach children about the importance of looking after their teeth and how to brush their teeth effectively. The overall aims of the study are to improve the brushing habits of year 2 children, improve knowledge around oral health and nutrition and understand how any changes in habit affect family routines and try to maximise the sustainability of any new behaviours.

Why have I been invited?

We are asking parents/guardians of children in year 2, attending primary schools in the Salford area to consent to their children taking part in the study. We are in addition asking parents/guardians to complete a questionnaire at three time points over the next 7 months as well as taking an active role in encouraging your child to use the home oral health educational kit during the programme.

Do I have to take part?

It is up to you to decide if you would like to take part in the research and if you child can be involved in the research. If you would like to ask further questions before deciding we would be happy to discuss anything on the ‘phone. You are free to withdraw from the study at anytime, up until publication of findings. Please

return the form indicating if you agree to take part, and if you give permission for your child to take part in the study.

What will happen if I take part?

1. All year 2 children will be included in the three lessons during the programme and provided with an oral health educational kit for home to encourage *twice-daily* brushing with the help of yourselves.
2. With you consent at three time points through the 7 months we will take plaque scores of your child's teeth, this is a clinical procedure that will be carried out by a trained and certified dental health professional. We ask children not to brush their teeth that morning. The examination will be conducted as follows:
    - Use of a standard dental measuring index (Modified Silness and Löe index)
    - The child will be need to be in the 'dental check-up' position laying on a fitness mat on a small table
    - The technique will require the use of air to gently dry the teeth
    - The technique will require a bright spotlight, their eyes will be protected using dark glasses
    - The assessor will use a dental check-up mirror and probe to firstly look at each tooth and then to run the probe around it to measure the presence of plaque. This will be repeated for each tooth, taking approximately four minutes to complete the whole mouth
    - The plaque scores will be recorded
3. With the consent of all parents in the year 2 class and the school, some lessons may be recorded to provide evidence of how they are taught and children interact with the programme.

What are the benefits of taking part?

Oral health promotion is a key government target for the NHS and Healthy School Programmes and as such one that this programme is aiming to have an impact on. The study will help us to understand if the school oral health programme in its current state can have a significant effect on improving the oral hygiene habits of

year 2 children. The information gained through this programme will aid development of a larger scale programme including how best to integrate it into the curriculum.

Will my taking part in this study be kept confidential?

Yes. We will follow all ethical and legal guidelines during this study. All information will be handled in confidence and stored securely. The information will only be viewed by researchers involved in the study. For the duration of the study you and your child will be given a unique code so follow-up data can be matched up. This will ensure that yourself or your child's personal details cannot be identified by anyone apart from the research team.

What will happen to the results of the research study?

We will be using the result as part of an evaluation for a PhD study at the University of Salford. The findings will be written up and some will be included in publications to help inform others about what has been learnt from this study. You will not be identified in any of the reports. If you would like a copy of any results please feel free to request them.

Who is organising the study?

The study is being organised through the University of Salford, Faculty of Health and Social Care in partnership with a company and NHS Salford (specifically the Healthy Schools team). All those taking part in the research have gone through an enhanced criminal record check (CRB) to work with children. Ethical approval to conduct the study has been gained through the University of Salford.

Please note there are no financial incentives available for taking part in this study

Further information and contact details

If you have any questions about the study, or wish to discuss any part further please feel free to contact me: Anna Cooper

Faculty of Health & Social Care, Allerton Building, University of Salford, Salford, Greater Manchester, M6 6PU. Tel: 0161 295 5094 Email: a.m.cooper@salford.ac.uk

If you have any concerns about this project please contact Dr Lindsey Dugdill or Professor Cynthia Pine who are supervising the study via the administrator Louise Robinson: Tel: 0161 295 2799

Finally many thanks for reading the information sheet and considering taking part. Please keep this for you records.

University of Salford
A Greater Manchester University

Participant Identification for study:

Ethics reference code: REP10/047

Consent form

Effectiveness of a Global Oral Health Campaign as applied to populations in NW England, UK.

Name of Researcher: Anna Cooper

Supervisors: Dr Lindsey Dugdill and Prof Cynthia Pine

Please initial the boxes you consent to:

1. I confirm that I have read and understood the information sheet provided for the above study and have had the opportunity to ask further questions.
2. I consent for my child to have a plaque exam at school.
3. I consent for the lesson in school to be videoed as part of the school programme.
4. I agree for the plaque exam to be repeated after a month and also for a six month follow-up.
5. I give consent for my child to take part in video focus groups and class based activities.
6. I fully understand that my child's participation in this study is voluntary and that they are free to withdraw at any time, without providing a reason, and without this affecting any rights.
7. *I give permission for results of the exam to be used in written reports as a result of this investigation and understand publications will be anonymised*.

_____ _____ _____

Name of Parent/guardian Date Signature

_____

Name of Child

OR

I do not give permission for my child to take part in the programme

_____ _____ _____

Name of Parent/guardian Date Signature

Please return signed form in the SAE provided Thank you

20. Control schools: Parent letter, Information sheet and consent form

Anna Cooper,
PhD Research Student,
Faculty of Health & Social Care,
The University of Salford
Allerton Building (AD101),
Fredrick Rd Campus,
Salford,
Greater Manchester
M6 6PU.
T: +44 (0)161 295 3103
E-mail: a.m.cooper@salford.ac.uk

Dear Parent or Guardian,

Re: Effectiveness of a Global Oral Health programme as applied to populations in NW England, UK

I am conducting a research project as part of my PhD around dental health of year 2 children in Tameside and Salford. The research is being conducted through the University of Salford and in close partnership with the NHS Healthy Schools Team. Oral health in the North West of England is among the worst in the UK.

Your child's school has agreed for the year 2 class to be part of an evaluation which will take place during the summer term, 2010. A dental hygienist along with myself will visit the school on three occasion to measure plaque. We will also be talking to the children about oral health and hygiene to learn more about their views and knowledge.

We will only involve your child in the research if you choose to complete and sign the consent form provided and return it to your child's teacher. It is really important that as many parents and children as possible take part in this important research project which has many elements that are the first of its kind in the UK.

Yours Sincerely,

Cooper

Anna Cooper

Principle Supervisor: Professor Lindsey Dugdill, Co-Supervisor: Professor Cynthia Pine

University of Salford
A Greater Manchester University

Information Sheet:

Effectiveness of a Global Oral Health Campaign as applied to populations in NW England, UK

Introduction

We would like to invite you and your child to take part in a research study. Please take the time to read the following information to understand why and how the research will be conducted.

What is the Purpose of the Study?

Good oral health is essential for all. Dental caries (tooth decay and cavities) is one of the most common diseases in childhood in the North West of England. There are simple ways that dental caries can be reduced which include brushing twice-a-day with fluoridated toothpaste. School programmes have frequently been used to help teach children about the importance of looking after their teeth and how to brush their teeth effectively. The overall aims of the study are to improve the brushing habits of year 2 children, improve knowledge around oral health and nutrition and understand how any changes in habit affect family routines and try to maximise the sustainability of any new behaviours.

Why have I been invited?

We are asking parents of year 2 children, attending primary schools in Tameside to consent, for their child to have a plaque examination taken by a qualified dental professional at school, on three separate intervals over the next 7 months. In addition we are asking parents to complete a questionnaire at three time points over the next 7 months in conjunction with the project.

Do I have to take part?

It is up to you to decide if you would like to take part in the research and if your child can be involved in the research. If you would like to ask further questions before deciding we would be happy to discuss your questions over the phone.

You are free to withdraw from the study at anytime, up until publication of findings. Please return the form indicating if you agree to take part, and if you give permission for your child to take part in the study.

What will happen if I take part?

1. If you consent, you child will take part in a videoed group at their school to find out their opinions on teeth and toothbrushing. This will be with the permission of the school in a safe setting. It will be interactive with activities. It will last no more than half an hour and all videos will be kept secure and confidential.
2. With your consent, at three time points throughout the 7 months we will take plaque scores of your child's teeth; this is a clinical procedure that will be carried out by a trained and certified dental health professional. The examination will be conducted as follows:
    - Use of a standard dental measuring index (Modified Silness and Löe index)
    - The child will need to be sat in a chair in front of the dental hygienist.
    - The technique will require a bright spotlight, their eyes will be protected using dark glasses
    - The assessor will use a dental check-up mirror and probe to firstly look at 6 teeth and then to run the probe around to measure the presence of plaque. This will be repeated for each tooth, taking approximately four minutes to complete the whole mouth
    - The plaque scores will be recorded

What are the benefits of taking part?

Oral health promotion is a key government target for the NHS and is incorporated in the Healthy Schools Programme, this programme will compliment this work. The study will help us to understand the current oral health habits of year 2 children in. This will help with planning in the future around improving the oral health or children.

Will my taking part in this study be kept confidential?

Yes. We will follow all ethical and legal guidelines during this study. All information will be handled in confidence and stored securely. The information will only be

viewed by researchers involved in the study. For the duration of the study you and your child will be given a unique code so follow-up data can be matched up. This will ensure that yourself or your child's personal details cannot be identified by anyone apart from the research team.

What will happen to the results of the research study?

We will be using the result as part of an evaluation for a PhD study at the University of Salford. The findings will be written up and some will be included in publications to help inform others about what has been learnt from this study. You will not be identified in any of the reports. If you would like a copy of any results please feel free to request them.

Who is organising the study?

The study is being organised through the University of Salford, Faculty of Health and Social Care in partnership with a company and NHS Salford (specifically the Healthy Schools Team). All those taking part in the research have gone through an enhanced criminal record check (CRB) to work with children. Ethical approval to conduct the study has been gained through the University of Salford.

Please note there are no financial incentives available for taking part in this study

Further information and contact details

If you have any questions about the study, or wish to discuss any part further please feel free to contact me: Anna Cooper

Faculty of Health & Social Care, Allerton Building, University of Salford, Salford, Greater Manchester, M6 6PU.

Tel: 0161 295 3103 Email: a.m.cooper@salford.ac.uk

If you have any concerns about this project please contact Professor Lindsey Dugdill or Professor Cynthia Pine who are supervising the study via the administrator Louise Robinson: Tel: 0161 295 2799

Finally many thanks for reading the information sheet and considering taking part. Please keep this for you records.

University of Salford
A Greater Manchester University

Participant Identification for study:

Ethics reference code:

Consent form

Title of Project: Effectiveness of a Global Oral Health Campaign as applied to populations in NW England, UK.

Plaque exams and follow-up

Name of Researcher: Anna Cooper

Supervisors: Dr Lindsey Dugdill and Prof Cynthia Pine

Please initial the boxes you consent to:

1. I confirm that I have read and understood the information sheet provided for the above study and have had the opportunity to ask further questions.
2. I consent for my child to have a plaque exam at school and take part in a class questionnaire.
3. I agree for the plaque exam to be repeated after a month and also for a six month follow-up.
4. I give consent for my child to take part in video focus groups.
5. I fully understand that my child's participation in this study is voluntary and that they are free to withdraw at any time, without providing a reason, and without this affecting any rights.
6. *I give permission for results of the exam to be used in written reports as a result of this investigation and understand publications will be anonymised.*

_____ _____ _____

Name of Parent/guardian Date Signature

_____

Name of Child

OR

I do not give permission for my child to take part in the programme

_____ _____ _____

Name of Parent/guardian Date Signature

Please return signed form to your child's teacher

21. SOHP material distribution information in relation to consent and group

The table below indicates which participants are to receive the different elements of the SOHP (*Brush Day & Night*) and the research evaluation. It also highlights the difference between those with and without consent.

<table>
<tr><th>Folder Recipient</th><th>Contents</th><th>Research tools</th><th>Distribution method</th><th>Distribution Week(s)</th><th>Distributed by</th><th>Completed by</th><th>Coding method</th></tr>
<tr><td></td><td colspan="7">INTERVENTION GROUP</td></tr>
<tr><td rowspan="8">Children (Positive consent received)</td><td>Toothbrush, Toothpaste</td><td rowspan="4"></td><td rowspan="2">Bag</td><td rowspan="2">Baseline</td><td rowspan="4">Teacher</td><td rowspan="2">For child to keep (Parent and child)</td><td>N/A</td></tr>
<tr><td>Calendar and stickers</td><td>Child’s Code</td></tr>
<tr><td>Worksheet 1</td><td rowspan="3">Child’s Folder</td><td>Wk 1</td><td rowspan="3">Child</td><td rowspan="5">Child’s Code
(On top name removed once collected, retained in child’s folder till completion on 4 weeks)</td></tr>
<tr><td>Worksheet 2</td><td>Wk 2</td></tr>
<tr><td>Worksheet 3</td><td>Wk 3</td></tr>
<tr><td rowspan="4"></td><td>Plaque exam</td><td>Dental Hygienist</td><td rowspan="4">Baseline, post-intervention, follow-up</td><td>Dental Hygienist</td><td>Dental Hygienist and Child</td></tr>
<tr><td>D&W</td><td rowspan="3">Research team</td><td rowspan="3">Research team</td><td rowspan="3">Child</td></tr>
<tr><td>Child Questionnaire</td></tr>
<tr><td>Focus Group</td></tr>
<tr><td rowspan="3">Primary Care giver (home) (Positive consent received)</td><td>Salford OH Report (constructed as a result of study 1)</td><td></td><td rowspan="3">Sealed Envelope</td><td>Baseline</td><td rowspan="3">Teacher in envelope with children’s packs</td><td>For parent to keep</td><td>N/A</td></tr>
<tr><td></td><td>Questionnaire</td><td>Baseline, post-intervention, follow-up</td><td>Parent</td><td>Parent Code</td></tr>
<tr><td>Letter (consent)</td><td></td><td>With each questionnaire</td><td>For parent to keep</td><td>N/A</td></tr>
</table>

	Parent Pack			Baseline		For parent to keep	N/A
		Parent Blog	Website	Wk1 – 6 months	Research Team via letter	Parent	N/A
Children (Positive consent NOT received)	Toothbrush, Toothpaste		Bag	Baseline	Teacher	For child to keep	N/A
	Calendar and stickers						
	Worksheet 1		Generic Folder	Wk 1	Teacher	Child	Will be collected with the other children's but not retained by the research team
	Worksheet 2			Wk 2			
	Worksheet 3			Wk 3			
		D&W	Research team	Baseline, post-intervention, follow-up	Research team		
Primary Care giver (Positive consent NOT received)	Parent Pack		Sealed Envelope	Baseline	Teacher in envelope with children's packs	For parent to keep	N/A
	Salford OH Report						
	Letter (no consent)						
Teacher (Positive consent received)	Teachers Pack		School's Box	Baseline	Research Team	For teacher to keep	N/A
	Lesson Plans			Baseline		Elements by Teacher after lesson	School Code
	Material and letters copies		Class Box	Wk 1		For teacher to keep	N/A
		Teachers Blog	Website (Paper)	Baseline, post-intervention, follow-up	Research Team via letter	Teacher	School Code

	Pack use letter, Pack instruction sheets		School's Box/ Class Box	Baseline, Wk 1	Research Team	For teacher to keep	N/A
	CONTROL GROUP						
Folder Recipient	**Contents**	**Research tools**	**Distribution method**	**Distribution Week(s)**	**Distributed by**	**Completed by**	**Coding method**
Control Children (Positive consent received)		Plaque exam	Dental Hygienist	Baseline, post-intervention, follow-up	Dental Hygienist	Dental Hygienist and Child	Child's Code (On top name removed once collected, retained in child's folder till completion)
		D&W	Research team		Research team	Child	
		Child Questionnaire					
		Focus Group					
	Toothbrush, Toothpaste, children pack		Bag	6 months	Teacher	For child to keep	N/A
Control Primary Care giver (Positive consent received)		Questionnaire	Sealed Envelope	Baseline, post-intervention, follow-up	Teacher	parent	Parent Code
	Letter (consent)			Wk 1		For parent to keep	N/A
	Parent Pack						
Control Children (Positive consent NOT received)	Toothbrush, Toothpaste, children pack		Bag	6 months	Teacher	For child to keep	N/A

Control Primary Care giver (Positive consent NOT received)	Parent Pack		Child's Bag	6 months	Teacher	For parent to keep	N/A
	Letter (no consent)		Sealed Envelope in Child's Bag				
Control Teachers (Positive consent received)	Teachers Pack		School's Box/ Class Box	6 months	Research Team	For teacher to keep	N/A
	Lesson Plans						
	Material and letters copies						
	Pack use letter, Pack instruction sheets						

22. Teachers: Information sheet and consent form

University of Salford
A Greater Manchester University

Information Sheet:

Effectiveness of a Global Oral Health Campaign as applied to populations in NW England, UK

Teachers Information sheet and consent

Introduction

We would like to invite you and your class to be part of an evaluation of a school oral health programme aimed at improving the oral hygiene habits of year 2 children.

What is the Purpose of the Study?

Good oral health is essential for all. Dental caries (tooth decay and cavities) is one of the most common diseases in childhood in Salford. There are simple ways that dental caries can be reduced which include brushing twice-a-day with fluoridated toothpaste. School programmes are commonly used to help teach children about the importance of looking after their teeth and how to brush their teeth effectively. The overall aims of the study are to improve the brushing habits of year 2 children, improve knowledge around oral health and nutrition and understand how any changes in habit affect family routines, with a focus on any change in behaviour being sustained.

Why have I been invited?

We are asking primary schools in Salford and specifically year 2 teachers to be part of the study. We require teachers to deliver three pre-planned lessons about oral health over three weeks to the children and encourage them to brush their teeth at home through reinforcing key messages. Teachers are being asked to be actively involved as it is often yourselves who are expected to deliver key messages on multiple topics; as a result your opinions and feedback are crucial for making any necessary programme modifications to improve its success.

Do I have to take part?

It is up to individual schools to take part in the study but we ask for you to be proactive and encourage the children. If you would like to ask further questions before deciding we would be happy to discuss anything on the phone. The school programme will aid aspects of the Healthy Schools programme and especially the enhanced model where a local area agreement is improving the oral health of schoolchildren; it will also provide evidence of changes in oral health of year 2 children through the plaque examinations and children's toothbrushing calendars used in the study.

What will happen if I take part?

1. You will be provided with the oral health education packs that are required to run the school programme and asked once-a-week, for three weeks, to deliver the lesson to the child with the accompanying worksheet.
    a. After each lesson and at other times you feel necessary we are asking you to complete an anonymous blog online to answer set questions around the programme to provide feedback about each lesson.
2. We will provide oral health education packs for all children to take home that we will ask you to hand out and during the three weeks encourage them to use them and reinforce the message of 'Brush day and night'.
3. Additionally we are asking for a sample of teachers to permit their lessons to be recorded so we can see how the children engage with the programme and how it fits into the curriculum.
4. All children whose parents provide consent in your class will be included in the three plaque measures to determine if brushing habit has improved. This will be done in class by a trained and certified dental professional.
5. In addition the research team for an afternoon session prior to the lessons beginning and after their completion would like to run with the children focus groups, a whole class questionnaire and draw & write exercise this will aid the evaluation.

What are the benefits of taking part?

Oral health promotion is a key government target for the NHS and Healthy School Programmes and as such one that this programme is aiming to have an impact on. The study will help us to understand if the school oral health programme in its current state can have a significant effect on improving the oral hygiene habits of year 2 children.

Will my taking part in this study be kept confidential?

Yes. We will follow all ethical and legal guidelines during this study. All information will be handled in confidence and stored securely. The information will only be viewed by researchers involved in the study. Children and their families will be given codes for identification so no identifying features are possible. All blogs completed will be anonymous.

What will happen to the results of the research study?

We will be using the result as part of an evaluation for a PhD study at the University of Salford. The finding will be written up and some will be included in publications to help inform others about what has been learnt from this study. You will not be identified in any of the reports. If you would like a copy of any results please feel free to request them.

Who is organising the study?

The study is being organised through the University of Salford, Faculty of Health and Social Care in partnership with a company and NHS Salford (specifically the Healthy Schools team). All those taking part in the research have gone through an enhanced criminal record check (CRB) to work with children. Ethical approval to conduct the study has been gained through the University of Salford.

Please note there are no financial incentives available for taking part in this study

Further information and contact details

If you have any questions about the study, or wish to discuss any part further please feel free to contact me: Anna Cooper

Faculty of Health & Social Care, Allerton Building, University of Salford, Salford, Greater Manchester, M6 6PU.

Tel: 0161 295 3103 Email: a.m.cooper@salford.ac.uk

If you have any concerns about this project please contact Dr Lindsey Dugdill or Professor Cynthia Pine who are supervising the study via the administrator Louise Robinson: Tel: 0161 295 2799

Finally many thanks for reading the information sheet and considering taking part. Please keep this for you records.

University of Salford
A Greater Manchester University

Participant Identification for study:

Ethics reference code:

Consent form

Title of Project: Effectiveness of a Global Oral Health Campaign as applied to populations in NW England, UK.

Teachers Consent

Name of Researcher: Anna Cooper

Supervisors: Dr Lindsey Dugdill and Prof Cynthia Pine

Please initial the boxes you consent to:

- I confirm that I have read and understood the information sheet provided for the above study and have had the opportunity to ask further questions.
- I agree to some of the class lesson being videoed for future analysis.
- I agree that any blogs that I complete can be used as part of the evaluation of the study but understand any quotes will be anonomysed.
- I give permission for information to be used in written reports as a result of this investigation and understand publications will be anonymised.

_____ _____ _____

Name of Teacher Date Signature

Please return signed form in the SAE provided Thank you

23. Letter to teachers explain confidentiality of the programme during the evaluation – intervention schools

Anna Cooper,

PhD Research Student,
Faculty of Health &
Social Care,
The University of Salford
Allerton Building (AD101),
Fredrick Rd Campus,
Salford,
Greater Manchester
M6 6PU.

T : +44 (0)161 295 5094
E-mail: a.m.cooper@salford.ac.uk

Dear ,

Please find enclosed your copy of the 'Brush Day & Night' school pack; this contains all the resources required to deliver the School Oral Health Programme and the 3 lessons. As this piece of work is evaluating schools that are receiving the Brush Day & Night programme with others who are not, it is essential that the procedures are followed in order to ensure validity of the data.

- Packs will be provided to the selected participating schools at the beginning of the study by the research team at the University of Salford.
- The pack is for use with year 2 children only, in the school that it is provided to.
- At the present time it should not be used in any other years, or given to or discussed with any other school until the study period has ended in Dec 2010.
- The 'Brush Day and Night' School Oral Health Programme should be delivered as described in the pack as consistently as is possible, to ensure standardisation of the programme across all schools.

Once the evaluation has finished in December we are happy for you to use the programme across the school with as many year groups as you wish.

Please feel free to contact me if you have any questions and I look forward to continuing to work with you and thank you for you continued support and time. This is a very important research study which will inform future oral public health strategy.

Yours Sincerely,

Anna Cooper

Principle Supervisor: Dr Lindsey Dugdill, Co-Supervisor: Professor Cynthia Pine

24. Teachers letter to explain teachers role and children's folders (highlighted sections) – intervention schools

Anna Cooper,
PhD Research Student,
Faculty of Health & Social Care,
The University of Salford
Allerton Building (AD101),
Fredrick Rd Campus,
Salford,
Greater Manchester
M6 6PU.
T: +44 (0)161 295 5094
E-mail: a.m.cooper@salford.ac.uk

Dear *[named added of individual teachers]*

Re: Children's folder and evaluation as part of School Oral Health Programme

Please find enclosed folders for each of the children whose parents consented for them to take part in the evaluation. I have also enclosed extra packs for those who did not consent as they can still take part in the lessons.

Each child has their own folder which contains everything they require for the duration of the evaluation. Each pack is uniquely coded to each child, it is therefore very important that the children do not swap the printed materials contained within their pack. I have attached a detailed explanation of the contents of the folders and how they are to be used; I hope that this will make things simple and easy to administer and help the programme to run smoothly, whilst ensuring that the children's anonymity is retained for the analysis. We will not be collecting in any of the sheets from those whose parents did not provide consent.

Please feel free to contact me if you have any questions, I look forward to continuing to work with you and thank you for your continued support and time.

Yours Sincerely,

Anna Cooper

Principle Supervisor: Professor Lindsey Dugdill, Co-Supervisor: Professor Cynthia Pine

For each of the three lessons:

- Each lesson plan has a section to record absentees – please can you note these down.
    - This is because if a child misses a lesson it could affect the results of the study, it is therefore important for us to know about any absences when we are analysing the results.
- There is also a section to record any notes, please also feel free to annotate and return with comments.
- After each lesson please briefly (5 minutes) fill in the evaluation form either via http://soph.moonfruit.com under 'Teachers Blog' (last tab) and click send when you have filled in each section. Or alternatively you can use the form that is included on the pen drive and email it back to me.

Class Worksheets:

- 3 class activities for after each of the lessons
    - In each of the children's folders you will find a worksheet (1 for each week) that is coded for the individual children.
    - I will collect these at the second plaque exam but am happy to copy them and return a set to the school for your records.

Other:

In each of the children's bag is an envelope to go home to their parent/guardian. This contains the parent pack, a letter explaining the programme, a parental questionnaire, and also routine charts.

- Parental Questionnaire
    - We have asked for this to be returned in a sealed envelope to yourself. Please can you collect these and either keep until the second plaque exam or I can come and collect at an earlier time.
    - This has only been sent to those who provided consent for their child.
    - It will be resent after the second plaque exam, please can you collect them for me in the sealed envelopes, I will then pick these up from you.

If the children would like to provide us with any feedback this would be welcomed and can be put into their folder or emailed to myself, as their opinions are very valuable.

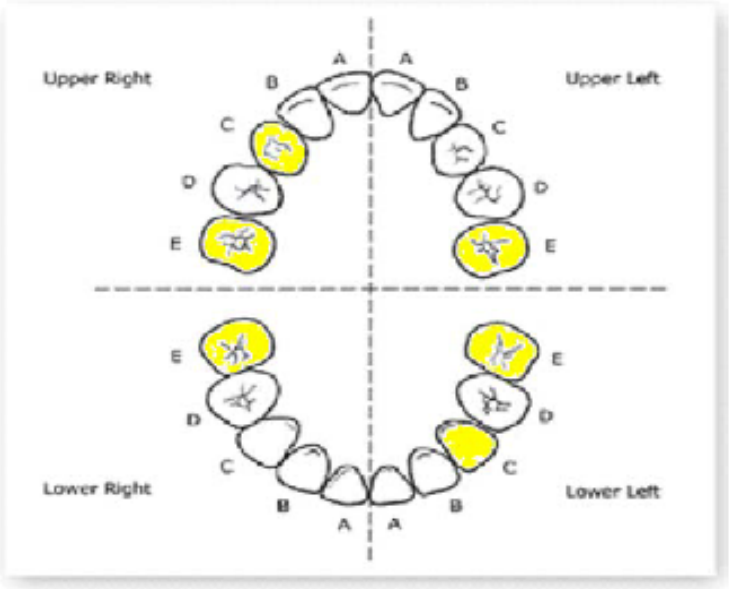
I hope you will find the programme has an impact of the oral hygiene habits of the children and you feel it is beneficial both in its design and evaluation method. As mentioned in all literature all information and results will be anonymous.

Measure	Conducted by	Wk 1	Wk 4	6 month follow-up	Delivered to	Explanation
Plaque Exam	Research Team	X	X	X	Children	Carried out at pre-arranged time (around 2 – 2.5 hours)
Children's questionnaire	Research Team	X	X	X	Children	
Children focus group	Research Team	X	X	X	Children	Carried out with a small group (up to 7) during time of plaque exam (1 or 2 groups – videoed) around 30 minutes each
Parental questionnaire	Parent	X	X	X	Parents	Asked to be returned to class in a sealed envelope on each occasion.
Draw & Write	Research Team	X	X	X	Children	Carried during research team visits
Worksheet	Teacher	1 after each of the 3 lessons			Children	To be completed by children at the end of each lesson. (in children's folder)
Teacher Blog	Teacher	Throughout Evaluation			Teacher	For completion after each lesson either online (http://soph.moonfruit.com) or form on USB
Parent Blog	Parent	Throughout Evaluation			Parents	Letter in envelop provides web address. If any feedback is sent to, you please collate and I will collect it.
Brushing calendar	Parent/child		X		Children	Please collect in so we can copy the relevant pages before returning to each child.

25. Dental hygienist plaque recording sheet

ORAL CLEANLINESS (buccal surfaces)

Date of examination: __ / __ / __ Child Participant Number_____
dd mm yy



mb URE	db URC	mb ULE
mb LRE	db LLC	mb LLE

0: tooth surface is clean	1:plaque seen after using probe adhering free gingival margin and adjacent area of tooth	
2: plaque is visible along the gingival margin	3: the tooth surface is covered with abundant plaque	9: surface excluded

Notes / Corrections: *(Number of missing teeth, number of permanent teeth)*

Signature of recorder: __ / __ / __
dd mm yy

26. Children plaque exam recording sheet

Your Name: _____

Date of Birth (AGE): _____

Enter the number from Left to right as the dental hygienist calls them out to you

Thank you for your help and your time

27. Parent letter enclosed with parent pack and initial evaluation materials – intervention schools

Anna Cooper,
PhD Research Student,
Faculty of Health & Social Care,
The University of Salford
Allerton Building (AD101),
Fredrick Rd Campus,
Salford,
Greater Manchester
M6 6PU
T : +44 (0)161 295 5094
E-mail: a.m.cooper@salford.ac.uk

Dear Parent or Guardian,

Re: Effectiveness of a Global Oral Health Programme as Applied to Populations in NW England, UK

As you are aware your child's school has agreed for year 2 to be part of the school oral health programme and the evaluation. This is taking place during the summer term, 2010.

Please find enclosed in the pack for use at home with your child:

- A toothbrush and toothpaste – for your child to keep and use during the programme.
- A pencil and eraser for your child to keep as a thank you.

Please also find enclosed for your information:

- An oral health report for Salford.
- Some tips and tricks about toothbrushing.
- Information about children's teeth from 0 – 12 years.

For the evaluation please find enclosed:

- A questionnaire
- Please take the time to complete the questionnaire enclosed and return to your child's teacher (sealed in the envelope provided) as soon as you have completed it.
- This will be re-sent at other time points in the evaluation to compare results.
- A brushing calendar and stickers

- At the end of the 1st month please return this to your child's school so it can be copied and returned to you.
- Your child can then keep this for the remainder of the programme to help them monitor their brushing habits.

All of the results of the above items will be anonymous and identified using a unique code for your child. Please complete them as honestly as possible as it is important for us to obtain a true reflection of Salford life around oral health for our research.

In addition we have set up a website with some predefined questions where you are able to provide us with feedback about the programme both positive and negative. The website address is http://sohp.moonfruit.com/ then please click on "Parents' Blog" to answer the predefined questions and click send at the end. We are also happy to receive feedback in writing; this can be sent via the teacher. Please provide us with as much feedback as possible; yours and your child's opinions are very important to us during the evaluation period.

Yours Sincerely,

Anna Cooper

Principle Supervisor: Dr Lindsey Dugdill, Co-Supervisor: Professor Cynthia Pine

28. SOHP parental questionnaire

University of Salford
A Greater Manchester University

BRUSH DAY+NIGHT

School Oral Health Programme questionnaire

To be completed by the primary care giver

We would like you to complete this questionnaire by providing us with information about your child who attends year 2 primary school (this page will be separated from the questionnaire upon receipt).

1. Child's name ……

2. Child's school ……

3. Child's date of birth ____day / ____ month / ____ year

4. Child's gender: male ☐$_1$ female ☐$_2$

Please complete this questionnaire and return to your child's school in the envelope provided.

If you need any help completing this questionnaire please contact Anna Cooper:

☎ **0161 295 5094**

✉ **a.m.cooper@salford.ac.uk**

Thank you

(Blank paged followed in printing)

ID No: ☐☐/☐/☐☐☐☐

Questionnaire for primary caregiver

Thank you for agreeing to take part in this school oral health research study. The study involves parents and children across Salford and Tameside. We are trying to understand oral health beliefs and behaviours within families.

There are no right or wrong answers – we are just trying to understand what is usual for your family.

This questionnaire is divided into 5 sections.

All information given in this questionnaire will be treated with the strictest confidentially and your answers will be completely anonymous.

We would like you to complete this questionnaire by providing us with information about your child who attends year 2 primary school.

Section A – YOUR CHILD'S toothbrushing habits

This first section is about your year 2 child's current oral hygiene habits

5. ***How often does your child brush their teeth?***

Once-a-week or less frequently ☐1 every other day ☐2

Once-a-day ☐3 2 or more time a day ☐4

6. ***Does your child brush his/her teeth before bedtime?***

Yes ☐1 No ☐2 Sometimes ☐3

7. ***Does your child brush his/her teeth in the morning?***

Yes ☐1 No ☐2 Sometimes ☐3

8. Who mainly brushes the child's teeth?

Child himself/herself ☐1 Usually by the mother ☐2

Usually by the father ☐3 Child and parent together ☐4

By one of the parents ☐5 Other ☐6

9. What type of toothbrush does your child mainly use?

Manual ☐1 electric ☐2

10. Does your child use:

Fluoride toothpaste:

Yes ☐1 No ☐2 Sometimes ☐3

Fluoride mouthwash:

Yes ☐1 No ☐2 Sometimes ☐3

11. How often does your child visit the dentist?

Regular dental check-up at least once a year ☐1

Only when I take my child ☐2

Have never been to the dentist ☐3

12. If your child had a decayed tooth would you choose:

- For the tooth to be filled ☐1
- To have the tooth pulled out ☐2
- To ignore the tooth ☐3
- Other ☐4

(please give details……..…….)

Section B - Your thoughts about YOUR CHILD'S oral health education

This next section is aiming to understand your views around educating your child about oral health

13. At what age do you think a child should start to learn about oral health?

…….years

14. Have you recently asked anyone about oral health education for your child's?

If so who: (please state)……

15. Has your child ever been involved in an oral health education programme?

Yes ☐$_1$ No ☐$_2$

16. Please rank these statements in terms of importance for your family: (1 is the most important and 4 is the least important)

- Explaining the reasons for having a healthy lifestyle to your child ……
- Having consistent routines yourself for your child to copy ……
- Teaching your child about his/her own individuality ……
- Teaching your child to be considerate towards other people ……

17. Please circle a number to indicate how consistent your child's upbringing with respect to health education has been?

Inconsistent 1 2 3 4 5 Consistent

18. What do you think is the best way to teach your child about health? Please tick one box only

To explain without an example ☐$_1$

To explain using an example ☐$_2$

To show the child by practising the skill (e.g. toothbrushing) ☐$_3$

19. How many hours each day does your child watch TV (please include DVDs and videos) ……

20. What is your child's usual bed time? ……

Section C - This section is about what YOUR CHILD usually eats/drinks:

Please tick one box only for each question

21. Does your child ever have a sugary snack after brushing their teeth at night?

Yes ☐1 No ☐2 Sometimes ☐3

22. Does your child usually have a drink if he/she wakes up at night?

Yes ☐1

No ☐2

If yes, what drink does he/she have?

usually water ☐1 usually juice ☐2

usually milk ☐3 other ☐4 (please give details……)

23. Does your child like sugar?

Yes ☐1 No ☐2

24. Does your child have sugar added to his/ her food or drink?

Often ☐1 once-a-week ☐2

has limited sugar in food ☐3 never ☐4

25. How often does your child eat sweets or chocolate?

Daily ☐1 a couple of times a week ☐2

Once-a-week (on a 'treat' day) ☐3 1 – 2 times a month ☐4

Hardly ever ☐5

26. How often do you give your child sweets or chocolate to comfort him/ her?

Not at all ☐1 Sometimes ☐2 Nearly Always ☐3

27. How often do you give your child sweets or chocolate to stop a temper tantrum?

Not at all ☐1 Sometimes ☐2 Nearly Always ☐3

28. How often do you give your child sweets or chocolate before bed?

Not at all ☐1 Sometimes ☐2 Nearly Always ☐3

Section D – YOUR CHILD's routine

Please tick one box only for each question

This part of the questionnaire is interested in exploring your child's normal routine within the family, to understand about family life across areas of NW England. Please tell us how often your child (in year 2) does each of the things below by ticking one of the boxes that is most relevant to each statement.

		Never	Rarely	Some times	Often	Nearly Always
My child						
1	…has a set routine for getting ready in the morning					
2	…knows what will happen if he or she doesn't follow the family's rules					
3	…takes turns with family members talking about their day					
4	….has regular chores					
5	….. tidies their bedroom					
6	… eats meals with the family at the table each day					
7	….hugs/kisses parent before bed					
8	…. Cleans up food mess after having a snack					
9	….spends one to one time talking with a parent each day					
10	…attends weekly out of school					

		Never	Rarely	Some times	Often	Nearly Always
	lessons, at the same time each week(such as dance or sports)					
11	….does the same things each night before bed					
12	….has house hold rules (e.g. “No swearing”, “No talking with your mouth full”)					
13	….wakes up about the same time on week days					
14	….must finish their household chores before play time					
15	…..receives rewards or privileges for good behaviour					
16	… eats their dinner about the same time each day					
17	…brushes their teeth before bed					
18	…picks up their dirty clothes after changing					
19	…washes their hands before meal time					
20	…goes to bed at about the same time on week nights					
21	…helps me to clean up after meals					
22	…has time limits on fun activities (eg TV, video games)					
My Child						
23	…washes their hands after using the toilet					
24	…is punished for misbehaving (e.g. loss of privileges or time out)					
25	…helps decide and prepare for family fun or trips					
26	…receives smaller punishments for minor misbehaviour					
27	…puts away their toys after playing with them					
28	…eats breakfast about the same time and place each morning					
29	…makes their bed each morning					
30	…helps put things away after shopping					
31	…is praised or rewarded for specific behaviour					
32	…takes part in family time each week when the family does					

		Never	Rarely	Some times	Often	Nearly Always
	planned activities					
School and Homework						
33	...attends school regularly					
34	…begins homework/reading at about the same time and place during the week					
35	…is supervised by an adult who helps with homework by explaining tasks, demonstrating the task and/or checking answers					
36	…completes their homework					
37	…prepares for tests (weekly spelling, reading, number)					

Section E - This section is about YOUR OWN oral health

Please tick one box only for each question

29. What treatment have you received from the dentist?

- 3 or more fillings or extractions per year ☐1
- 1 or 2 fillings or extractions per year ☐2
- 1 or 2 fillings or extractions in the last 5 years ☐3
- No fillings or extractions in the last 5 years ☐4

30. How often do you brush your teeth?

Once-a-week or less frequently ☐1 every other day ☐2

Once-a-day ☐3 2 or more times a day ☐4

31. Do you brush your teeth before bedtime?

Yes ☐1 No ☐2 Sometimes ☐3

32. Do you brush your teeth in the morning?

Yes ☐1 No ☐2 Sometimes ☐3

33. Do you use toothpaste when brushing your teeth?

Every time ☐1 No ☐2 Sometimes ☐3

34. Do you use tooth picks?

No ☐1 From Time to Time ☐2 Daily ☐3

35. Do you use dental floss?

No ☐1 From Time to Time ☐2 Daily ☐33

36. How often do you visit the dentist?

Regular dental check-up at least once a year ☐1

Only when I take my child ☐2

Have never been to the dentist ☐3

37. If you have a decayed tooth would you choose:

- To have a filling in the tooth ☐1
- Have the tooth pulled out ☐2
- Ignore the tooth ☐3
- Other details……) ☐4 (please give

<u>Section F - Demographic questions</u>

Now to the final questions. People have different care arrangements for their children. The following questions help us understand child care routines, and the section ends with a few routine questions on background information.

38. Are you:

Child's mother ☐1 Child's father ☐2

Other ☐3 please state……

39. What is your age: ……..years

40. Where does your child live the majority of the time (5 nights per usual week)? With his/ her….

Mother ☐1 Father ☐2

Mother and father ☐3 Mother and stepfather ☐4

Father and stepmother ☐5 Grandparents ☐6

Other ☐7

(specify)……

41. How many children are living in your house now? …….

42. Is this your first child, second child etc? ……..

43. What is your relationship status?

Married ☐1 Single ☐2

Divorced / separated? ☐3 Widowed ☐4

Co-Habiting ☐5 Other ☐6

44. Mother's occupation

In full-time employment ☐1 please state ……

In part-time employment ☐2 please state ……

In full-time education ☐3

In part-time education ☐4

Full-time carer ☐5

Currently unemployed ☐6

Other ☐7 please give details…….

45. Father's occupation

In full-time employment ☐1 please state ……

In part-time employment ☐2 please state ……

In full-time education ☐3

In part-time education ☐4

Full-time carer ☐5

Currently unemployed ☐6

Other ☐7 please give details…….

46. At what level did the child's mother finish her full-time education?

Primary school ☐1 Secondary school ☐2

Further education (college) ☐3 Higher education (university) ☐4

No formal education ☐5

Other ☐6 Please specify ……

47. At what level did the child's father finish his full-time education?

Primary school ☐1 Secondary school ☐2

Further education (college) ☐3 Higher education (university) ☐4

No formal education ☐5

Other ☐6 Please specify ……

48. What is your ethnic group? Please choose one section from (a) to (e), then place a cross in the appropriate box to indicate your cultural background

a. White

British ☐

Irish ☐

Other ☐

b. Mixed

White and Black Caribbean ☐

White and Black African ☐

White and Asian ☐

Other ☐

c. Asian or Asian British

Indian ☐

Pakistani ☐

Bangladeshi ☐

Other ☐

d. Black or Black British

Caribbean ☐

African ☐

Other ☐

e. Chinese or other Ethnic Group

Chinese ☐ Other ☐ please specify……

Please take a moment to ensure you have answered all the questions

Thank you for completing this questionnaire

Please return the completed questionnaire to your child's teacher in the sealed envelope provided

29. SOHP evaluation site screen shots for teachers and parents feedback – intervention schools

SOHP Schools Oral Health Program

Home | Information | Parents' Blog | Useful Links | Forum | Teachers' Blog

Welcome to the School Oral Health Programme Evaluation Site

Welcome to the evaluation site for the School Oral Health Programme taking place in year 2 classes across Salford.

Please click on the relevant page at the top to provide the research team with your feedback about the programme by completing the form and clicking send.

Thank you!!

BRUSH DAY+NIGHT

As you are aware, good oral health is essential for all. Dental caries (tooth decay and cavities) is one of the most common diseases in children across Salford.

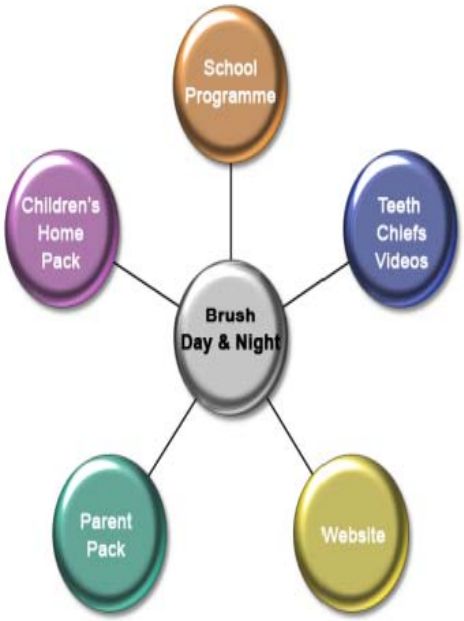
There are simple ways that dental caries can be reduced which include brushing twice a day with fluoridated toothpaste. School programmes have frequently been used to help teach children about the importance of looking after their teeth and how to brush their teeth effectively.

The overall aims of the study are to improve the brushing habits of year 2 children, improve knowledge around oral health and nutrition and understand how any changes in habit affect family routines and to try to maximise the sustainability of any new behaviours.

SOHP Schools Oral Health Program

Home | Information | Parents' Blog | Useful Links | Forum | Teachers' Blog

School Oral Health Programme



Research Team

For the duration of the study we will follow all ethical and legal guidelines. All information will be handled in confidence and stored securely. The information will only be viewed by researchers involved in the study.

For the duration of the study you will be given a unique code so follow up data can be matched. This will ensure all your personal details cannot be identified by anyone apart from the research team. We will be using the result as part of an evaluation for a PhD study at the University of Salford.

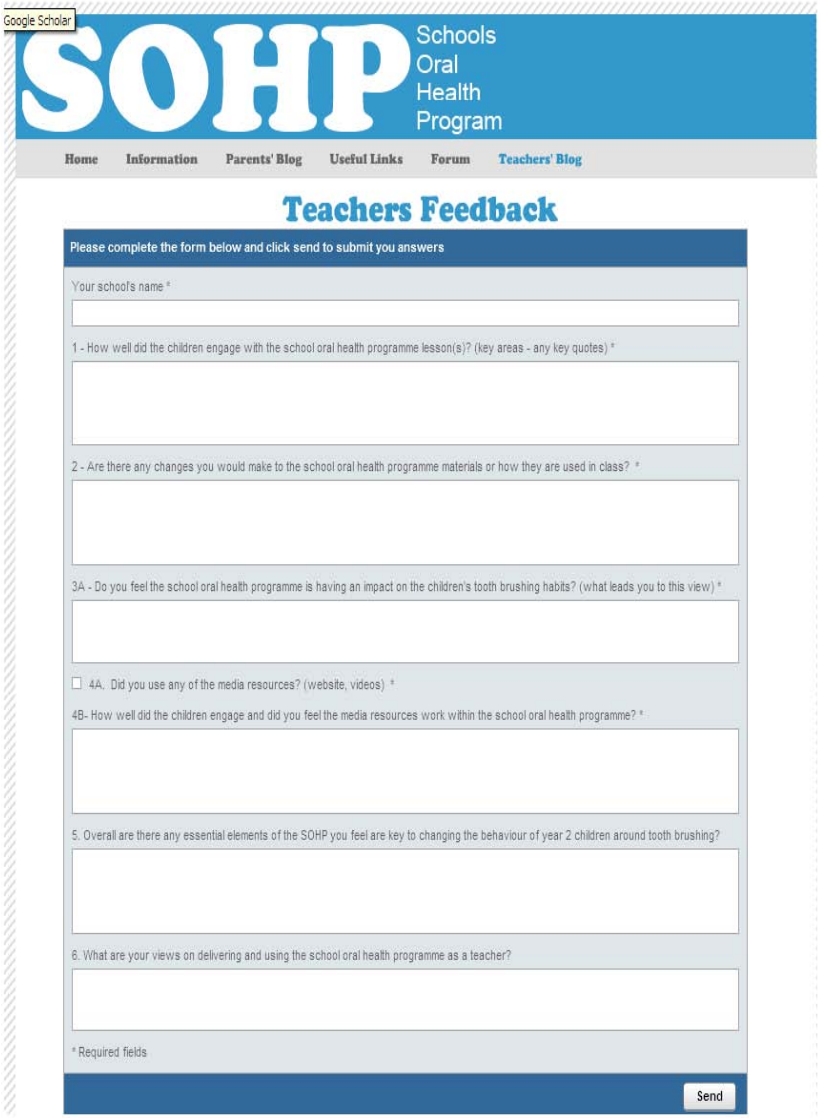
The findings will be written up and some will be included in publications to help inform others about what has been learnt from this study. You will not be identified in any of the reports.If you would like a copy of any results please feel free to request them.

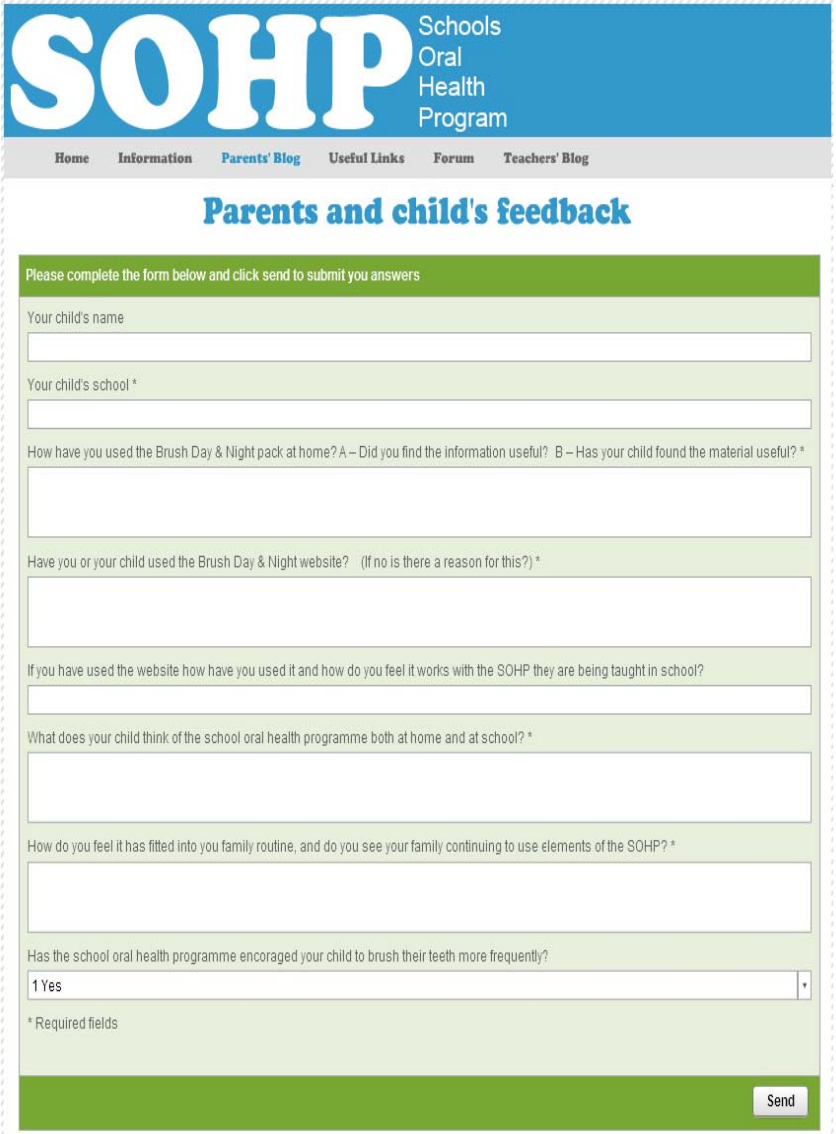
Information Use

The study is being organised through the University of Salford, Faculty of Health and Social Care in partnership with a company and NHS Salford (specifically the Healthy Schools team). All those taking part in the research have gone through an enhanced criminal record check (CRB) to work with children. Ethical approval to conduct the study has been gained through the University of Salford.

If you have any questions about the study, or wish to discuss any part further please feel free to contact me: *Anna Cooper, Faculty of Health & Social Care, Allerton Building (AD101), University of Salford, Salford, Greater Manchester, M6 6PU. Tel: 0161 295 3103 Email: a.m.cooper@salford.ac.uk*

If you have any concerns about this project please contact *Dr Lindsey Dugdill or Professor Cynthia Pine who are supervising the study via the administrator Louise Robinson: Tel: 0161 295 2799*


Google Scholar
SOHP
Schools
Oral
Health
Program
Home
Information
Parents' Blog
Useful Links
Forum
Teachers' Blog
Teachers Feedback
Please complete the form below and click send to submit you answers
Your school's name *
1 - How well did the children engage with the school oral health programme lesson(s)? (key areas - any key quotes) *
2 - Are there any changes you would make to the school oral health programme materials or how they are used in class? *
3A - Do you feel the school oral health programme is having an impact on the children's tooth brushing habits? (what leads you to this view) *
4A. Did you use any of the media resources? (website, videos) *
4B- How well did the children engage and did you feel the media resources work within the school oral health programme? *
5. Overall are there any essential elements of the SOHP you feel are key to changing the behaviour of year 2 children around tooth brushing?
6. What are your views on delivering and using the school oral health programme as a teacher?
* Required fields
Send


SOHP
Schools
Oral
Health
Program
Home
Information
Parents' Blog
Useful Links
Forum
Teachers' Blog
Parents and child's feedback
Please complete the form below and click send to submit you answers
Your child's name
Your child's school *
How have you used the Brush Day & Night pack at home? A – Did you find the information useful? B – Has your child found the material useful? *
Have you or your child used the Brush Day & Night website? (If no is there a reason for this?) *
If you have used the website how have you used it and how do you feel it works with the SOHP they are being taught in school?
What does your child think of the school oral health programme both at home and at school? *
How do you feel it has fitted into you family routine, and do you see your family continuing to use elements of the SOHP? *
Has the school oral health programme encoraged your child to brush their teeth more frequently?
1 Yes
* Required fields
Send

SOHP Schools Oral Health Program

Home | Information | Parents' Blog | Useful Links | Forum | Teachers' Blog

Useful Links

Please click the links below for more information

THE UNIVERSITY OF SALFORD

BRUSH DAY+NIGHT

Healthy Schools

NHS choices

Google Search

30. Post-intervention control group letter

Anna Cooper,
PhD Research Student,
Faculty of Health & Social Care,
The University of Salford
Allerton Building (AD101),
Fredrick Rd Campus,
Salford,
Greater Manchester
M6 6PU.
T: +44 (0)161 295 5094
E-mail: a.m.cooper@salford.ac.uk

Dear Parent or Guardian,

Re: Effectiveness of a Global Oral Health Programme as Applied to Populations in NW England, UK

As you are aware your child's school has agreed for the year 2 class to be part of the school oral health evaluation which will take place during the summer term, 2010.

Please find enclosed a second copy of the questionnaire, I would be grateful if you would take the time to re-complete this and return in the SAE provided. This is being resent so we can evaluate any changes in opinions, and would be grateful if you would complete it a second time.

All of the results of the above items will be anonymous and identified using a unique code for your child. Please complete them as honestly as possible as it is important for us to obtain a true reflection of Tameside life around oral health for our research. Thank you for consenting for your child to be part of the evaluation and for continuing to support this work.

Yours Sincerely,

Anna Cooper

Principle Supervisor: Professor Lindsey Dugdill, Co-Supervisor: Professor Cynthia Pine

31. Post-intervention teacher's questionnaire – intervention schools

School Oral Health Programme
Teacher's Evaluation

Thank you for agreeing to take part in this school oral health programme evaluation study designed to improve the tooth brushing behaviour of year two children. Now you have finished teaching the lessons I would be grateful if you would complete a short questionnaire. In this questionnaire there are no right or wrong answers – we are just trying to understand more about the programme.

All information given in this questionnaire will be treated confidentially.

General Information

School name: .....

Section A

The first set of questions are about the lessons.

1. **The teachers pack (all items in the box) was easy to understand?** Yes ☐1 No ☐2
2. **Did you enjoy teaching the lessons?** Yes ☐1 No ☐2
3. **The information integrated well into the terms work?** Yes ☐1 No ☐2
4. **Did you find the lesson plans related to the programme** Yes ☐1 No ☐2

Did you make any changes to lesson 1 Yes ☐1 No ☐2

Please explain:

Did you make any changes to lesson 2 Yes ☐1 No ☐2

Please explain:

Did you make any changes to lesson 3 Yes ☐1 No ☐2

Please explain:

2. **W ould you teach the lessons again in its current state?** Yes ☐1 No ☐2

Please explain:

3. **Do you feel the material was suitable for year 2 children?** Yes ☐1 No ☐2
4. **Do you feel it is important to teach them about teeth at this age?** Yes ☐1 No ☐2
5. **Did you feel the worksheets complimented the learning?** Yes ☐1 No ☐2
6. **The worksheets where aimed at an appropriate level?** Yes ☐1 No ☐2
7. **Are there any changes you would make to the worksheets?**

8. **What resources did you use?**

Power point slides	☐1	Lesson Plan	☐2
Teeth Chief videos	☐3	Posters	☐4
'Brush Day & Night' Website	☐5	Mouth models	☐6

9. **What resources did you feel are most important to helping the children?**

Power point slides	☐1	Lesson Plan	☐2
Teeth Chief videos	☐3	Posters	☐4
'Brush Day & Night' Website	☐5	Mouth models	☐6

10. **What resources did you feel where not as important to helping the children?**

Power point slides	☐1	Lesson Plan	☐2
Teeth Chief videos	☐3	Posters	☐4
'Brush Day & Night' Website	☐5	Mouth models	☐6

11. **Are there any changes you would make to the programme as a whole?**

Section B

The next set of questions are about the Teeth Chiefs.

5. **Did you use the videos in class?** Yes ☐1 No ☐2

6. **Do you feel they complimented the programme?** Yes ☐1 No ☐2

7. **Do you think they helped the children with understanding?** Yes ☐1 No ☐2

8. **Did the children enjoy them?** Yes ☐1 No ☐2

9. **Would you use them again?** Yes ☐1 No ☐2

10. **Are there any changes you would make?**

Section C

The following questions are related to the 'Brush Day & Night' website.

1. **Did you use the website in class?** Yes ☐1 No ☐2

2. **Do you use the website for any additional resources?** Yes ☐1 No ☐2

Please explain:

3. **Do you let the children play any of the games in class?** Yes ☐1 No ☐2

4. **Do you feel it supports the programme?** Yes ☐1 No ☐2

5. **Would you use it again?** Yes ☐1 No ☐2

6. **Are there any changes you would make?**

Section D

The following questions are related to <u>your</u> experiences of the children during the programme

1. **Do you think the children enjoyed the lessons?** Yes ☐1 No ☐2

2. **Do you feel enjoyed the home materials?** Yes ☐1 No ☐2

3. **Do you think parents were engaged?** Yes ☐1 No ☐2 Some ☐3

4. **Do you think it has impacted their behaviour?** Yes ☐1 No ☐2

Please explain:

5. **What do you feel has been the most beneficial?**

6. **Are there any changes you would make to enhance their experience?**

Section E

The following questions are related to <u>your</u> perceived the parents engagement during the programme

1. **How well did the programme engine parents?**

Very well ☐1 Well ☐2

Partially engaged ☐3 Did not engage ☐4

Hard to tell ☐5 Negative response ☐6

2. **What gave you this impression?**

3. **What do you feel could be done to improve parental engagement in the future?**

Section F

Finally if there are any other comments both positive and negative these would be appreciated:

Please take a moment to ensure that you have answered all the questions.

Thank you very much for your help.

32. Post-intervention parent's letter and questionnaire – intervention schools

Anna Cooper,
PhD Research Student,
Faculty of Health & Social Care,
The University of Salford
Allerton Building (AD101),
Fredrick Rd Campus,
Salford,
Greater Manchester
M6 6PU.
T : +44 (0)161 295 5094
E-mail: a.m.cooper@salford.ac.uk

Dear Parent or Guardian,

Re: Effectiveness of a Global Oral Health Programme as Applied to Populations in NW England, UK

As you are aware your child has been taking part in a school oral health programme and its evaluation.

For the next part of the evaluation please find enclosed:

- Two questionnaires
  - Please take the time to complete the questionnaires enclosed and return to the University using the prepaid envelope provided.
    - The first one you will have already received and completed, however I would be grateful if you could complete the questionnaire again as part of the evaluation of the school programme.
    - The second one is a short set of questions about the school programme. Your feedback is very valuable to us and will affect how this programme is run in the future. I am keen to hear any positive and/ or negative feedback from you.

All of the results of the above items will be anonymous and identifiable using a unique code that only the immediate research team will have access to. Your confidentiality is guaranteed. Please complete the questionnaires as honestly as possible as it is important that we understand how effective this school oral health programme has been

In addition, we have set up a website with some predefined questions where you are able to provide us with feedback about the programme both positive and negative. Please feel free to use this to provide feedback now and over the course of the next 6 months. The website address is http://sohp.moonfruit.com we are also happy to receive feedback in writing; this can be sent via the teacher. Please provide us with as much feedback as possible; yours and your child's opinions are very important to us during the evaluation period.

Yours Sincerely,

Anna Cooper

Principle Supervisor: Professor Lindsey Dugdill, Co-Supervisor: Professor Cynthia Pine

School Oral Health Programme
Primary Caregiver Evaluation

Thank you for agreeing to let your child take part in this school oral health programme evaluation study designed to improve the tooth brushing behaviour of year two children. Now the lessons have finished I would be grateful if you would complete a short evaluation questionnaire. In this questionnaire there are no right or wrong answers – we are just trying to understand more about the programme.

All information given in this questionnaire will be treated confidentially.

General Information

School name: ……

Childs name: ……

Section A

The first set of questions are about the parent pack that was sent home

1. **Did you receive a parent pack?** Yes ☐1 No ☐2 Not sure ☐3
2. **Did you find the information easy to read?** Yes ☐1 No ☐2 Did not read ☐3
3. **Did you think the information was useful?** Yes ☐1 No ☐2 Did not read ☐3
4. **Did you learn something new?** Yes ☐1 No ☐2 N/A ☐3
5. **Was there anything additional you would have liked included?** Yes ☐1 No ☐2

Please explain:

Section B

The next set of questions are about the your child's engagement with the programme

1. **Did your child enjoy the programme?** Yes ☐1 No ☐2
2. **Do your child use the brushing chart?** Yes ☐1 No ☐2
3. **Did you use the routine chart?** Yes ☐1 No ☐2
4. **Do you think it has improved your child's brushing behaviour?** Yes ☐1 No ☐2

Please explain:

5. **My child now brushes twice a day – morning and evening?** Yes ☐1 No ☐2
6. **Did your children go on the website?** Yes ☐1 No ☐2
7. **Did you use the website?** Yes ☐1 No ☐2
8. **Which aspects did you use? (e.g. games, information)**

Section D

The following questions are related to <u>your</u> experiences of the programme

1. **Did you find it useful?** Yes ☐1 No ☐2
2. **Do you feel a benefit from the programme?** Yes ☐1 No ☐2
3. **Will you continue to use the brushing chart with your child?** Yes ☐1 No ☐2 Some ☐3
4. **Have you felt the programme helped you with tooth brushing routines?** Yes ☐1 No ☐2

Please explain?

Section E

Finally if there are any other comments both positive and negative these would be appreciated:

Please take a moment to ensure that you have answered all the questions.

Thank you very much for your help.

33. Follow-up parent letter – pre visit

Anna Cooper,
PhD Research Student,
Faculty of Health & Social Care,
The University of Salford
Allerton Building (AD101),
Salford,
Greater Manchester
M6 6PU.
T: +44 (0)161 295 5094
E-mail: a.m.cooper@salford.ac.uk

Dear Parent or Guardian,

Re: Effectiveness of a Global Oral Health Programme as Applied to Populations in NW England, UK

As you are already aware, your child has been taking part in a school oral health programme and its evaluation, which began in April. The research team will once again be visiting your child's school in the next two weeks to complete the evaluation work with the children. You have already provided consent for your child to take part in this programme, however if you no longer wish for your child to take part please let us know by contacting your child's teacher on the matter.

Additionally, you may recall we set up a website with some predefined questions where you are able to provide us with any feedback about the programme, both positive and negative. Please feel free to use this to provide feedback if you have continued to use the materials, the website address is http://sohp.moonfruit.com.

Yours Sincerely,

Anna Cooper

Principle Supervisor: Professor Lindsey Dugdill, Co-Supervisor: Professor Cynthia Pine

34. Follow-up parent letter – intervention schools

Anna Cooper,
PhD Research Student,
Faculty of Health & Social Care,
The University of Salford
Allerton Building (AD101),
Salford,
Greater Manchester
M6 6PU.
T: +44 (0)161 295 5094
E-mail: a.m.cooper@salford.ac.uk

Dear Parent or Guardian,

Re: Effectiveness of a Global Oral Health Programme as Applied to Populations in NW England, UK

As you are aware, your child took part in a school oral health programme and its evaluation. We are currently conducting the 6 month follow-up with the children. For the final part of the evaluation please take the time to complete the questionnaires enclosed and return to the University using the prepaid envelope provided.

- The first questionnaire, I would be grateful if you could complete again as part of the evaluation of the school programme.
- The second is a short set of questions about any continued effects of the school programme. Your feedback is very valuable to us and will affect how this programme is run in the future. I am keen to hear any positive and/ or negative feedback which you may have.

All of the information collected by these questionnaires will be anonymous and only identifiable using a unique code which can only be accessed by the immediate research team. In addition, the website is still live so please feel free to use this to provide feedback online if you prefer. The website address is http://sohp.moonfruit.com.

Yours Sincerely,

Anna Cooper

35. Follow-up parent letter – control schools

Anna Cooper,
PhD Research Student,
Faculty of Health & Social Care,
The University of Salford
Allerton Building (AD101),
Salford,
Greater Manchester
M6 6PU.
T: +44 (0)161 295 5094
E-mail: a.m.cooper@salford.ac.uk

Dear Parent or Guardian,

Re: Effectiveness of a Global Oral Health Programme as Applied to Populations in NW England, UK

As you are aware, your child took part on a school oral health evaluation which began in the summer term, 2010 when they were in year 2. We are currently conducting the 6 month follow-up with the children. For the final part of the evaluation please take the time to complete the questionnaires enclosed and return to the University using the prepaid envelope provided.

All of the results will be anonymous and identified using a unique code for your child. I would be grateful if you would take the time complete the questionnaire to allow us to obtain a true reflection of child oral health in Tameside. Thank you for consenting for your child to be part of the evaluation and for continuing to support this work.

Yours Sincerely,

Cooper

Anna Cooper

Principle Supervisor: Professor Lindsey Dugdill, Co-Supervisor: Professor Cynthia Pine

36. Summary of main areas relating to toothbrushing and nighttime sugar-snacking for parents who returned the questionnaire at baseline, post-intervention and follow-up

For completeness descriptive data is presented here for those parents returning the Parent questionnaires at baseline, post-intervention, and follow-up. However, due to the very low numbers it is not possible to draw conclusions but is beneficial to briefly explore the outcomes to determine any patterns to these parents reporting in comparison to their children's and how this may link to *study 2*. For parents who returned all the questionnaires (control (n=10) and intervention group (n=10)), their children's self-reported brushing and ranges of plaque scores at baseline, post-intervention and follow-up are presented in the table below. From this it can be seen that across both groups children were most likely to report brushing twice-daily, which is in line with parental reporting and the relatively low plaque scores seen at baseline, post-intervention and follow-up.

Children's self-reported brushing and plaque scores for parents who returned all 3 Parent questionnaire

	Intervention group		**Control group**	
	Children's reported brushing behaviour	**Range of children's plaque score**	**Children's reported brushing behaviour**	**Range of children's plaque score**
Baseline	All reported brushing morning and night	0.000-0.833	n=1 not brush, n=6 brush twice, n-2 only brush in the evening and n=1 who was unsure if they had brush that morning but reported brushing the previous night	0.000-0.917
Post-intervention	n=8 reported brushing morning and night; n=1 who reported brushing the previous evening but not the morning and 1 who did not answer those questions	0.083-0.917	n=1 not brush; n=9 brush morning and night	0.000-0.583

Follow-up	n=7 reported brushing morning and night; n=1 who was not sure if they had brushed at the two time points and n=2 who were not sure if they had brushed at one of the time points but did brush at the other.	0.000-0.750	n=8 brush morning and night; n=1 unsure if they had brush that morning but reported brushing the previous night; n=1 who reported brushing in the morning but not the previous evening	0.000-0.750

At baseline, post-intervention and follow-up for the parents who returned all 3 questionnaires in both the control and intervention group they most frequently reported their children brushing twice-daily. At bassline and follow-up one intervention parent reported their child only brushed once-a-day. When asked about specific times of day one intervention group parent reported their child not brushing in the morning at baseline and post-intervention and one control parent (of the n=10) reported their child only sometimes brushed. Similarly at follow-up n=1 intervention parent (of the n=10) and n=2 control parents (of the n=10) reported their children only sometimes brushing in the morning. This suggests that reporting of toothbrushing is reported differently when parents are asked about specific time points compared to more general questions. For the parents who returned the questionnaire at all three time points more control group children were reported to receive support with toothbrushing then intervention group children throughout *study 2*.

For sugar-snacking at baseline none of the parents in the control and intervention group who returned all three questionnaires reported their children having sugary snacks at night. However, for these children post-intervention n=1 control child was reported to have sugar-snacks after brushing and 1 intervention child was reported as sometimes having sugar-snacks after brushing. At follow-up all ten of the intervention parents reported their children not having sugary-snacks at night but n=1/10 control group parent reported their child sometimes having sugary snacks.

37. Example of school feedback

Effectiveness of a Global Oral Health Programme as applied to populations in NW England, UK

PhD Student: Anna Cooper

Principal Supervisor: Prof Lindsey Dugdill, Co-Supervisor: Prof Cynthia Pine

This report is to give you an overview of the findings to date, and of the group results for your school. The authors are very grateful for your participation in the study that has made this research possible.

1. Study summary

Study 2 was a feasibility study evaluating the SOHP's materials and method to identify improvements to the programme and delivery mechanism prior to study 3. The SOHP aims to increase toothbrushing to *twice-daily*, morning and nighttime and reduce sugar-snacking at night after brushing. The study aimed to:

1. Explore how best the current SOHP can integrate into the curriculum.
2. Investigate how the resource pack [79] for the SOHP needs to be developed to make it fit for purpose.
3. Assess effectiveness of the SOHP in terms of changing children's tooth-brushing behaviour in the home environment.

2. Participants

Intervention group (n=180): The SOHP was implemented in Year 2 classes (n=8).
Control group (n=76): continued with normal OH activities at home and school. It was decided to locate the control schools (n=5) in a different geographical area of Greater Manchester to the intervention schools to reduce risks of contamination from the ongoing SOHP.

Evaluative measures were taken at *baseline* – to understand the current brushing levels, knowledge and oral hygiene levels of the children. *Post-intervention* – after the 1 month period to measure the direct effects of the SOHP on children

[79] Teachers' resources (*lesson guides, lesson plans, power point slides, worksheets, props, posters*); children's pack (*brushing calendars and stickers, toothbrush and toothpaste, pencil/rubber*); parents' pack (*leaflets, tips and tricks, Salford Oral Health Report*) and 'Brush Day & Night' website.

brushing, knowledge and oral hygiene. Final measures were taken after a six month *follow-up* period to allow any lasting effects if the SOHP to have been examined.

3. Data Analyses:

Primary outcome measure: Presence of dental plaque.
Secondary outcome measure: Behavioural outcome (Consistent twice-daily brushing indicated by changes in plaque and children's 24 hour recall).
Tertiary outcome measure: Knowledge outcomes (Increased understanding of twice-daily brushing and its effects; parental engagement in establishing and maintaining OH routines; incorporating a school OH intervention into NC).

4. Summary of key findings and results

The following section outlines key findings to provide an overview of the results.

4.1 Children's Questionnaire

Intervention Group:
Reported baseline measures showed only 8% (n=14) of children reported not brushing in the morning (yes 90%, n=157; don't know 2%, n =3) compared to 14% (n=25) who reported not brushing at night (yes 80%, n=139; don't know 6%, n =10).

Post-intervention the intervention group showed no reduction in the number of children who did not brush in the morning (8%, n=13, vs yes did brush in the morning 90%, n=148; don't know 2%, n=4) but did show a non-significant reduction in the number of children reporting not brushing at nighttime (11%, n=18, yes 82%, n=136; don't know 7%, n=11).

At six month follow there was no change in the number of children not brushing their teeth in the morning (8%, n=11, yes 87%, n=128; don't know 5%, n=8) but reported brushing reverted to above the baseline frequency for number of children not brushing in the evening (18%, n=26, yes 75%, n=110; don't know 7%, n=11).

Control Group:

In contrast to this the control group showed the opposite pattern with slightly more children reporting not brushing in the morning (19%, n=14; yes 75%, n=55; don't know 6%, n =4) compared to the evening (12%, n=9; yes 84%, n=62; don't know 4%, n =3).

Post-intervention the group showed no change in the number who did not brush in the morning (19%, n=14, yes 80%, n=59; don't know 1%, n=1) from baseline and a slight increase in those who did not brush in the evening during the recall period (15%, n=11, yes 78%, n=57; don't know 7%, n=5).

At the six month follow-up for the control group there was a slight decrease in the number of children who did not brush in the morning (15%, n=10, yes 79%, n=53; don't know 6%, n=4) compared to baseline and post-intervention, with evening brushing rates (12%, n=8, yes 81%, n=55; don't know 7%, n=5) equal to those at baseline and being a slight reduction in those reported post-intervention.

4.2 Reported nighttime sugar-snacking

Although the predominant focus of the '*Brush Day & Night*' intervention was to increase children's toothbrushing to *twice-daily*, it also aimed to inform them about the impacts of sugar-snacking before bed. To understand this, children were asked to answer "*Do you eat sweet things or have fizzy drinks before going to bed?*" At baseline for both the control and the intervention group 13% of children in each reported having sugary snacks at nighttime (Intervention n=22, *no 65% n=114*; Control n=9, *no 72% n=52*). There were a higher percentage of children in the intervention group at baseline who reported that they sometimes had sugary snacks at night compared to the children in the control group (Intervention 22%, n=38, Control 15% n=11).

Post-intervention there was a marked reduction in intervention children who sometimes had sugary snacks (16%, n=26; *no 72% n=120; yes 12% n=20*) and double the number of children in the control group reporting they sometimes had sugary snacks (34% n=25). The higher percentage of children who reported sometimes having snacks in the control group lead to a reduction in those who reported never having snacks (no 54%, n=39; *yes 12% n=9*) this could indicate an

increased awareness of what the question was asking (through a greater level of understanding around sugar indicated in the FG with the children) or recent shifts in their nighttime activities not measurable through this evaluation.

For the control group at follow-up there was a slight reduction in those reporting they had snacks before bed (10%, n=14; *no 58% n =84*) but a doubling of the frequency of children who reported sometimes having snacks (32%, n=47). The increased percentage seen post-intervention in control group children who sometimes reported snacking was sustained during the follow-up period (32%, n=22), with comparable percentages of children reporting having snacks (14%, n =10; *no 54% n = 37*).

The main focus of the SOHP was not related to nighttime sugar-snacking although this is known to have an impact on child oral health problems and for this reason, aspects of the programme related to this behaviour. For both the intervention group and the control group, the children reporting that they do have nighttime sugary snacks remained stable from baseline to post-intervention; suggesting the programme has a limited impact on their snacking behaviours. There is however, evidence to suggest that the programme may have been more successful in raising the children's awareness in this area.

4.3 Plaque data:

There were no significant changes of plaque levels in either intervention or control groups as a whole. There were however, as with the reported changes in toothbrushing behaviour, cohorts of children who showed a significant improvement and deterioration in their plaque levels. A multi-level analysis to determine the effects of the '*Brush Day & Night*' programme at a group and gender level found a non-significant effect for group and gender.

Overall mean plaque scores:

Intervention group:	Control group:
Baseline = 0.174	Baseline = 0.231
Post-intervention = 0.248	Post-intervention = 0.315
Six month follow-up = 0.266	Six month follow-up = 0.306

Multiple regression analysis shows overall there was no significant difference across each group at each time point indicating there was no overall intervention effect[80].

4.4 Children's feedback summary:

The overall reception to the programme by the children was positive with only 4% saying they did not enjoy it and 5% saying they only enjoyed elements of the SOHP. Upon completion of the SOHP only 2% (n=4) of the children were unable to answer "*Do you remember when you should brush your teeth?*" From the 6 month follow-up feedback received from the children, the key message was still remembered and understood but the use of the reinforcement materials provided e.g. brushing calendars, had dramatically decreased over the six months.

In support of the teachers' feedback it was also noticeable that the worksheets were received in both positive and negative ways and is an area that can be developed to increase their support of the lessons and the children's understanding. The support and engagement of primary caregivers is key to a behaviour being sustained and the habit being produced in the home environment. In relation to this, although a high percentage of children reported using the sticker calendar, few reported receiving support/reinforcement from a parent or career.

Children also reported that the website was not accessed and used as part of the reinforcement tools in the home; this finding was supported by both teachers and parents. Only 35% of children reported accessing the website and this was most commonly to play the games (40%). From the self-reported feedback from the children 82% of them reported using the brushing calendar with 8% indicated they only used them sometimes. At follow-up, as with the feedback reported through parents, the use of the brushing calendar dropped from 82% post-intervention to

[80] This has been verified and conducted independently by a dental statistician.

33% at follow-up; with 21% of children reported sometimes using the calendar at follow-up.

Through the feedback from the children via the post-intervention questionnaire the children overall expressed enjoying the programme. It was also apparent that the impact of the SOHP varied greatly across the schools and also was influence by enjoyment of the lessons and the elements at home. For some of the children as expressed by the teachers the engagement of primary caregivers was a negative to the program but others expressed how their primary caregivers and others in their family had helped with the programme. An element that was not accommodated for in the SOHP was the effects that toothbrushes and toothpaste can have on the brushing habits of children. If they have negative association with them a SOHP to encourage *twice-daily* brushing is not able to aid this and the effects it is having on the frequency of brushing. The brushing calendar was well received by the children as a method visually determining when they had brushed their teeth which is in slight contrast to the teachers perceptions that they felt it was not being used due to only small numbers being returned, or brought in during the programme. The current '*Brush Day & Night*' programme has many facilitating factors to achieving a change in brushing behaviour in the children but also, as with other school programs, many barriers that need to be addressed to increase the effectiveness from just rising knowledge and awareness to achieving a sustained change in behaviour.

The children's feedback taken in conjunction with that of primary caregivers and teachers supports the conclusion that in its current state the '*Brush Day & Night*' programme has many facilitating factors but also long and short term barriers to its ability to change behaviour in conjunction with the increased knowledge of the children regarding brushing and sugar-snacking. It was clearly evident that knowledge of children post-intervention was high in intervention schools around the topics in the SOHP however, significant behaviour change was not reported post-intervention and or during the six month follow-up. However this may have been due to a fairly high level of self-reported brushing (average over 1.5 times/day) at baseline as mentioned above. A drawback to this evaluation is when the children change school years it affects the continuity of delivery and reinforcement.

4.5 Teachers feedback

As a whole the programme was well received as an additional element to teach at a busy time of year by the teachers, but the teachers were unsure about the overall effectiveness on the programme on the children's tooth-brushing behaviour; and felt a shortfall of the programme was how well it had been able to engage the children's primary care givers. From the feedback provided by the teachers the SOHP used in Study 2 is a beneficial resource but did not achieve its desired outcome further than increasing children's knowledge of oral health. It is also clear that any resource provided to schools needs to be able to accommodate a spectrum of ability both between and within classes. Effects of this can be seen through: adaptations to the programme for school/class to ensure they would get the most out of it and changes to how aspects are taught such as germs and key words they felt children would struggle with.

4.6 Feedback Discussion

The feedback that was received both post-intervention and during the data collection at 6 months highlighted a number of barriers and facilitators to the '*Brush Day & Night*' programme evaluated in study 2. The barrier that will have the greatest impact on the ability of the programme to increase children's brushing to *twice-daily* is the engagement with the SOHP within the home. The parental pack provided as part of the programme is passive in its nature and requires parents to actively engage with the contents and message within. The '*Brush Day & Night*' programme relies on the active components of the children's home pack e.g. sticker calendar to further engage the primary caregivers as well as the children.

Through the feedback collected via child and parent questionnaires, the children's focus groups and talking with the teachers, the core components of the programme convey the correct messages regarding oral health to the children, but development is needed to increase the overall 'activeness' of the SOHP and fundamentally the link from the school to the home. As the website was not a well-used resource, developing techniques for involving primary caregivers, providing reinforcement, and distributing information/reinforcement without using the website is an area to be addressed. A means of reducing the impact of the low website use could explore elements using other technology such as the use of mobile phones

through text messaging or ‘apps’ to send information, collect information and provide more real time feedback. Non-technological changes could be made through adapting the SOHP to involve more proactive work in the home that provides more of a direct link to the schools programme e.g. The low use of the website could have an impact on sustainability of the programme once support for delivery is removed and additional resources are sought by al involved and as a mechanism to provide continued reinforcement.

An area that was not directly evaluated but became apparent as an influence was the school environment: teachers, location, and ethos. The present programme has few elements that allow it to be tailored to account for difference in school environments. Future development of the programme and evaluations would benefit from exploring the impacts of this further, both through increased tailoring in the home and schools.

5. Individual School Summary

The below section outlines a summary of your individual schools results.

5.1 Children’s reported toothbrushing habits:

At baseline and following the SOHP delivery 15 children reported they had brushed twice in the previous 24 hours. 3 children indicated they only brushed once prior to the beginning of the SOHP, all following the programme reported an increase to *twice-daily* brushing. This change in brushing routine was reported to be sustained by one during the follow-up period but not by the other child who was present the day of the follow-up. Prior to the SOHP one child taking part indicated they had not brushed their teeth in the previous 24 hours, post-intervention they reported an increase to brushing twice in the recall period. 8 children reported they brushed *twice-daily* across all three time points. Following the SOHP 88% of children were able to correctly identify the brushing message carried by the programme (brush twice day -morning and night), this dropped to 58% of the children at the 6 month follow who remembered the message. 77% of children reported that they had used the brushing calendars during the one month SOHP, with 29% of these reporting having help. 58% of children reported they continued to use the brushing calendar during the 6 month follow-up period, with only 17% having indicated they had support from parents with this.

Prior to the SOHP no children reported they had sugary snacks before bed, with 21% indicating they sometimes had sugary snacks after brushing their teeth at night. Following the SOHP one child now reported they had sugary snacks at night, with a significant reduction to only 6% of children reporting they sometimes have sugary snacks at night. During the follow-up 6 months after the SOHP 5 children asked reported sometimes having snacks at night and again one reported they had sugary snacks after brushing their teeth at night.

5.2 Plaque data

As part of the evaluation at baseline (week 1, 19 children), post-intervention (week 4, 17 children) and follow-up (6 months, 13 children) had a plaque exam. The plaque was scored by the dental hygienist from 0 (tooth surface is clean) to 3 (the tooth surface is covered with abundant plaque). At each time point this was scored on using a probe on 6 teeth. The overall plaque score for each child was then calculated taking into account the number of surface scored to allow the class means to be calculated.

As can be seen in the table below across all three time points the average level of plaque found on girls teeth was lower than for boys. As a class from baseline to post-intervention and follow-up there was no significant change in the levels of plaque the levels. Of the 3 children that reported an increase in their brushing habit one showed a reduction, one showed no change and the other a slight increase in their plaque score. The mean levels of plaque recorded for the school were competitively lower than paired control schools across the evaluation time period, and within the schools who delivered the school programme.

Plaque score	Mean	Mean boys	Mean girls
Baseline	0.10	0.11	0.09
Post-intervention	0.23	0.31	0.17
Follow-up	0.23	0.38	0.10

5.3 Focus groups:

Through the initial focus group all children reported brushing their teeth in the morning but 2 reported not brushing at night, they also reported being reminded to brush their teeth by their parents. This was mainly by their mothers. The children

taking part in the focus groups reported not having sugary snacks and drinks at night once they had brushed their teeth. They showed a high level of knowledge around what would happens to your teeth if you do not look after them, but had less of a developed knowledge about the impact of germs. They reported that it was hard to brush their teeth at times especially the back. Over half of the group reported having an electric toothbrush to help them ensure brush correctly. Although they knew which foods and drinks were good and bad for us the children were not able to explain in great deal how the food affects our teeth or the impact of sugar.

In the focus group following the intervention all the children reported they had brushed their teeth twice in the previous 24 hours. They reported that the programme had taught them to brush their teeth for longer and to remember the importance of brushing their teeth twice-a-day. The children showed an increased level of knowledge around the impact of sugar and how it affects our teeth. They were able to explain how germs affect our teeth and how brushing helped to reduce the impact of germs. When the children were asked the same question again (from pre-intervention to post-intervention) 'how does food affect your teeth?', they were able to provide more detailed explanation and reason around the impact of food, for example explaining the difference between good food (milk, water), bad food (sweets, fizzy drinks) and how it leads to problems with our teeth. Overall the programme increased the children's knowledge around teeth and the importance of good oral hygiene, with the Teeth Chiefs being seen as the best part of the programme.

Six months after the programme all children reported brushing in the morning with some forgetting to brush the previous evening. A third of the class reported they had continued to use their sticker book during the phase but were not receiving help with this. The children who were still using the calendar reported that it was helping them to continue to remember to brush their teeth. When asked about the programme, the children recalled the Teeth Chiefs cartoons in greater detail to the lessons delivered and how it taught them about germs and the time they should brush their teeth for. Over half of the class still reported the taste of the toothpaste was still the aspect they disliked about brushing their teeth. Over the course of the 6 month follow-up the children had retained the increased level of knowledge

reported post-intervention around germs, good & bad food and the importance of teeth.

6. Current work published around evaluation:

Study 1: Pilot exploration of 6/7 year olds perception of toothbrushing and nutrition.

a. Poster Presentation: Cooper, A; Dugdill, L; Pine, C., (2010). Why Brush?: 6-year-olds' perspectives on oral health routines, Salford, UK. The International Association for Dental Research 80th General Session. 14th – 17th July 2010, Barcelona, Spain.

b. RISE Article: Cooper, A; Dugdill, L; Pine, C., (2010). The six-year old and the toothbrush. Post-grad Article, RISE May – June 2010. http://www.research.salford.ac.uk/cms/resources/uploads/File/RISE/RISE%20May%20June.pdf

Study 2: School Oral Health Programme: 'condensed delivery model' evaluation

a. Poster Presentation: Cooper, A; Dugdill, L; Pine, C., (2010). Participatory Research Involving Children: Developing a School Oral Health Programme in Salford, NW England. INVOLVE Conference: Public Involvement in Research: innovation and impact, Nottingham.
b. Poster Presentation: Cooper A., Dugdill L., Pine C., (2011). Children's understanding of oral health routines: Explorations using Draw & Write. EADPH Conference. Rome, Italy.

Section 4: Questionnaire validation – Chapter 8

38. Pilot – Information sheet and consent form

Information Sheet

Effectiveness of a Global Oral Health Campaign as applied to populations in NW England, UK

Children's Questionnaire and study toothbrushes

Introduction

We would like to invite you and your child to take part in a research study. Before you decide if they can take part please take the time to read the following information to understand why and how the research will be conducted.

What is the Purpose of the Study?

Good oral health is essential for all. Dental caries (tooth decay and cavities) is one of the most common diseases in childhood in Salford. There are simple ways that dental caries can be reduced which include brushing twice-a-day with fluoridated toothpaste. The purpose of this study is to evaluate a children's questionnaire around toothbrushing and to learn more about children's toothbrushing behaviours.

Why have I been invited?

We are asking parents/guardians of children aged six to consent to their children taking part in the study.

Do I have to take part?

It is up to you to decide if your child can be involved in the research. If you would like to ask further questions before deciding we would be happy to discuss anything on the phone. You are free to withdraw from the study at any time, up until publication of findings. Please return the attached form indicating if you give permission for your child to take part in the study.

What will happen if they take part?

The research will last 4 days in total. At the end of this period we would like your child to complete a simple questionnaire with your assistance if needed. This will ask about toothbrushing, what they think about toothbrushing and about nighttime sugar-snacking behaviours. The questionnaires take about 5-10 minutes to complete.

You and your child will be issued with a study toothbrush that will tell us more about their toothbrushing habits over the 4 days, by recording their behaviour. It is important that they use this study toothbrush for the period instead of their regular toothbrush as part of their normal brushing routine. So ideally their normal toothbrush should be stored away during this time to ensure constant use with the study toothbrush is maintained. The study toothbrushes are property of Unilever Oral Care and as such they have to be returned so as not to incur a cost to the research team, consequently we would be grateful if they were used as intended but no attempt is made to remove the end and they are returned to us after the study.

What are the benefits of taking part?

Oral health promotion is a key government target for the NHS and Healthy School Programmes. This study hopes to learn more about children's brushing habits as they develop and will therefore contribute to government targets. The information gained through this programme will aid the re-development of a school based oral health programme targeting 6-7 year olds.

Will my taking part in this study be kept confidential?

Yes. We will follow all ethical and legal guidelines during this study. All information will be handled in confidence and stored securely. For the duration of the study your child will be given a unique code so data can be matched across the study. This will ensure that your child's personal details cannot be identified by anyone apart from the research team. The suppliers of the study toothbrush will be provided with anonymised results for use: "*to understand technical functioning of the loggers when in field. There is no interest in the people who use the brushes,*

nor the conditions in which this takes place. Hence anonymity will be preserved even to the macro level of the site."

What will happen to the results of the research study?

We will be using the results as part of an evaluation for a PhD study at the University of Salford. The findings will be written up and some will be included in publications to help inform others about what has been learnt from this study. You or your child will not be identified in any of the reports. If you would like a copy of any results please feel free to request them.

Who is organising the study?

The study is being organised through the University of Salford, College of Health and Social Care in partnership with Unilever Oral Care and NHS Salford. All those taking part in the research have gone through an enhanced criminal record check (CRB) to work with children. Ethical approval to conduct the study has been gained through the University of Salford.

Please note there are no financial incentives available for taking part in this study

Further information and contact details

If you have any questions about the study, or wish to discuss any part further please feel free to contact me: Anna Cooper

Faculty of Health & Social Care, Allerton Building, University of Salford, Salford, Greater Manchester, M6 6PU. Tel: 0161 295 5094 Email: a.m.cooper@salford.ac.uk

If you have any concerns about this project please contact Professor Lindsey Dugdill or Professor Cynthia Pine who are supervising the study via the administrator Louise Robinson: Tel: 0161 295 2799

Finally many thanks for reading the information sheet and considering taking part. Please keep this for you records.

University of Salford MANCHESTER

Consent form

Title of Project: Effectiveness of a Global Oral Health Campaign as applied to populations in NW England, UK. *Children's questionnaire and study toothbrushes*

Ethics reference code:
Name of Researcher: Anna Cooper
Supervisors: Prof Lindsey Dugdill and Prof Cynthia Pine

- I confirm that I have read and understood the information sheet provided for the above study and have had the opportunity to ask further questions.
- I fully understand that my child's participation in this study is voluntary and that they are free to withdraw at any time, without providing a reason, and without this affecting any rights.
- I give permission for results to be used in written reports as a result of this investigation and understand publications will be anonymised.
- I give permission for anonymised results to be shared with the producers (Unilever Oral Care) of the study toothbrushes for internal use only.

Please sign below and indicating if you give consent or do not give consent:

I ***give*** consent for my child to take part ☐

I ***do not*** give consent for my child to take part ☐

_____ _____ _____

Name of Parent/guardian Date Signature

_____

Name of Child

Please return the signed form to Anna Cooper

Thank you

39. Pilot – Instructions and toothbrushing recording sheet

Toothbrushing trial

Study instructions:

- Over the next 4 days please use the brushes provided for yourself and your 6 year old child, as part of the normal family brushing routine instead of your current toothbrushes.
- Each time you and your child use the toothbrushes please record the time of day in the table below. (*This is to check accuracy of the toothbrushes during the pilot*)
- Please also record on the table if the brush was used at any time in the bath or shower (as this can help us determine if it affects the results).
- On the final day of using the brush please ask your child to complete the attached questionnaire, please ask them to be honest (it is not a test).
- If your child requires assistance with the questionnaire please read the questions as they are written, this helps us to get standard answers from everyone.

Persons using brush (*please delete as appropriate*): **Mother/ Father…. Boy/ Girl**

Day	Parent/Child	Time of day	Time of day	Time of day
1	Parent			
	Child			
2	Parent			
	Child			
3	Parent			
	Child			
4	Parent			
	Child			

40. Pilot – Example of participant feedback

Effectiveness of a Global Oral Health Programme as applied to populations in NW England, UK

PhD Student: Anna Cooper

Principal Supervisor: Prof Lindsey Dugdill, Co-Supervisor: Prof Cynthia Pine

This summary gives you an overview of the findings of the pilot, and of your individual results. The authors are very grateful for your participation in the study that has made this research possible.

The purpose of the pilot you took part in was to determine the ability of the provided toothbrushes to measure behaviour and to ensure the accuracy of the settings. The average brushing time for detected events in adults was 68.20 seconds. For adults the self-reported brushing frequency correlated in all but one event with the objective measure in the toothbrush. With the average brushing time for detected events for children being 33.68. With the children's objective measure in the setting that detected behaviour the self-report correlated, however the setting for 2 of the children's brushes was too high to accurately detect behaviour against self-report in all instances.

Participant Feedback – Mother/Son

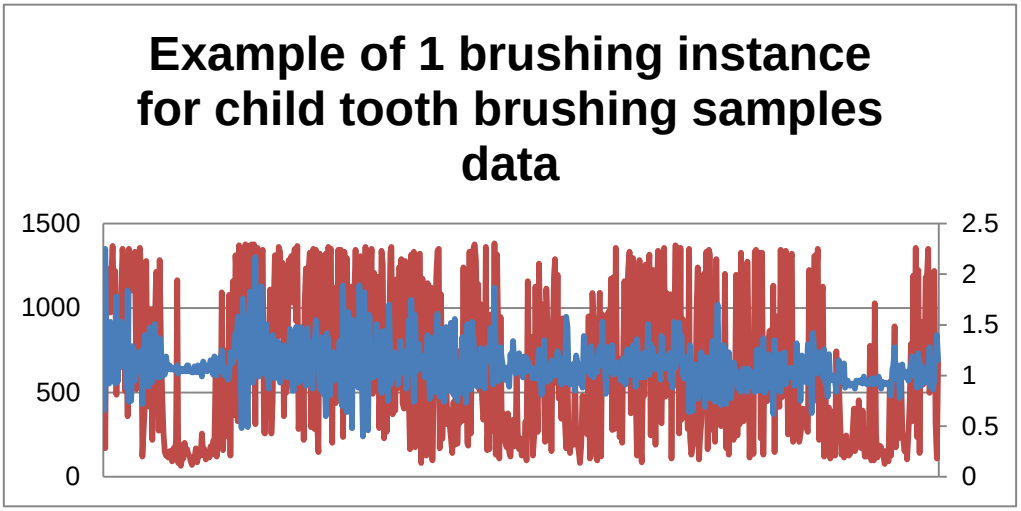
The table below highlight the specific outcome data detected by the toothbrush for both the parents and the child:

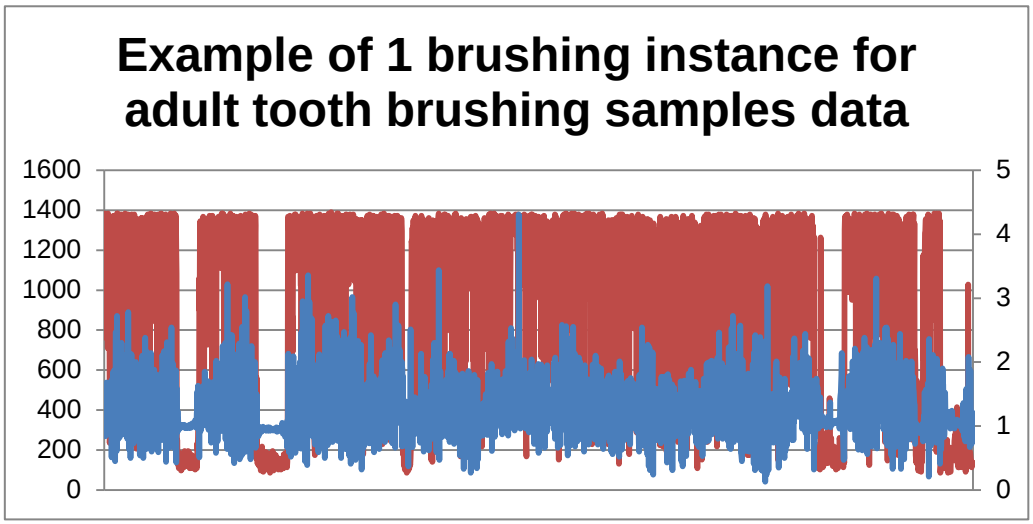
Participant	Parent number of reported events **(no of possible events)**	Parent number of recorded events on logger **(average brushing time)**	Child number of reported events **(no of possible events)**	Child number of recorded event on logger **(average brushing time)**
Mother/son	9 (9)	9 (83.58sec)	6 (6)	6 (59.67sec)

In addition to asking parents to report when brushing occurred the results were analysed in conjunction with the children's questionnaire. As can be seen in the table below the child, parent and objective measure agreed across the 24 hour re-call period.

Child report brushed in the morning	Child report brushed before went to sleep	Adult report of child brushing in the morning	Adult report of child brushing before went to sleep	Logger recorded brushing in morning	Logger recording brushing in evening
Yes	Yes	Yes	Yes	Yes	Yes

The graphs below are examples of one toothbrushing event.





41. Evaluation phases – Letter to parent, information sheet and consent form

Anna Cooper,
PhD Research Student,
College of Health & Social Care,
The University of Salford
Allerton Building,
Fredrick Rd Campus,
Salford,
Greater Manchester
M6 6PU.

T: +44 (0)161 295 5094
E-mail: a.m.cooper@salford.ac.uk

Dear Parent or Guardian,

Re: Effectiveness of a Global Oral Health programme as applied to populations in NW England, UK

I am conducting a research project as part of my PhD to understand more about year 2 children's toothbrushing habits. The research is being conducted through the University of Salford and in close partnership with the NHS Salford. Oral health in Salford is amongst the worst in the North West of England and the UK. We are hoping to learn more about children's toothbrushing routines through the use of study toothbrushes to improve the redevelopment of a school oral health programme.

Your child's school has agreed for the year 2 class to take part in the research that will last 6 weeks in total. Please find attached an information sheet and consent form for you to understand about the project, I am happy to answer questions and provide additional information where necessary.

Your child will not be involved in the research unless you fill in and sign the consent form provided and return it to your child's teacher. When we attend school your child will also be asked if they would like to be part of the research. It is really important that as many parents and children take part in this new research project which is the first of its kind in the UK.

Yours Sincerely,

Anna Cooper

Principle Supervisor: Professor Lindsey Dugdill, Co-Supervisor: Professor Cynthia Pine

Information Sheet

University of Salford MANCHESTER

Effectiveness of a Global Oral Health Campaign as applied to populations in NW England, UK

Children's Questionnaire and study toothbrushes

Introduction

We would like to invite your child to take part in a research study. Before you decide if they can take part please take the time to read the following information to understand why and how the research will be conducted.

What is the Purpose of the Study?

Good oral health is essential for all. Dental caries (tooth decay and cavities) is one of the most common diseases in childhood in Salford. There are simple ways that dental caries can be reduced which include brushing twice-a-day with fluoridated toothpaste. The purpose of this study is to evaluate a children's questionnaire around toothbrushing and to learn more about children's toothbrushing behaviours.

Why have I been invited?

We are asking parents/guardians of children in year 2, attending primary schools in the Salford area, to consent to their children taking part in the study.

Do I have to take part?

It is up to you to decide if your child can be involved in the research. If you would like to ask further questions before deciding we would be happy to discuss anything on the phone. You are free to withdraw from the study at any time, up until publication of findings. Please return the attached form indicating if you give permission for your child to take part in the study.

What will happen if they take part?

The research will last 6 weeks in total. Over these weeks your child will be asked to complete a simple questionnaire in class at various intervals. The questionnaire will ask about toothbrushing, what they think about toothbrushing and about

nighttime sugar-snacking behaviours. The questionnaires will be filled out individually as an exercise in class, this will be run by a member of the research team. The questionnaire takes about 5-10 minutes to complete.

Your child will also be issued with a study toothbrush that will tell us more about their toothbrushing habits over a month, by recording their behaviour. It is important that they use this study toothbrush for the one month period instead of their regular toothbrush as part of their normal brushing routine. So ideally their normal toothbrush should be stored away during this time to ensure constant use with the study toothbrush is maintained. Upon the final visit to the school by the research team your child should bring the study toothbrush back into school for collection. The study toothbrushes are property of Unilever Oral Care and as such they have to be returned so as not to incur a cost to the research team, consequently we would be grateful if they were used as intended but no attempt is made to remove the cap on the bottom of the toothbrush and that they are returned to us after the study.

What are the benefits of taking part?

Oral health promotion is a key government target for the NHS and Healthy School Programmes. This study hopes to learn more about children's brushing habits as they develop and will therefore contribute to government targets. The information gained through this programme will aid the re-development of a school based oral health programme targeting 6-7 year olds. At the end of the study your child will be given a small gift upon return of the study toothbrush.

Will my taking part in this study be kept confidential?

Yes. We will follow all ethical and legal guidelines during this study. All information will be handled in confidence and stored securely. For the duration of the study your child will be given a unique code so data can be matched across the study. This will ensure that your child's personal details cannot be identified by anyone apart from the research team. The supplies of the study toothbrush will be provided with anonymised results for use: "*to understand technical functioning of the loggers when in field. There is no interest in the people who use the brushes, nor the conditions in which this takes place. Hence anonymity will be preserved*

even to the macro level of the site." The only information Unilever will be given is the data provided will have been conducted with children in Salford.

What will happen to the results of the research study?

We will be using the result as part of an evaluation for a PhD study at the University of Salford. The findings will be written up and some will be included in publications to help inform others about what has been learnt from this study. You or your child will not be identified in any of the reports. If you would like a copy of any results please feel free to request them.

Who is organising the study?

The study is being organised through the University of Salford, College of Health and Social Care in partnership with Unilever Oral Care and NHS Salford. All those taking part in the research have gone through an enhanced criminal record check (CRB) to work with children. Ethical approval to conduct the study has been gained through the University of Salford.

Please note there are no financial incentives available for taking part in this study

Further information and contact details

If you have any questions about the study, or wish to discuss any part further please feel free to contact me: Anna Cooper

College of Health & Social Care, Allerton Building, University of Salford, Salford, Greater Manchester, M6 6PU. Tel: 0161 295 5094 Email: a.m.cooper@salford.ac.uk

If you have any concerns about this project please contact Professor Lindsey Dugdill or Professor Cynthia Pine who are supervising the study via the administrator Louise Robinson: Tel: 0161 295 2799

Finally many thanks for reading the information sheet and considering taking part. Please keep this for you records.

University of Salford MANCHESTER

Consent form

Title of Project: Effectiveness of a Global Oral Health Campaign as applied to populations in NW England, UK.

Children's questionnaire and study toothbrushes

Ethics reference code: REP11/069
Name of Researcher: Anna Cooper
Supervisors: Prof Lindsey Dugdill and Prof Cynthia Pine

1. I confirm that I have read and understood the information sheet provided for the above study and have had the opportunity to ask further questions.

2. I fully understand that my child's participation in this study is voluntary and that they are free to withdraw at any time, without providing a reason, and without this affecting any rights.

3. I give permission for results to be used in written reports as a result of this investigation and understand publications will be anonymised.

4. I give permission for anonymised results to be shared with the producers (Unilever Oral Care) of the study toothbrushes for internal use only.

Please sign below and indicating if you give consent or do not give consent:

I ***give*** consent for my child to take part ☐

I ***do not*** give consent for my child to take part ☐

_____ _____ _____

Name of Parent/guardian Date Signature

_____

Name of Child

Please return the signed form to your child's teacher

Thank you

42. Evaluation phases – Collection letter and demographic questionnaire for parents

Anna Cooper,
PhD Research Student,
College of Health & Social Care,
The University of Salford
Allerton Building,
Fredrick Rd Campus,
Salford,
Greater Manchester
M6 6PU.
T : +44 (0)161 295 5094
E-mail: a.m.cooper@salford.ac.uk

Dear Parent or Guardian,

Re: Effectiveness of a Global Oral Health programme as applied to populations in NW England, UK

As you are aware I am currently carrying out an oral health project with the year 2 children at your child's school. As part of this I would be grateful if you would complete a short questionnaire around home routines and demographics.

I will be attending your child's school on *[insert date]* to complete the work. I would be grateful if the questionnaire could be returned, along with the study toothbrush your child was provided with to your child's teacher to allow collection within this period. The brushes need to be returned to the manufacturer before *[insert date]* and I appreciate your help in making this possible.

As previously stated in the information sheet your school has given permission for your child to receive a small token of thanks for helping me with this work, this will be given to them upon collection of the brushes, if you have any reservation around them receiving this please feel free to contact me.

Yours Sincerely,

Anna Cooper

Principle Supervisor: Professor Lindsey Dugdill, Co-Supervisor: Professor Cynthia Pine

Demographic Questionnaire

Thank you for agreeing to allow your child to take part in this oral health study. The study involves children across Salford and as a result we would be grateful if you would complete a short demographic questionnaire. We would like you to complete this questionnaire by providing us with information about your child who attends year 2 primary school. All information given in this questionnaire will be treated with the strictest confidentiality and your answers will be completely anonymous.

General Information

1. **Child's name** …….

2. **Child's school** …….

3. **Child's date of birth** ____day / ____ month / ____ year

4. **Child's gender**: male ☐$_1$ female ☐$_2$

5. **Child's Home Postcode** ……..

Please complete this questionnaire and return to your child's school in the envelope provided.

If you need any help completing this questionnaire please contact Anna Cooper:

☎ **0161 295 5094**

✉ **a.m.cooper@salford.ac.uk**

Thank you

Childs ID:

People have different care arrangements for their children. The following questions help us understand your child's routines at home and their care arrangements, and the section ends with a few routine questions on background information.

6. **How often does your <u>child</u> brush their teeth?**

Once-a-week or less frequently ☐1 Every other day ☐2

Once-a-day ☐3 2 or more time a day ☐4

7. **Who mainly brushes the <u>child's</u> teeth?**

Child himself/herself ☐1 Usually by the mother ☐2

Usually by the father ☐3 Child and parent together ☐4

By one of the parents ☐5 Other ☐6 ……

8. **What type of toothbrush does your <u>child</u> mainly use?**

Manual ☐1 Electric ☐2

9. **Does your <u>child</u> ever have a sugary snack after brushing their teeth at night?**

Yes ☐1 No ☐2 Sometimes ☐3

10. **How often do you brush <u>your</u> teeth?**

Once-a-week or less frequently ☐1 Every other day ☐2

Once-a-day ☐3 2 or more times a day ☐4

11. **Are you:** child's mother ☐1 child's father ☐2

12. **What is your age:**

Under 20 ☐1 20 - 30 ☐2

31 – 40 ☐3 Over 40 ☐4

13. **Where does your child live the majority of the time (5 nights per usual week)?**

With his/ her….

Mother	☐1	Father	☐2
Mother and father	☐3	Mother and stepfather	☐4
Father and stepmother	☐5	Grandparents	☐6

Other ☐7 (specify) ……

14. **How many children are living in your house now?** ……

15. **Is this your first child, second child etc?** ……..

16. **What is your marital status?**

Married	☐1	Single	☐2
Divorced / separated?	☐3	Widowed	☐4
Co-Habit	☐5		

17. **Mother's occupation**

In full-time employment ☐1 please state job……

In part-time employment ☐2 please state job ……

In full-time education	☐3	In part-time education	☐4
Full-time carer	☐5	Currently unemployed	☐6

Other ☐7 (please give details) ……

18. **Father's occupation**

In full-time employment ☐$_1$ please state job……

In part-time employment ☐$_2$ please state job ……

In full-time education ☐$_3$ In part-time education ☐$_4$

Full-time carer ☐$_5$ Currently unemployed ☐$_6$

Other ☐$_7$ (please give details) ……

19. **At what level did the child's mother finish her full-time education?**

Primary school ☐$_1$ Secondary school ☐$_2$

Further education (college) ☐$_3$ Higher education (university) ☐$_4$

No formal education ☐$_5$

Other ☐$_6$ (specify) ……

20. **At what level did the child's father finish his full-time education?**

Primary school ☐$_1$ Secondary school ☐$_2$

Further education (college) ☐$_3$ Higher education (university) ☐$_4$

No formal education ☐$_5$

Other ☐$_6$ please specify ……

21. **What is your ethnic group? Please choose one section from (a) to (e), then place a cross in the appropriate box to indicate your cultural background**

a. White **b. Mixed**

British ☐ White and Black Caribbean ☐

Irish ☐ White and Black African ☐

Other ☐ please specify……White and Asian ☐

Other ☐ please specify…….

c. Asian or Asian British

Indian ☐

Pakistani ☐

Bangladeshi ☐

Other ☐ please specify…….

d. Black or Black British

Caribbean ☐

African ☐

Other ☐ please specify…….

e. Chinese or other Ethnic Group

Chinese ☐ Other ☐ please specify…….

Please take a moment to ensure you have answered all the questions

Thank you for completing this questionnaire

Section 5: Other

43. Literature review search strategy and details

Searches were conducted using: Medline via OVID, PsycINFO via OVID, CINAHL via EBSCO and PubMED. In addition relevant Cochrane reviews were sourced using their search database.

The search strategy used was based on:

- Schools/
- (School$ and (primary or elementary or junior or infant)).mp
- Child/
- ("school age child$" or "school-age child$" or "4-11 year$ old$).mp
- Child$.mp
- Or/1-5
- Oral health/
- Dental Plaque index or dental plaque or fluoride$ or toothbrush$ or dental caries
- Or/7-8
- 6 and 9

With additional search terms added to the specific area of literature being searched at the time. These related to:

- Habit$
- Behaviour or behaviour
- Intervention
- Programme or program
- Nutrition
- Cariogenic and (food or drink)
- 'nighttime snacking' or 'nighttime snacking'