University of Salford MANCHESTER

Vascular Health Checks in Salford: an exploration using FARSITE data

Research report

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Abbreviations

AUDIT	Alcohol Use Disorders Identification Test
BHF	British Heart Foundation
BMI	Body Mass Index
CHD	Coronary Heart Disease
CKD	Chronic Kidney Disease
CVD	Cardiovascular Disease
DBP	Diastolic blood pressure
DH	Department of Health
FAST	Fast Alcohol Screening Test
GP	General Practice/General Practitioner
GPPAQ	General Practice Physical Activity Questionnaire
HDL	High-density lipoprotein
IHD	Ischaemic Heart Disease
JBS	Joint British Societies
NHS	National Health Service
NICE	National Institute for Health and Care Excellence
PHE	Public Health England
SBP	Systolic blood pressure
SEPHO	South East Public Health Observatory
UK	United Kingdom
WHO	World Health Organisation

1 Introduction

1.1 Background and rationale for exploring NHS Health Checks (formerly known as vascular checks)

The National Health Service (NHS) Health Check programme, which began in 2009, is part of a national initiative aimed at preventing cardiovascular disease (CVD) through early identification and management of risk factors, or early detection of disease (Department of Health [DH], 2009). It is estimated that about 15 million adults in the UK are eligible for an NHS Health Check, targeted at adults at risk of developing "*heart disease, stroke, diabetes, kidney disease and some forms of dementia*", between the ages of 40 and 74 years old (Public Health England [PHE], 2013a).

The NHS Health Check is aimed at those who have no existing diagnosis of heart disease, stroke, kidney disease or diabetes, and provides an assessment of risk over a specified time period. Ideally it should be carried out once every five years. The NHS Health Check presently includes questions about:

1. Family and personal medical history
2. Lifestyle – level of physical activity, smoking and drinking behaviour
3. Demographic information - sex, age and ethnicity
4. Body Mass Index (BMI) (kg/m^2)
5. Blood pressure
6. Cholesterol level check

Since April 2013, the programme has been the responsibility of Local Authorities[1], and it is a legal requirement to ensure that systems are put in place to correctly identify the eligible population and offer this population NHS Health Checks within a five-year period (National Institute for Health and Care Excellence [NICE], 2014). National evidence suggests that implementation and take up of health checks is variable across the country, and that the referral to and follow up of interventions following a health check (both medical and those aimed at improving people's lifestyles) needs to improve (PHE, 2013a).

Earlier identification of CVD is of paramount importance, given that CVD is the main cause of death and disability in the UK (British Heart Foundation [BHF] Health Promotion Research Group, 2012; World Health Organisation [WHO], 2011). Whilst there have been considerable improvements in overall mortality from CVD in the UK since the 1970s (due to reductions in some of the main risk factors such as smoking), CVD remains the main cause

[1] The NHS Health Check programme had previously been the responsibility of Primary Care Trusts

of death. CVD accounted for 180,000 deaths in 2010 (approximately one third of total deaths), with almost half (45%) being attributed to coronary heart disease (CHD), and 28% to stroke (BHF Health Promotion Research Group, 2012). CVD is also one of the main causes of premature mortality (death before age 75) in the UK, with 28% of all premature deaths in males and 19% of all deaths in females due to CVD in 2010; CVD was the cause of 46,000 premature deaths in 2010, with 25,000 premature deaths attributable to CHD in the same year (BHF Health Promotion Research Group, 2012).

Across England, premature mortality from CHD is highest in the North West and lowest in the South East and South West. This north-south gradient across England is also seen with respect to myocardial infarction (heart attack) death rates. CHD mortality exhibits a strong positive relationship with deprivation when using a measure of relative inequality (i.e. when comparison is made between the most and least deprived areas). Whilst overall CHD mortality has declined over the past decade, this inequality gradient has shown no sign of significant improvement (BHF Health Promotion Research Group, 2012).

By targeting modifiable risk factors[2] of CVD, diabetes, stroke and chronic kidney disease (CKD), the NHS Health Check aims to reduce the mortality, morbidity and inequalities associated with these conditions (PHE, 2014d). Public Health England (2014b) estimate that in a year: 650 deaths can be prevented; 400 people can be stopped from developing type 2 diabetes; and 19,000 cases of undiagnosed diabetes and 24,000 cases of kidney disease can be detected (PHE, 2014b).

1.2 Salford cardiovascular disease profile

Salford is situated in the North West of England; it lies within the boundaries of the Greater Manchester, Lancashire and South Cumbria Strategic Clinical Network (South East Public Health Observatory [SEPHO], 2013), and covers an area of 97.29km^2. Salford has an expanding population of approximately 237,000 (in 2012) (PHE, 2014e); this is expected to rise to 261,500 by 2021 (SEPHO, 2013). The 2011 Census reported that 9.9% of Salford's population were from black and minority ethnic groups (compared to over 14% for England) (SEPHO, 2013).

Salford has higher levels of deprivation compared with the average for England, with 46.5% of its population living in the most deprived national quintile and 4.9% of its population in the least deprived quintile (Figure 1.1) (SEPHO, 2013; PHE, 2014e). All-cause mortality has

[2] High blood pressure, smoking, high cholesterol, obesity, poor diet, physical inactivity, alcohol consumption

decreased over the last decade in Salford; and whilst premature mortality due to heart disease and stroke has fallen, rates are still worse than the average for England (SEPHO, 2013).

A detailed CVD profile for Salford showed that the total CVD mortality rate for all people (2009-2011) was 198.3/100,000; significantly higher than England (155.6/100,000), and also higher when compared to the Greater Manchester, Lancashire and South Cumbria Clinical Network as a whole (183.5/100,000) (SEPHO, 2013). Male CVD mortality rates were significantly higher than female rates (251.3/100,000 and 150.9/100,000 respectively). In the most deprived areas compared with the least deprived areas of Salford, CVD mortality rates were 243.8/100,000 and 127.2/100,000 respectively. These rates are higher than overall CVD mortality rates for the most and least deprived areas in England (213.1/100,000 and 120.6/100,000 respectively). In Salford, the percentage of cardiovascular deaths as a proportion of all deaths was 24.3% for those under 75 years old (compared to England, 23.8%), and 33.6% for those aged 75 years and over (compared to England, 34.7%) (SEPHO, 2013).

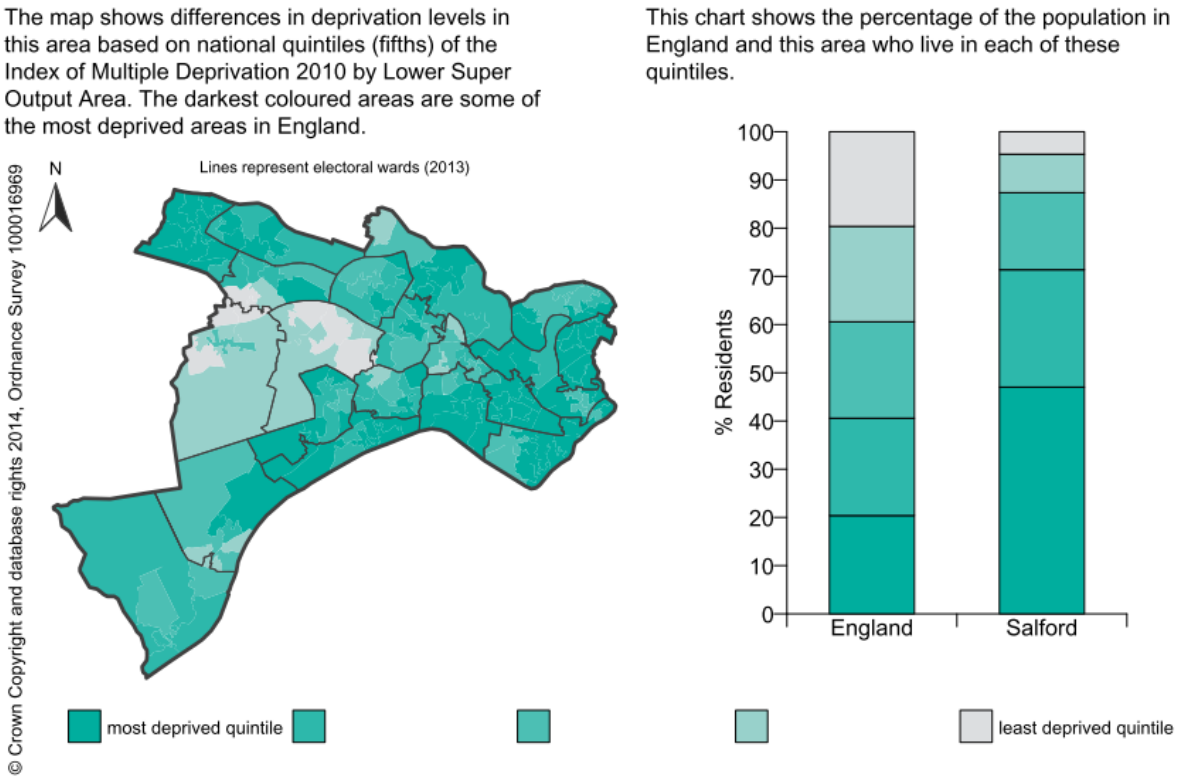

Figure 1.1 Deprivation profile of Salford compared to England (PHE, 2014e)

The all persons emergency admissions rate for CHD in Salford (2011-2012) was 244.9/100,000, equating to 672 admissions; significantly higher than England

(198.3/100,000). Similarly, the all persons emergency admissions rate for stroke in Salford (2011-2012) was 127.5/100,000, equating to 376 admissions; significantly higher than England (89.5/100,000) (SEPHO, 2013).

Modifiable, lifestyle-related behaviours such as diet and smoking are estimated to be worse in Salford compared to the England average, whilst alcohol consumption is not significantly different (PHE, 2014e). This has resulted in higher than average levels of obesity and smoking related deaths in the adult population. Consequently, avoiding premature mortality from CVD is a public health priority for Salford (PHE, 2014e). Over a quarter of adults (26.3%) were estimated to smoke in Salford compared to 19.5% for England (2012); 27% of the adult population were estimated to be obese (compared with 23% for England) (2012); only 45.5% of adults were estimated to have achieved at least 150 minutes of physical activity per week, compared to 56% for England (2012); and there was a small difference in adults estimated to be drinking at increased and higher risk levels in Salford compared to England (22.1% vs. 22.3%, 2008) (SEPHO, 2013; PHE, 2014e).

1.3 The Health Check Process

Public Health England and the Department of Health have produced best practice guidance documents that outline the methodology and implementation of the NHS Health Check (DH, 2013b). The programme is summarised in sections 1.3.1 and 1.3.2 below, and represented graphically in Figure 1.2.

1.3.1 Inclusion and exclusion criteria

The **inclusion criteria** are:

- Aged 40-74 years[3], who have not been offered an NHS Health Check within the previous five years

The **exclusion criteria** are:

- People already diagnosed with; CVD, CKD (classified as stage 3, 4 or 5), diabetes, hypertension, atrial fibrillation, transient ischaemic attack, familial hypercholesterolemia, heart failure, peripheral arterial disease and stroke
- People being prescribed statins for the purpose of lowering cholesterol

[3] Local Authorities have the flexibility to extend their programme

- People who have been assessed through an NHS Health Check (or any other check undertaken through the health service in England), and found to have a 20% or higher risk of developing CVD over the next ten years (DH, 2013b)

The location of the NHS Health Check can be determined by the Local Authority; however, all the data collected from these checks must be provided to the relevant general practices (DH, 2013b).

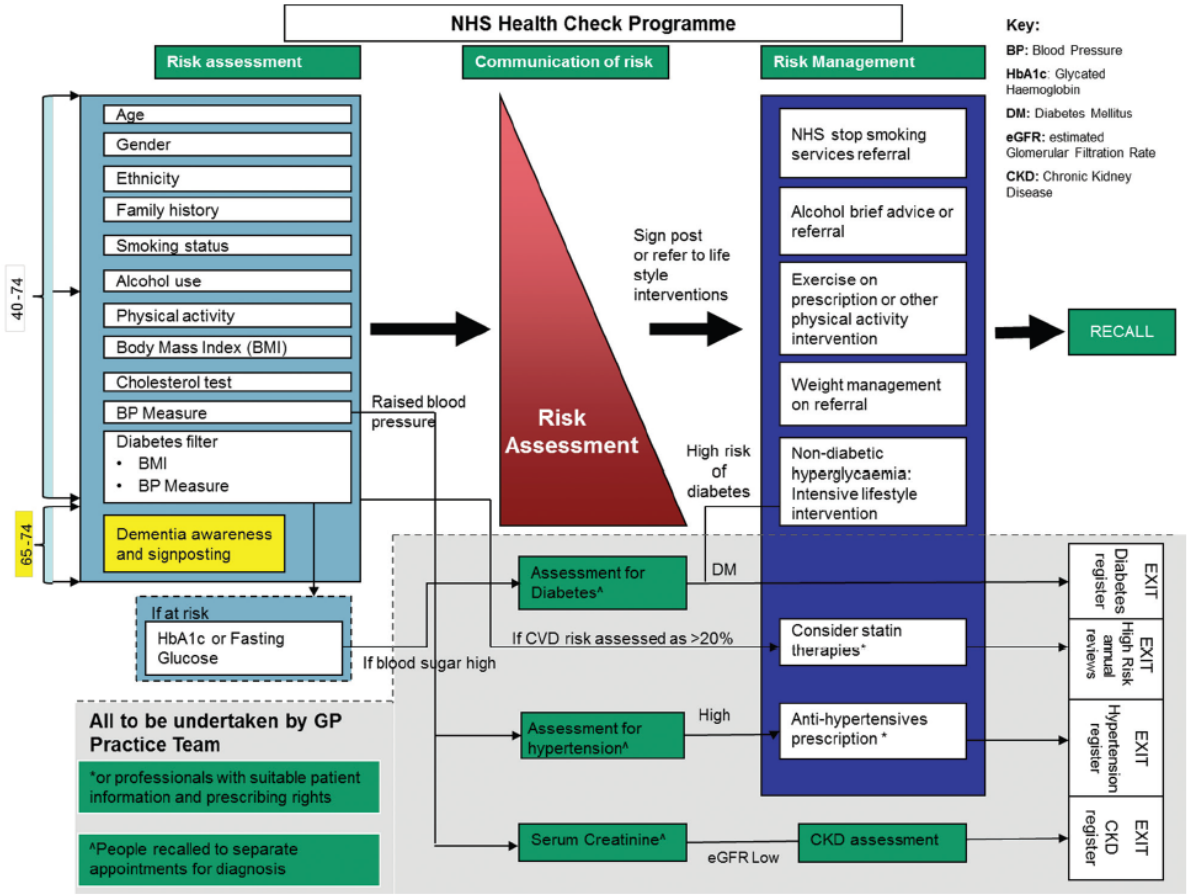

Figure 1.2 Diagrammatic overview of the vascular risk assessment and management programme (DH, 2013b)

1.3.2 Carrying out a health check

A complete NHS Health Check requires that **all** the elements outlined in the best practice guidance are taken **at the time of the health check**. The data to be collected during an NHS Health Check are based on the risk factors for CVD, diabetes, stroke and CKD; these include

- Age
- Gender
- Ethnicity

- Smoking status
- Family history of CHD
- Systolic blood pressure (SBP) and diastolic blood pressure (DBP)
- Total and HDL[4] cholesterol
- BMI
- Physical activity level - using the General Practice Physical Activity Questionnaire (GPPAQ) screening tool
- Alcohol use – using either the Alcohol Use Disorder Identification Test (AUDIT) **or** Fast Alcohol Screening Test (FAST)

Those aged 65 to 74 years old are also made aware of the signs and symptoms of dementia (DH, 2013b).

1.3.3 Cardiovascular risk score

A CVD risk engine is used to calculate a person's risk (expressed as a percentage) of developing heart disease within the next 10 years. There are four main CVD risk engines that are currently used in primary care:

- Framingham 1991 (Anderson, Wilson, Odell, & Kannel, 1991)
- JBS2[5] (Joint British Societies' guidelines of prevention of cardiovascular disease in clinical practice) (British Cardiac Society et al., 2005)
- QRISK (Hippisley-Cox et al., 2007)
- QRISK2 (Hippisley-Cox et al., 2008)

The Framingham algorithm is derived from participants in the Framingham Heart Study (Massachusetts, USA), that began in 1968 (Anderson et al., 1991). The Framingham equations are used to predict a person's five and 10 year risk of CHD; the algorithms use data from the following risk factors:

- Age
- HDL cholesterol
- Total cholesterol
- SBP
- Smoking status
- Diabetes diagnosis

[4] HDL=high-density lipoprotein
[5] JBS have recently updated this to JBS3, which also includes data on ethnicity, BMI, deprivation and co-morbidities (British Cardiac Society et al., 2014)

- ECG-LVH diagnosis[6] (Left ventricular hypertrophy, as measured by electrocardiography)

The JBS2 algorithm is based on the Framingham 1991 equations; however, it is CVD risk that is predicted and not CHD risk (British Cardiac Society et al., 2005). The Framingham algorithm is known to overestimate CVD risk in men by approximately 5% (Collins & Altman, 2012).

The two QRISK calculators are derived from a UK population, using data from general practices contributing to the QRESEARCH database; alongside the previously measured risk factors, the algorithms also include data on ethnicity, deprivation, BMI and co-morbidities (Hippisley-Cox et al., 2007; Hippisley-Cox, Coupland, Robson, & Brindle, 2010).

1.3.4 What happens after a health check?

On completion of the health check, the results are communicated to the individual, using every day language, so as to ensure the individual understands the results and the implications of them. This should be done face to face. Additionally, individualised written information with advice on the risks identified and referral information for lifestyle interventions should be provided (DH, 2013b).

The results of the health checks determine which pathways individuals will follow; all individuals should have access to high quality and appropriate risk management interventions, such as stop smoking services, physical activity interventions, weight management interventions and alcohol use interventions (DH, 2013b). Additionally, when the health check flags up an abnormal parameter, individuals should stay in the Health Check programme (see Figure 1.2), until these have been followed up and either diagnosed or cleared. Any individual diagnosed with conditions such as diabetes, hypertension, or CKD exits the programme and is managed according to the relevant NICE guidance (DH, 2013b).

1.3.5 Uptake of NHS Health Checks in the UK

It is recognised that the challenges of encouraging uptake of NHS Health Checks are manifold, with multifaceted reasons for people attending and not attending health checks. However, understanding the population and the factors that may impact attendance are vital for the commissioning of effective services (DH, 2013a).

[6] If information on diabetes and ECG-LVH diagnoses is not available, they are assumed to be negative

Whilst there is limited literature on the factors influencing the uptake of health checks it is recognised that because a number of the risk factors for vascular disease are asymptomatic, this can lead to the potential beneficiaries being reluctant to present for screening either because they are unaware of their risk (Forde, Chandola, Raine, Marmot, & Kivimaki, 2011), or because of individual views regarding the purpose of screening (Thornton, 2010).

Notwithstanding this, health screening programmes are known to show low response rates to invitations. The DH economic modelling document assumed that 75% of those invited would attend for an NHS Health Check (DH, 2008); although, this estimate was based on uptake of the National Breast Screening Programme (NHS Health and Social Care Information Centre, 2006). Recent studies of cardiovascular screening across the UK have reported uptake rates of between 25% and 47% (Artac et al., 2013; Dalton, Bottle, Okoro, Majeed, & Millett, 2011; Kumar et al., 2011; Lambert, Burden, Chambers, & Marshall, 2012; Marshall et al., 2008; Richardson et al., 2008).

Table 1.1 presents a comparison of health check uptake data from 2013-2014 NHS Health Check statistics for both the Greater Manchester region, and also for England. In 2013-2014, the uptake of NHS Health Checks in Salford was comparable to that of England (48.9% vs. 49.0%); however, the uptake rate across Greater Manchester was significantly higher (62.1%).

Area	Eligible population[7] (A)	Number of Health Check invitations (B)	Number of Health Checks attended (C)	% of attendance of NHS Health Checks (C/A*100)	% uptake of NHS Health Checks (C/B*100)
Greater Manchester (GM)	726,243	132,865	82,535	11.4%	62.1%
Salford[8]	43,615[9]	7794	3810	8.7%	48.9%
Tameside: lowest uptake in GM	66,109	9420	3598	5.4%	38.2%
Bolton: highest uptake in GM	80,302	18,587	15,112	18.8%	81.3%
England	15,308,022	2,819,665	1,382,864	9.0%	49.0%

Table 1.1 Comparison of health check data from 2013-2014 NHS Health Check statistics for Greater Manchester and England

The DH (2013) emphasise that good quality data is needed to drive improvement in managing people with or at risk of CVD, and consequently there is a need to evaluate the impact of the NHS Health Check in primary care (DH, 2013a). However, presently within Salford there is only limited information around who attends NHS Health Checks from those who are eligible.

[7] Total population (aged 40-74), minus the ineligible population (i.e. on a disease register)
[8] http://www.healthcheck.nhs.uk/interactive_map/north_of_england/greater_manchester/?la=Salford&laid=87
[9] The eligible population in Salford for 2013-2014 was approximately 57,000; the number used for the national quarterly reports was calculated incorrectly, and therefore, this led to an overestimated attendance rate.

2 Project aims and methodology

2.1 Project aims

The aims of this project were to:

- Assess the level of uptake for the NHS Health Check programme in Salford, by demographic characteristics.
- Provide a better understanding of who takes up health checks in Salford, and how many of these are at high risk of cardiovascular disease.

2.2 Research Questions

Specifically, the research questions were:

1. Who takes up the health checks?
2. How many of these are at high risk of cardiovascular disease?
3. Are there differences in outcomes for screened and non-screened individuals?
4. What are the impacts on prescribing?
5. Is there information available on onward referral to other lifestyle services?
6. How complete is the information in terms of risk factors for cardiovascular disease being recorded on the system and coding of health checks?

2.3 Research methodology

2.3.1 FARSITE

This project is a secondary data analysis of the FARSITE[10] system. This approach follows 'Action 10' of the Cardiovascular Disease Outcomes Strategy (DH, 2013a), which asserts that better use of information is needed in order to drive improvement of CVD outcomes. This research design is advocated, "*to answer high impact questions, that would otherwise be prohibitively expensive and time-consuming to study"* (Smith et al., 2011, p. 920).

FARSITE is a system that is used within Salford to capture NHS data, including information relating to health checks. FARSITE provides a comprehensive search filter based on Read codes or keywords assigned to diagnoses, clinical symptoms, measurements, prescribed medication, tests, administrative data, and procedures. The Read code system is "*a coded thesaurus of clinical terms"*, based on a hierarchical structure that can record all aspects of a patients care (Health and Social Care Information Centre, 2014).

[10] http://www.nweh.org.uk/products/farsite

FARSITE has been designed as a 'search and find' software, which allows a controlled platform for recruitment of patients for clinical research (NorthWest EHealth, 2014). The FARSITE software is also used by researchers to perform anonymised searches over whole populations (i.e. those registered with a GP in Salford), based on their primary care data.

Using the FARSITE system, only aggregate level data are obtained, depending on the search terms used. Searches can be limited by date and demographic information.

Data for this report were extracted by a researcher from the University of Salford, between October and November 2014, at Salford City Council offices.

2.3.2 Ethical approval

This project sits within the Audit and service evaluation strand of NHS research ethics, and therefore does not require NHS ethical approval (NHS Health Research Authority, 2013). University of Salford ethical approval was granted by the College of Health and Social Care ethics committee on 24/10/2014 (ref: HSCR14/96).

2.3.3 Statistical analysis

Descriptive statistics were analysed in Microsoft Excel 2010, and comparative analyses were carried out in Stata 13 (StataCorp., College Station, TX, USA).

3 Quantitative analysis

3.1 Data extraction

Data were extracted by quarter and yearly cross sections, depending on the research question being answered. Years were defined from April 1st to March 31st, and quarters:

- Quarter 1 – April 1st – June 30th
- Quarter 2 – July 1st – September 30th
- Quarter 3 – October 1st – December 31st
- Quarter 4 – January 1st – March 31st

Of the 47 general practices in Salford, seven practices did not actively invite patients for the NHS Health Check; however, the Health Improvement Service offers NHS Health Checks on the Salford Health Bus that operates in community settings within the borough. Therefore, people from practices that do not offer health checks still have the chance to have one opportunistically.

3.1.1 Data limitations

Searches that included risk factor information, obtained the most recent data within the time period specified. For example, if a search was carried out from April 2013 to March 2014, a person may have attended for a health check in April 2013 where BMI was recorded, but then had further BMI recordings in December 2013 and March 2014; within FARSITE, only the latest BMI recording (i.e. March 2014) would be retrieved through that search. Consequently, risk and risk factor data do not always link to the actual date that the NHS Health Check was carried out, as FARSITE is only able to provide aggregate data.

3.1.2 Age range for analysis

Analysis for all research questions was carried out on those aged 40-74 years; however, it should be noted that when limiting the analysis to this age range, FARSITE uses the age of a person on the date the search is carried out. Therefore, searches for years prior to 2014 had to be adjusted; i.e. searches for April 2013 to March 2014 used an age range of 41-75 years as these people would have been 40-74 years in the year 2013-2014, and searches for April 2012 to March 2013 used the age range 42-76 years etc. (i.e. the age when the search was carried out). This limitation should be noted when interpreting results across different age bands.

3.1.3 Read codes

The Read codes used for each search were informed from the Read code mapping guidance, available from the NHS Health Check website (Health and Social Care Information Centre, 2014). In the case where national Read codes were not widely utilised or available, then the FARSITE database was checked to see which Read code was commonly used in Salford for each condition/variable; the Read codes used for each search can be found in the Supplementary material (Read code book).

3.1.4 Analysis notes

- Data are presented for the financial year 2013-2014 (more specifically, 01/04/2013-31/03/2014), unless otherwise stated. Detailed data from previous years (and quarters, where available), have been analysed but not presented here.
- Analysis of invited uptake rates assumed that individuals were invited and received an NHS Health Check within the time period of the search; for example, a search to obtain data on the number of people who were invited and attended for a health check between April 2013 and March 2014 would include all invites across the year, but no information on those people that attended for a health check after March 2014.
- Analyses of differences between the screened and non-screened individuals assumes that those screened were all those who attended for a health check (includes those invited and those not invited); and those who did not attend, were those who were invited but did not attend for a health check within the same time period.

3.2 Question 1: Who takes up the health checks?

3.2.1 Identifying the eligible population

In order for uptake and attendance rates to be calculated, it was important to establish the eligible population for each year of analysis. Figure 3.1 shows how patients who attended and did not attend for an NHS Health Check were identified from all 40-74 year olds in Salford (A). The non-eligible population (B) (see section 1.3.1 for further details) was obtained using a national list of exclusion Read codes (Health and Social Care Information Centre, 2014). The eligible population (C) was calculated from (A) minus (B), as it was not possible to perform a search using Read codes in FARSITE to identify the number of eligible people.

The analysis showed that there were a number of patients who attended for a health check that were not invited (H); this figure is likely to include opportunistic health checks (e.g. those people who received an NHS Health Check on the Health Bus, or people who were offered a

health check opportunistically when attending the general practice for a different reason), and those that were not coded as invited on the general practice database.

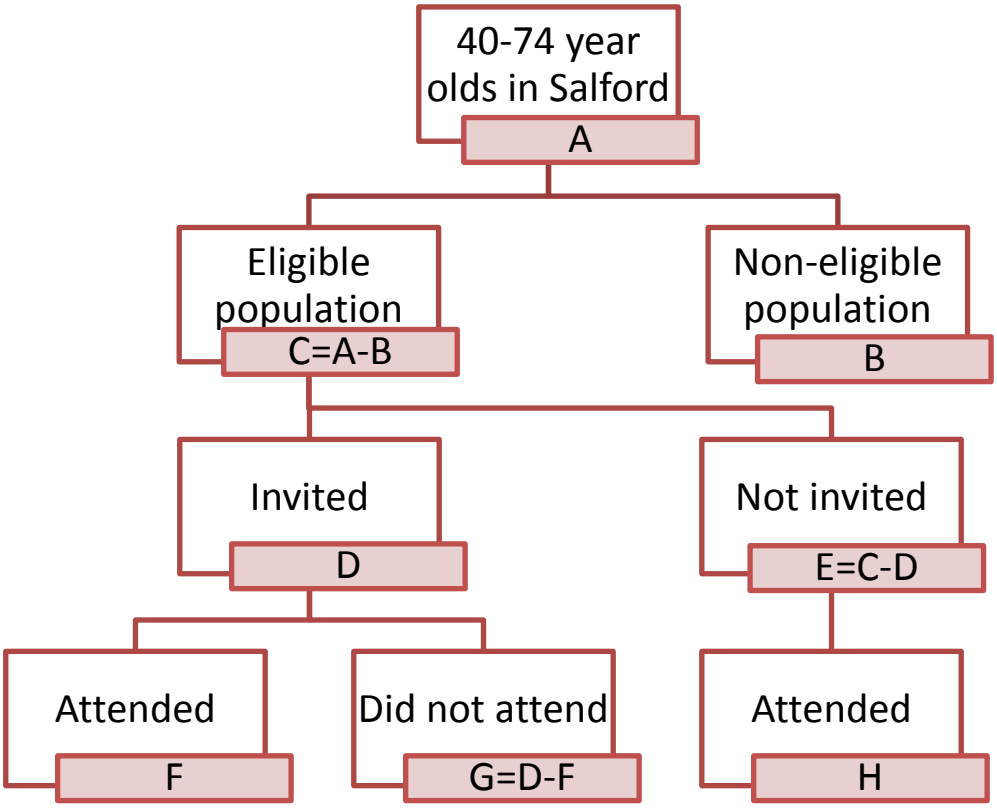

Figure 3.1 Diagram illustrating the identification of the eligible population; attenders and non-attenders for a health check

From Figure 3.1 above, we were able to calculate the **overall uptake rates,** the **invited uptake rates**, and the **attendance rates**, in order for better interpretation of results within this section, as follows:

- **Overall uptake rate**[11] = number of health checks carried out (F+H) / number of people invited for a health check (D)
- **Invited uptake rate** = number of health checks carried out if invited (F) / number of people invited for a health check (D)
- **Attendance rate** = number of health checks carried out (F+H) / number of eligible people (C)

[11] This definition is used for quarterly uptake data that is uploaded to the NHS Health Check website

3.2.2 Overall uptake rate

From the 40 practices in this analysis, 57,486 patients were identified as eligible in 2013-2014; of these, 13.7% (n=7850) were sent invitations to attend an NHS Health Check (Table 3.1). Overall uptake for a health check was 50.1% (n=3933), with attendance at 6.8%. The projected attendance rate by the Government for the NHS Health Check is 18% (Artac et al., 2013). Table 3.1 gives uptake rates (overall and invited) and attendance rates for each year since the NHS Health Check was introduced in Salford (April 2011).

Year	40-74 year olds	Non-eligible	Eligible	Invited	Attended (all)	Did not attend	Overall uptake rate	Invited uptake rate	Attendance rate
2011-2012	88,909	32,820	56,089	4389	2673	2800	60.9%	36.2%	4.8%
2012-2013	90,892	34,002	56,890	4920	3709	3208	75.4%	34.8%	6.5%
2013-2014	92,660	35,174	57,486	7850	3933	5821	50.1%	25.8%	6.8%
2014-2015[12]	94,292	36,095	58,197	4436	2548	-	57.4%	-	4.4%[13]

Table 3.1 Uptake and attendance rates by year (adapted from Cooper & Dugdill, 2014)

Overall uptake rates increased from 2011-2012 to 2012-2013; however, uptake rates (both overall and invited) decreased in the first year (2013-2014) that Local Authorities were responsible for delivering the NHS Health Check. Nevertheless, attendance rates have continued to increase since 2011[14], and data from the first two quarters of 2014-2015 indicates that uptake rates will continue to increase alongside attendance rates.

Trends in quarterly uptake rates were explored but not reported here; however, there were no clear trends in overall and invited uptake rates, or attendance rates. It is anticipated that this is because general practices vary in their procedures for inviting and recalling patients.

3.2.3 Uptake by patient demographics

Overall uptake of the NHS Health Check was higher in females (n=2058, 53%) compared to males (n=1875, 47%) in 2013-2014. This finding was consistent across previous years (2011-2012 and 2012-2013), with 63% of females and 52% of males attending for health

[12] 2014-2015 data were only available for Quarter 1 and Quarter 2 at time of analysis
[13] Data only available for two quarters
[14] Attendance rates for 2014-2015 are likely to exceed those from the previous years if uptake rates remain consistent with the first two quarters

checks so far in 2014-2015. Uptake significantly increased with increasing age group in 2013-2014 (Figure 3.2), ranging from 40% for those aged 40-44 , up to 66% for those aged 65-74, ($p<0.001$).

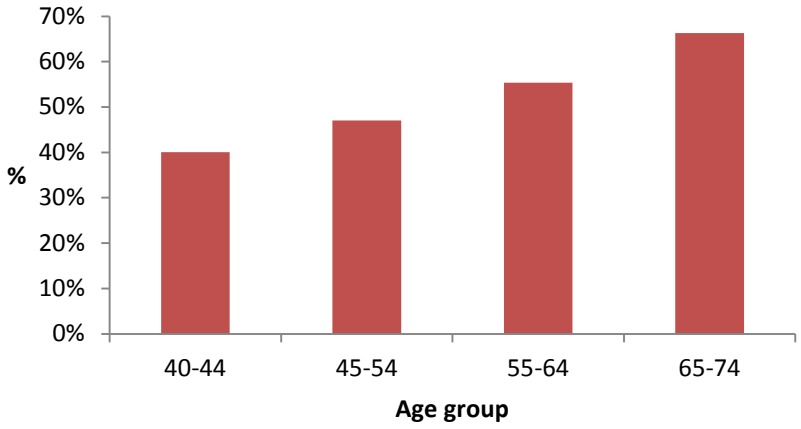

Figure 3.2 Uptake rate (%) by age group

3.2.4 Uptake by practice and area (cluster)

Uptake of the NHS Health Check varied greatly by practice; overall uptake ranged from 6% to 1030%[15], in 2013-2014. These inflated uptake rates highlight those practices that code for health checks, but do not necessarily assign a Read code to an invitation, therefore 'uptake rates' end up being significantly higher than coded invites. Invited uptake rates also varied by practice, from 3% up to 85% in 2013-2014 (Figure 3.3)[16].

[15] This practice had 103 people who attended for a health check in 2013-2014, but had only coded 10 invitations in the same year

[16] Three of the 40 practices offering health checks did not provide sufficient data on invitations sent out in 2013-2014 for an invited uptake rate to be calculated.

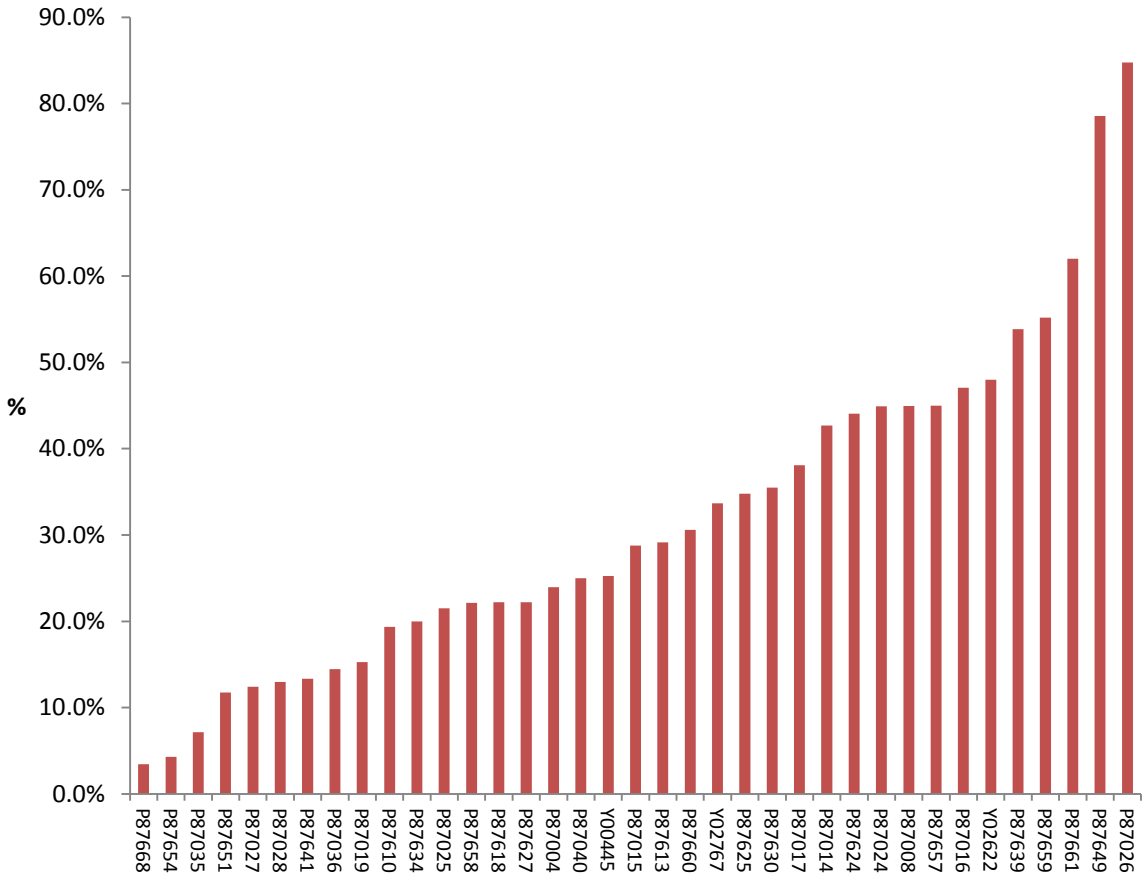

Figure 3.3 Invited uptake rate (%) by practice

FARSITE was not able to provide any individual deprivation data for patients; therefore uptake rates are provided to examine uptake of NHS Health Checks within the different areas (clusters) of Salford. Table 3.2 shows the overall and invited uptake rates alongside attendance rates for each cluster in Salford, across all three years of health checks. Although some clusters had high uptake rates (overall and invited), their attendance rates were much lower in comparison.

Cluster	Overall uptake rate (%)			Invited uptake rate (%)			Attendance rate (%)		
	2011/12	2012/13	2013/14	2011/12	2012/13	2013/14	2011/12	2012/13	2013/14
Broughton, Lower Kersal & Irwell Riverside	67.3	182.3[17]	43.9	35.8	24.6	11.4	4.6	14.0	10.8
Claremont, Weaste & Seedley	121.9	106.1	42.2	32.6	34.8	29.2	7.6	7.4	6.2
Eccles, Barton & Winton	51.8	60.4	45.9	43.5	47.2	34.0	2.7	4.4	5.6
Irlam & Cadishead	58.8	106.5	67.0	40.2	50.4	36.3	5.1	8.8	13.0
Little Hulton	128.8	75.7	45.6	38.5	41.6	39.8	3.5	7.4	6.3
Ordsall & Langworthy	64.6	81.6	43.4	33.2	31.8	16.7	4.0	5.0	8.5
Swinton & Pendlebury	35.2	25.3	46.4	24.3	16.9	27.3	3.5	2.8	4.4
Walkden, Boothstown, Ellenbrook & Worsley	73.3	78.3	63.4	46.5	46.2	34.1	8.7	10.1	8.9

Table 3.2 Uptake and attendance rates (%) by cluster

In Swinton and Pendlebury, over a quarter of those invited, attended for a health check in 2013-2014 (invited uptake rate of 27.3%); the overall uptake rate was 46.4%, but their attendance rate was the lowest (4.4%) for all clusters, indicating that a low number of invitations were sent out in this area. Conversely, practices in Broughton, Lower Kersal and Irwell Riverside had a low invited uptake rate (11.4%) in 2013-2014, and a much higher overall uptake rate (43.9%); this suggests that some of the practices in this area carried out opportunistic health checks or did not code invitations. The attendance rate in this area was high at 10.8%. There were no obvious trends within the overall uptake rates between the clusters; seven out of the eight clusters had a drop in invited uptake rates between 2012-2013 and 2013-2014 as was seen in the total yearly data (section 3.2.2). Only three of the clusters saw a **year-on-year** increase in attendance rates, as per the yearly data.

3.2.5 Health checks 'declined' or 'failed to respond'

Since the implementation of the NHS Health Check in Salford, the 'failed to respond' Read code has been used 1278 times (from 29 practices; 909 of these from just three practices),

[17] Some of the overall uptake rates are over 100%; this is explained by a large number of opportunistic health checks being carried out in these areas, or that some of the practices in these areas are not coding invitations. This results in a larger numerator (number of health checks carried out) than denominator (number invited for a health check).

equating to 6% of all invitations. This is significantly less than the percentage of people who do not attend for a health check if invited (68% across the three years).

The 'NHS Health Check declined' code has been used 351 times (from 26 practices) since April 2011; however, the majority of these (n=216) were within 2013-2014.

The use of these Read codes varies greatly between practices, and it is dependent on each practice on how these codes are applied. The NHS Health Check is a continuous programme, and therefore some practices may refrain from using the 'failed to respond' code, as patients will most likely be re-invited in subsequent years. Other practices may apply in-house 'ruling' to this Read code; for example, if the patient does not reply within a given number of weeks.

3.2.6 Did not attend

A Read code is also available for those patients who agree to attend for an NHS Health Check but do not attend. The use of this code also varies greatly between practices. There have only been 380 uses of this Read code (across 26 practices) since April 2011.

3.2.7 Question 1: Summary

There are 47 general practices in Salford (leading to 57,487 eligible people in 2013-2014). Of these 47, seven practices did not actively invite patients to the NHS Health Check, although opportunistic health checks were available (e.g. through the Salford Health Bus). FARSITE data relies on Read codes; however, it is important to highlight that FARSITE is only able to provide aggregate data. For example, when someone has been invited for a health check in one year (e.g. 2012-2013) but attends for a health check in the following year period (2013-2014), this cannot be captured in the data analysis (i.e. they would show as attended, but not as invited in the 2013-2014 period). Further to this, it is important to note that the use of Read codes varies between practices.

The eligible population was calculated from FARSITE by subtracting the non-eligible population from all 40-74 year olds in Salford. However, analysis showed that there were a number of patients who attended for a health check who were not recorded as invited. This group have been included in both the overall uptake rates and the attendance figures.

Overall uptake rates increased between 2011 and 2013, although there was a decrease in 2013-2014 (uptake 75.4% 2012-2013; 50.1% 2013-2014). Nevertheless, attendance rates have continued to increase from 4.8% (2011-2012), to 6.8% (2013-2014) and data from 2014-2015 indicates that uptake rates will continue to increase alongside attendance rates.

Consistently there was higher uptake for females compared to males, and uptake significantly increased with increasing age groups (e.g. in 2013-2014 66% of those aged 65-74 attended). We were unable to generate meaningful data in respect to ethnicity, as it is unclear as to what Read codes are used to retrieve ethnicity within FARSITE, and also potentially because these data were not recorded at the health check in the year that each search was run. Uptake of the NHS Health Check varied greatly by practice and in some cases uptake rates were significantly higher than coded invites, indicating that invites had not been correctly coded or opportunistic checks were provided. Invited uptake rates also varied by practice form 3% to 85% in 2013-2014.

3.3 Question 2: How many of these are at high risk of cardiovascular disease?

3.3.1 Cardiovascular risk calculators

The different types of risk calculators used to predict a person's risk of developing heart disease within the next 10 years were described in section 1.1.3. Within Salford, there is no standard procedure of which risk calculator to use in an NHS Health Check. Of all health checks completed between 2011 and 2014, the most commonly used risk calculator was the JBS2 (75.4%), followed by the Framingham algorithm (10.8%), QRISK2 (8.2%) and the original QRISK (5.5%). The use of the calculators was not consistent within practices, with the majority (31/40) of practices having used all four risk calculators during the three years since health checks began in Salford (2011-2014).

3.3.2 Cardiovascular risk profile

Between 2011 and 2014, 10,315 people had attended for an NHS Health Check in Salford; of these 8822 (85.5%) had a corresponding 10-year CVD risk score, calculated from the four different risk calculators. The risk profile of these attenders can be seen in Table 3.3; the risk score is the most recent risk score available within the time period of the search, from any of the four CVD risk calculators.

CVD Risk Score	Year			All years	Gender[18]	
	2011-2012	2012-2013	2013-2014	2011-2014	Male	Female
<10%	49.9%	50.1%	56.7%	52.3%	38.8%	67.0%
10-20%	33.1%	34.0%	30.8%	32.6%	38.3%	26.5%
20-30%	12.3%	12.8%	9.5%	11.5%	17.2%	5.3%
>30%	4.7%	3.1%	3.0%	3.5%	5.7%	1.2%

Table 3.3 Cardiovascular risk profile in those who attended an NHS Health Check

Across the three years, 15.0% of those who attended for an NHS Health Check were considered to have a high CVD risk (≥20%) over the next 10 years. Males were significantly more likely to have a high CVD risk score compared to females (22.9% vs. 6.5%) (p<0.001). The prevalence of a high CVD risk score (between 2011-2014), ranged from 2.9% in those aged 40-44, up to 44.6% in those aged 75-84 (Figure 3.4).

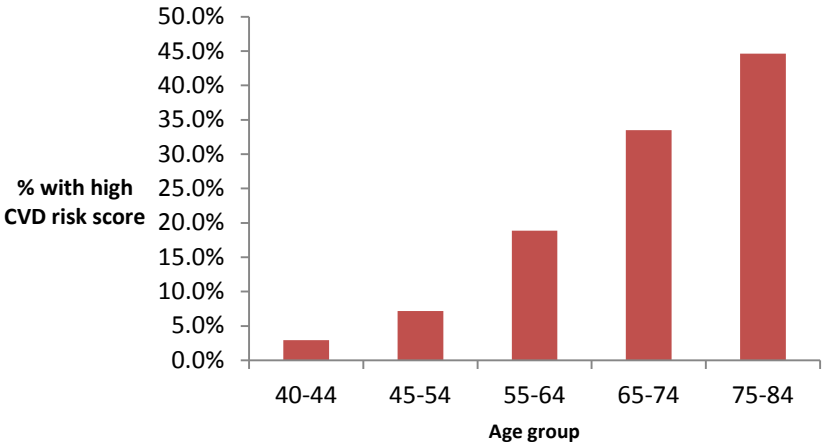

Figure 3.4 High CVD risk (≥20%) by age group (2011-2014)

Out of the 11,829 people that did not attend for a health check, between 2011 and 2014, 707 of these had a CVD risk score recorded. Those that were invited for an NHS Health Check but did not attend were more likely (20.7% vs. 15.0%) to have a high CVD risk score (≥20%), compared to those that did attend for a health check (p<0.001) (data not shown here).

3.3.3 Question 2: Summary

Risk of CVD is estimated using risk calculators; however, within Salford there is no standard procedure for which risk calculator is used, although the majority of general practices use the

[18] Total from 2011-2014

JBS2 (75.4%). Within some practices there is evidence of all four risk calculators being used. Between 2011 and 2014, 10,315 people attended for an NHS Health Check in Salford; of these 8822 (85.5%) had a corresponding 10 year CVD risk score. Of these 8822, 15% were considered to have high CVD risk over the next 10 years. Males were significantly more likely to have a high CVD risk score than females (22.9% vs. 6.9%) and risk increased with age. For those people who did not attend for a health check between 2011 and 2014 (n=11,829), 707 had a recorded CVD risk score; their risk of having a high CVD risk score was significantly higher than those who had attended a health check.

3.4 Question 3: Are there differences in outcomes for screened and non-screened individuals?

Differences in outcomes were analysed for clinical diagnoses, assessments and CVD risk factors, between those who attended and did not attend for a health check in 2013-2014 (unless otherwise stated). Data in each section below are presented as the number and percentage of various outcomes, comparing between those who did attend (n=3933) and those who did not attend (n=5821) in 2013-2014. The odds ratio shows how much more or less likely those who attended for a health check were of having the outcome (e.g. diagnosis or assessment) compared to those who did not attend.

3.4.1 Diagnoses

Data were available on the number of patients diagnosed with type 2 diabetes, CKD, hypertension, hypercholesterolemia, non-diabetic hyperglycaemia and ischaemic heart disease (IHD); national Read codes were used for type 2 diabetes, CKD, hypertension, and non-diabetic hyperglycaemia. The most commonly used Read codes that encompassed hypercholesterolemia and IHD in Salford were used for these two conditions (see Supplementary material).

Diagnosis	Number diagnosed (n, %)		Odds ratio of being diagnosed if attended
	Attended	Did not attend	
Type 2 diabetes mellitus	43 (1.1%)	26 (0.5%)	2.46
Chronic kidney disease	-	-	-
Hypertension	111 (2.8%)	62 (1.1%)	2.70
Hypercholesterolemia	77 (2.0%)	27 (0.5%)	4.29
Non-diabetic hyperglycaemia	16 (0.4%)	9 (0.2%)	2.64
Ischaemic heart disease[19]	9 (0.2%)	12 (0.2%)	1.11

Table 3.4 Numbers and percentages of diagnoses in persons who did or did not attend an NHS Health Check (2013-2014)

For all conditions in 2013-2014, those who attended for an NHS Health Check were more likely to be diagnosed, compared to those who were invited and did not attend (Table 3.4). It is not possible to distinguish from these data whether diagnoses occurred after a health check. The odds for IHD (1.11) were not significant, and are hard to assess due to the small numbers; however, IHD is more likely to present acutely and therefore picked up outside of a health check. In 2013-2014, there were fewer than five cases of CKD; however, from 2011-2014 the odds of being diagnosed with CKD in those who attended for a health check was 2.4 times than compared to those who did not attend (data not shown here).

3.4.2 Assessments

National Read codes were available for further assessments for: diabetes, serum creatinine (kidney function test), hypertension, fasting cholesterol, and impaired fasting glycaemia/impaired glucose tolerance (test for risk of developing type 2 diabetes). With the exception of serum creatinine, the use of Read codes for the other assessments was rare; therefore, results for assessments are presented across the three years, 2011-2014 (Table 3.5)

[19] Including myocardial infarction, angina and CHD

Assessment	Number assessed (n, %)		Odds ratio of being assessed if attended
	Attended	Did not attend	
Diabetes	-	-	-
Serum creatinine	7343 (71.2%)	3810 (32.2%)	5.20
Hypertension	21 (0.2%)	18 (0.2%)	1.34
Fasting cholesterol	28 (0.3%)	130 (1.1%)	0.24
Impaired fasting glycaemia/ impaired glucose tolerance	-	-	-

Table 3.5 Numbers and percentages of persons receiving further assessments in persons who did or did not attend an NHS Health Check (2011-2014)

The percentage of people assessed for serum creatinine between 2011 and 2014, increased from 63.5% in 2011-2012, to 71.6% in 2012-2013 and to 76.0% in 2013-2014. The numbers for the other assessments were too small to perform any trend analysis.

The Read codes for diabetes and impaired fasting glycaemia/impaired glucose tolerance assessments were used fewer than five times each year, and therefore no meaningful analyses could be completed for these two assessments; these assessments may only be carried out on those patients identified as high risk as detailed in best practice guidance (DH, 2013b). Serum creatinine assessment was prevalent in both those who attended and in those who did not attend for an NHS Health Check. Over 70% of those who attended for a health check (2011-2013) were also assessed for their serum creatinine; attenders were five times more likely to be assessed for serum creatinine compared to those who did not attend. Those who attended for a health check were also more likely to be assessed for hypertension, although this was not significant. Conversely, those who attended for a health check were significantly less likely to be assessed for fasting cholesterol, compared to those who did not attend.

3.4.3 Cardiovascular risk factor differences

The differences in risk factors between those patients who attended for an NHS Health Check and those who were invited, but did not attend were analysed using data from 2013-2014. Since individual raw data are not available in FARSITE, comparison tests (on the means) of continuous variables could not be performed; therefore, each risk factor was dichotomised into 'healthy' vs. 'non-healthy', based on relevant normal boundaries (see footnotes below Table 3.6). Results are presented as number (percentage); Chi-squared tests were performed for all categorical variables.

People who attended for an NHS Health Check in 2013-2014 were more likely to have more favourable risk factor recordings, i.e. healthier, compared to those who did not attend (with the exception of total cholesterol and systolic blood pressure) (Table 3.6).

People who attended for a health check had significantly lower diastolic blood pressure readings, BMI, waist circumference and AUDIT (alcohol use) scores compared to those who did not attend for a health check. Those people who attended for an NHS Health Check were more likely to be categorised as active (58.5% vs. 41.5%) and be a non-smoker (76.3% vs. 59.8%), compared to those people who were invited but did not attend.

Risk factor variable	Attended n (%)	Did not attend n (%)	p-value
Systolic blood pressure (<140 vs. ≥140 mm Hg)[20]	3332 (65.2)	2001 (72.6)+	<0.001
Diastolic blood pressure (<90 vs. ≥90 mm Hg)	3545 (91.5)+	2101 (89.1)	0.002
Total cholesterol (≤5 vs. >5 mmol/l)	1658 (42.5)	634 (48.0)+	0.001
Total cholesterol:HDL cholesterol ratio (<4 vs. ≥4 mmol/l)	1939 (61.3)	738 (61.5)	0.886
BMI (18.5-24.9 vs. ≥ 25 kg/m^2)[21]	1253 (33.2)+	490 (28.2)	0.001
Waist circumference ('normal' vs. 'raised')[22]	145 (60.0)+	6 (26.1)	0.002
Physical activity (active vs. inactive)[23]	1063 (58.5)+	124 (41.5)	<0.001
Smoking status (non-smokers vs. current smokers)	2977 (76.3)+	1541 (59.8)	<0.001
Alcohol use (non-hazardous vs. hazardous)[24]	190 (82.3)+	19 (65.5)	0.032

+ indicates a 'healthier' result

Table 3.6 CVD risk factor differences (2013-2014)

[20] http://www.nhs.uk/conditions/nhs-health-check/Pages/Understanding-your-NHS-Health-Check-results.aspx, was used to define boundaries for 'normal' blood pressure and cholesterol levels
[21] Based on WHO classification
[22] Waist circumference is a proxy measure for abdominal obesity, which is linked to an increased risk of type 2 diabetes, CVD and mortality. Cut-points of 'raised' waist circumference to define abdominal obesity are defined as, >88cm in women and >102cm in men (Grundy et al., 2005).
[23] The GPPAQ is categorised as active, moderately active, moderately inactive and inactive
[24] AUDIT scores of ≥8 are recommended as indicators of hazardous alcohol use (Babor, Higgins-biddle, Saunders, & Monteiro, 2001).

3.4.4 Question 3: Summary

Looking at differences in diagnoses between those who attended and did not attend a health check, data were available on the number of patients diagnosed with diabetes, CKD, hypertension, hypercholesterolemia, non-diabetic hyperglycaemia and IHD. For all conditions in 2013-2014, those who attended for an NHS Health Check were more likely to be diagnosed than those who were invited but did not attend. However, it is not possible to know if this diagnosis was as a result of a health check.

The use of Read codes for assessments (diabetes, hypertension, fasting cholesterol, and impaired fasting glycaemia/impaired glucose tolerance) for those who attended and did not attend a health check was sparse with the exception of assessment for serum creatinine (kidney function test). Those who attended for a health check were five times more likely to be assessed for serum creatinine than those who did not attend between 2011-2014. Meaningful analyses on the other assessments could not be completed due to the small numbers coded between 2011-2014.

People who attended for an NHS Health Check in 2013-2014 were more likely to have significantly lower (i.e. healthier) risk factor recordings for diastolic blood pressure readings, BMI, waist circumference and AUDIT scores compared to those who did not attend for a health check. In addition, they were more likely to be categorised as being active and non-smokers.

3.5 Question 4: What are the impacts on prescribing?

3.5.1 Prescription analysis

Prescription data were only available for statins; the Read codes used for statins were the same six Read codes found in the national list of exclusion codes (see Supplementary material).

The number of people prescribed statins has increased steadily since 2008, from 18,022 in 2008-2009 to 22,304 in 2013-2014 (Figure 3.5). There was no notable increase in the number of people prescribed statins since the implementation of the NHS Health Check in Salford (2011).

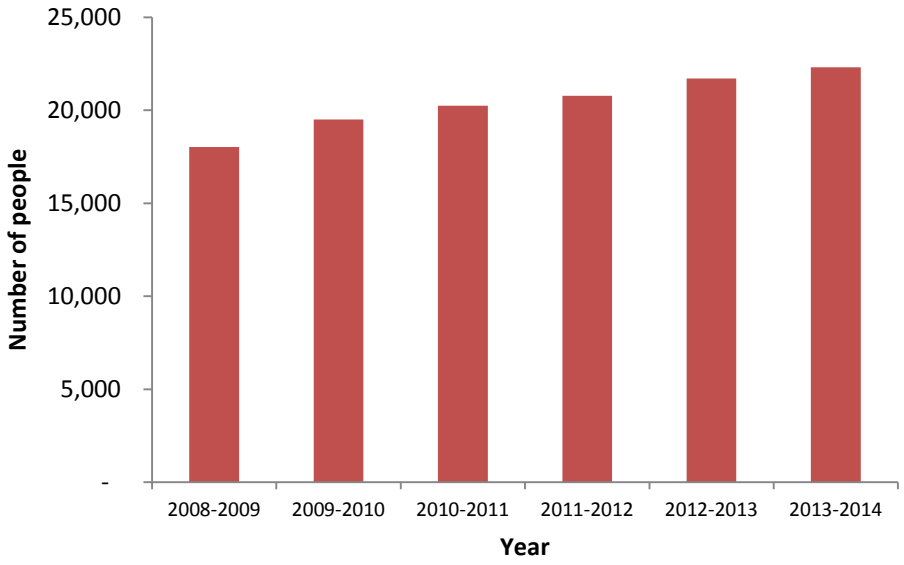

Figure 3.5 Number of people prescribed statins (2008-2014)

Figure 3.6 shows the number of people prescribed statins for the three years since 2011, as a percentage of all those aged 40-74 years old (purple line), those who attended an NHS Health Check (red line) and those who were invited but did not attend a health check (green line). The percentage of all 40-74 year olds prescribed statins increased slightly from 23% to 24%, from 2011-2012 to 2013-2014 (purple line).

The percentage of those who attended for a health check that were prescribed statins decreased between 2012-2013 and 2013-2014 (14% to 11%) (red line); this pattern was similar in those who were invited but did not attend for health check (14% to 12%) (green line). People who attended and did not attend for an NHS Health Check were all from the eligible population (i.e. not on a disease register). The decrease in the percentage of people prescribed statins in the eligible population compared to the increase in people prescribed statins in the 40-74 year age group is most likely explained by a high number of statins prescriptions in those who were not eligible to be invited for a health check (i.e. already diagnosed with or at increased risk of CVD) (however, data for statins prescription in the non-eligible population were not available).

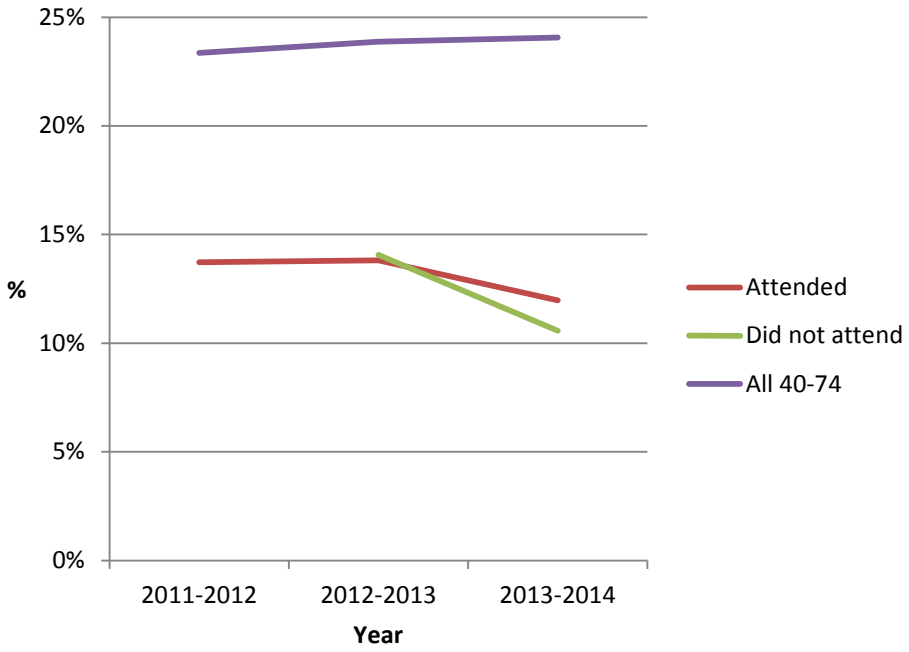

Figure 3.6 Percentage of people prescribed Statins (2011-2014)

3.5.2 Question 4: Summary

When considering the impact of health checks on prescribing, Read codes for prescription data were only available for statins. The number of people prescribed statins has increased steadily since 2008 with no noticeable change/increase since the implementation of the NHS Health Check in 2011 (from 2011-2012 to 2013-2014 there was only an increase of 1% from 23% to 24%). Looking at those who attended for an NHS Health Check (and those who were invited but did not attend), the percentage of people being prescribed statins decreased between 2012-2013 and 2013-2014. The overall trend of a slight increase in prescribing is likely to be explained by the large number of people who were not eligible for a health check, because they were already identified as having an increased risk of CVD.

3.6 Question 5: Is there information available on onward referral to other lifestyle services?

Data for advice and referrals were sparse (with the exception of smoking cessation) for those attending and not attending an NHS Health Check. Data for advice and referrals are presented as the number advised/referred (for those who attended and did not attend a health check) and the odds ratio, comparing those who attended to those who did not attend. Data is presented for the year 2013-2014.

3.6.1 Advice

Advice	Number advised (n, %)		Odds ratio of being advised if attended
	Attended	DNA	
General lifestyle	125 (3.2)	9 (0.2)	21.20
Smoking cessation	1139 (29.0)	1040 (17.9)	1.87
Weight management	59 (1.5)	-	-
Alcohol	349 (8.9)	61 (1.1)	9.19

Table 3.7 Lifestyle advice (2013-2014)

Those who attended a health check were more likely to be given lifestyle advice, compared to those who did not attend, but were invited for a health check (Table 3.7). Advice regarding smoking cessation was the most common lifestyle advice given; given to 29% of those who attended for an NHS Health Check. Only 1.5% (n=59) of those who attended for a health check in 2013-2014 (n=3933) were given a Read code for weight management advice; however, over 60% of those who attended for a health check in 2013-2014 were overweight (BMI ≥25) (data not shown here).

3.6.2 Referrals

Data on referrals were only available for referral to smoking cessation services in 2013-2014, with only 24 people in total (for both those who did and did not attend for a health check) allocated with a Read code for this referral service (Table 3.8). People who attended for an NHS Health Check were four times more likely to be referred to a smoking cessation service compared to those who did not attend a health check; although significant, this finding is based on only 24 referrals in 2013-2014. There were fewer than five people given codes for the other referral services (physical activity programme, weight management, drug and alcohol teams) for those who attended and did not attend for a health check in 2013-2014. Numbers for these referrals services were sparse across all three years (2011-2014). It is not known whether this is a coding issue (people may have been referred to these services and not coded on the general practice database), or whether some practices offered 'in-house' services, such as smoking cessation, or whether patients were given the relevant information to self-refer to services.

Referrals	Number referred (n, %)		Odds ratio of being referred if attended
	Attended	DNA	
Physical activity programme	-	-	-
Stop-smoking clinic/service/cessation advisor	18 (0.5)	6 (0.1)	4.46
Weight management programme	-	-	-
Alcohol team/drug and alcohol team	-	-	-

Table 3.8 Referrals (2013-2014)

3.6.3 Question 5: Summary

Data for advice and referrals to other lifestyle services were sparse with the exception of smoking cessation. Those who attended a health check were more likely to be given lifestyle advice (most commonly smoking cessation advice) compared to those who did not attend but were invited for a health check. Only 1.5% of those who attended for a health check in 2013-2014 were coded as being given weight management advice, although over 60% of those who attended a health check in the same year were overweight. Referral data were only available for smoking cessation services; people who attended for a health check were four times more likely to be referred to a smoking cessation service compared to those who did not attend. Out of those who attended a health check in 2013-2014, 24% were coded as being a smoker, however only 0.5% were referred to smoking cessation services.

3.7 Question 6: How complete is the information in terms of risk factors for CVD being recorded on the system and coding of health checks?

3.7.1 Completeness of data

Completeness of data for each variable required to be collected at an NHS Health Check is reported as a percentage out of all those who attended for an NHS Health Check in 2013-2014 (n=3933); however, it is not possible to know if the information was collected on the day of a health check due to the limitations of obtaining only aggregate data in FARSITE (see section 3.1.1).

All 3933 patients that attended for an NHS Health Check in 2013-2014 had data available for age and gender, as these data are already contained within FARSITE for all those registered with a GP in Salford (i.e. no Read code for age and gender are necessary within FARSITE searches). For ethnicity data, FARSITE has an option within its demographic box to break down results by different ethnicities; however, numbers for the ethnicity groups provided by

FARSITE were lower than when calculated using national Read codes for a NHS Health Check. Ethnicity was recorded for 1949 (50.0%) of those who attended for a health check in 2013-2014; 90.7% of these were white[25]. Within this question, ethnicity data were obtained using the national Read codes for the NHS Health Check allocated to ethnicity classifications (see Supplementary material). Differences in outcomes obtained from FARSITE codes and national Read codes may have occurred for two reasons: the Read codes for ethnicity used within FARSITE are not known, and they may not be as extensive as the national Read codes used for NHS Health Checks; ethnicity may already have been recorded in the system previously and not 'updated' on the date of the NHS Health Check. However, best practice guidance states that all elements required for a health check should be recorded at the time of the health check (PHE, 2013b), although a risk score can be calculated without all elements being included.

3.7.2 Completeness for cardiovascular risk factors

The completeness of recording for CVD risk factors for those people who attended an NHS Health Check in 2013-2014 are shown in Table 3.9. Over 90% of patients had a recording of blood pressure, BMI and smoking status; only 33.3% had had their waist circumference measured[26]. There were 87.6% of people who attended for a health check in 2013-2014 who had a cholesterol reading (either total, HDL or total:HDL ratio). Just over 45% of patients who attended for a health check had undertaken the physical activity questionnaire, and 31.1% had been asked questions about their alcohol use.[27] A recording of whether someone did or didn't have family history of CVD was available for 35.4% of health check attenders in 2013-2014; knowledge of family history of CVD is not required for the JBS2 CVD risk calculator.

Although best guidance recommends that all risk factors should be recorded at a health check, the results from Table 3.9 suggest that it is the risk factors required to calculate a 10-year CVD risk score that have high completeness rates.

[25] This is comparable to the percentage of white people recorded in the 2011 Census in Salford (90.1%).
[26] Waist circumference is an additional proxy measure for adiposity; NICE recommend that it may be used *alongside* BMI to assess risk of CVD and diabetes in those with a BMI<35kg/m^2 (NICE, 2006).
[27] This data includes patients who only completed the AUDIT questionnaire; a shortened version of this questionnaire (AUDIT-C), and another alcohol use questionnaire (FAST) have also been recommended for use in a health check (data not available here).

Risk factor variable	Completeness (n,%) (in those who attended, n=3933)
Blood pressure reading	3823 (97.2)
Cholesterol (either total, HDL or ratio)	3446 (87.6)
Family History of CVD	1393 (35.4)
BMI	3656 (93.0)
Waist circumference	1310 (33.3)
Physical activity	1783 (45.3)
Smoking status	3717 (94.5)
Alcohol use	1222 (31.1)

Table 3.9 Completeness of each CVD risk factors (2013-2014)

3.7.3 Complete CVD risk factor profile of an NHS Health Check in Salford

A complete CVD risk factor profile was defined for those patients who had information recorded for age, gender, systolic and diastolic blood pressure, total and HDL cholesterol and smoking status. These factors are the minimum requirements within all four CVD risk calculators[28] used in Salford and are also the basis for calculating a risk score within the JBS2 (the most commonly used risk calculator within Salford).

Out of the 3933 people that attended for an NHS Health Check in 2013-2014, 3518 (89.5%) had a complete CVD risk factor profile as outlined above; 72.8% (n=2561) of these had a corresponding 10-year CVD risk score recorded in the same year. Therefore, overall 65.1% (2561/3933) of people who attended an NHS Health Check in 2013-2014 had a recording of a CVD risk score.

3.7.4 Question 6: Summary

On the whole, recording of CVD risk factors was high for those attending a health check in 2013-2014; over 85% of people had a recording for blood pressure, cholesterol, BMI and smoking status. However, recording for waist circumference, GPPAQ and AUDIT was significantly lower. It should be noted that, through the FARSITE system, it is not possible to know if the risk factors were recorded as part of a health check or at a later date within 2013-2014.

In order to generate a 10-year CVD risk score, a number of elements of 'risk' need to be calculated. Whilst it is best practice to have all of the CVD risk factors recorded, including for example, ethnicity and waist circumference, it is possible to calculate a risk score using a

[28] The QRISK calculators also consider ethnicity, deprivation, BMI and co-morbidities.

number of key variables (age, gender, systolic and diastolic blood pressure, total and HDL cholesterol and smoking status). In this respect, sufficient data to calculate a 10-year CVD risk factor score were available for 89.5% (n=3518) of those who attended for a health check in 2013-2014; however, only 73% (n=2561) of these had a corresponding CVD risk score recorded on FARSITE. This equates to 65.1% (n=2561) of the total number of people who attended for a health check in 2013-2014 (n=3933).

4 Summary, recommendations and conclusions

4.1 Extraction of FARSITE data, limitations and assumptions:

4.1.1 Limitations

Whilst extracting data from FARSITE the following limitations were noted and need to be considered when interpreting results:

- FARSITE is only able to provide aggregate data over a search period. This means that where someone was invited for a health check in one year (e.g. 2012-2013) but attended for a health check in the following year (2013-2014), this cannot be captured in the data analysis (i.e. they would show as attended, but not as invited in the 2013-14 period).
- There are a variety of Read codes that could potentially be utilised for diagnoses, clinical symptoms, measurements, prescribed medication, tests, administrative data, and procedures.
- Inputting of Read codes within general practices for health checks appears to be inconsistent.
- Age, gender and ethnicity are integrated within the FARSITE system, so run as standard on searches. However, during analysis for Question 6, it was discovered that caution should be employed when using the inbuilt ethnicity filter in FARSITE and national Read codes should be used were possible (see section 3.7.1 for more details).
- When limiting the analysis to age range, FARSITE uses the age of a person on the date the search is carried out. Therefore, searches for years prior to 2014 had to be adjusted; i.e. searches for April 2013 to March 2014 used an age range of 41-75 years as these people would have been 40-74 years in the year 2013-2014, and searches for April 2012 to March 2013 used the age range 42-76 years etc. (i.e. the age when the search was carried out). This limitation should be noted when interpreting results across different age bands.

4.1.2 Assumptions

The eligible population was calculated from FARSITE by subtracting the non-eligible population from all 40-74 year olds in Salford. However, analysis showed that there were a number of patients who attended for a health check who were not recorded as invited. This group have been included in the overall uptake rate and attendance figures.

4.1.3 Recommendations

- Explore why health check invites are not consistently coded.
- Agreement and consistency of Read codes to be used throughout the Salford practices.
- Consideration of software to assist with consistency of Read code use, such as BMJ Informatica, alongside a Read code booklet provided to each general practice.
- Consider regular 'top up' training on the use of FARSITE and Read codes (PHE, 2014c).

4.2 Question 1 Summary: Who takes up the health checks?

There are 47 general practices in Salford (leading to 57,487 people eligible in 2013-2014). Of these 47, seven practices did not actively invite patients to the NHS Health Check, although opportunistic health checks were available (e.g. through the Salford Health Bus).

Overall uptake rates increased between 2011 and 2013, although there was a decrease in 2013-2014 (uptake 75.4% 2012-2013; 50.1% 2013-2014). Nevertheless, attendance rates have continued to increase from 4.8% (2011-2012), to 6.8% (2013-2014) and data from 2014-2015 indicates that uptake rates will continue to increase alongside attendance rates.

Consistently there was higher uptake for females compared to males and uptake significantly increased with increasing age groups (e.g. in 2013-2014 66% of those aged 65-74 attended). We were unable to generate meaningful data in respect to ethnicity, because of the way ethnicity is retrieved within FARSITE and also potentially because these data were not recorded at the health check in the year that each search was run. Uptake of the NHS Health Check varied greatly by practice and in some cases uptake rates were significantly higher than coded invites, indicating that invites had not been correctly coded or that opportunistic checks were taken up. Invited uptake rates also varied by practice from 3% to 85% in 2013-2014.

4.2.1 Question 1: Discussion

Nationally, NHS Health Checks are projected to have an attendance rate of 18% (Artac et al., 2013); however, currently Salford is achieving 6.8%, having increased from 4.8% over the previous three years. In addition, attendance rates per practice differed (between 3% and 85% in 2013-14).

Looking at those who attended an NHS Health Check, the finding that more women than men are attending for health checks in Salford could suggest that men, who are more at risk

of CVD than women, are not currently being detected through the Health Check programme (BHF Health Promotion Research Group, 2012). Similarly, evaluations of health checks elsewhere in the country have also found that uptake rates are higher in women than in men (Dalton et al., 2011). Research Works Limited (2013) found that getting the 'right people' to attend was problematic; the findings from their report suggested that this was partly due to the fact that a general practice only gets paid for sending out an initial invitation, and not 'chaser' letters (Research Works Limited, 2013).

In Salford, the attendance rates of health checks by age group increased in line with the increase in CVD risk in these groups. Salford is becoming increasingly diverse in relation to ethnicity; however, of those who attended a health check only 50% of them had their ethnicity recorded in 2013-2014, limiting the ability to understand the ethnic profile of attenders and non-attenders. The literature indicates that, nationally, certain ethnic minority groups have higher CVD mortality rates, for example South Asians have a 40% higher CHD death rate compared to the general population (BHF, 2009). Thus, it is important that ethnicity is recorded correctly to allow greater exploration into the ethnic profile of those attending and not attending health checks within Salford.

4.2.2 Question 1: Recommendations

- Further research into understanding the motivation behind individuals in Salford choosing to attend or not attend a health check.
- Consider financial incentives relating to 'chaser' health check invitations.
- Explore Public Health England recommendations such as alternative locations to enable a health check to be more widely accessible (PHE, 2014c).
- Explore the reasons of high uptake rates in certain practices, and disseminate learning from good practice in order to target areas with low uptake rates.
- Explore ways to encourage more men to attend health checks, potentially by providing more opportunistic health checks e.g. through workplaces, sports events etc.
- Explore ways of encouraging general practices to code health check invitations.
- Ensure that data is collected consistently in respect of ethnicity.

4.3 Question 2 Summary: How many of these are at high risk of cardiovascular disease?

Risk of CVD is estimated using risk calculators; however, within Salford there is no standard procedure for which risk calculator is used, although the majority of general practices use the

JBS2 (75.4%). Within some practices there is evidence of all four risk calculators being used. Between 2011 and 2014, 10,315 people attended for an NHS Health Check in Salford; of these 8822 (85.5%) had a corresponding 10 year CVD risk score. Of these 8822, 15% were considered to have high CVD risk over the next 10 years. Males were significantly more likely to have a high CVD risk score than females (22.9% vs. 6.9%) and risk increased with age. For those people who did not attend for a health check between 2011 and 2014 (n=11,829), 707 had a recorded CVD risk score; their risk of having a high CVD risk score was significantly higher than those who had attended a health check.

4.3.1 Question 2: Discussion

Within this exploration of data, the risk of having a high CVD risk score was significantly higher in those who did not attend compared to those who attended a health check in 2013-2014. This reflects the findings in Question 1 where it appears the health check within Salford is not capturing the most 'at risk' populations. This may indicate that it is the 'worried well' who are more likely to attend a health check, and echoes the findings of the Research Works (2013) report, which found that while most GPs preferred to direct their resources towards the sick, *"both GPs and Commissioners acknowledged that NHS Health Checks attract 'the worried well'"* (Research Works Limited, 2013, p. 27). As a result it is imperative to ensure NHS Health Checks are targeted at, and taken up by, those people most in need of treatment/intervention, in order to ensure that health inequalities are improved rather than worsened (Capewell & Graham, 2010).

4.3.2 Question 2: Recommendations

- Consider standardisation of the CVD risk calculator to be used during health checks in Salford. As part of this, consider introducing the most recent update of the Joint British Societies CVD risk calculator, and implement training for those who deliver the health check (British Cardiac Society et al., 2014).
- Ensure a complete data set of CVD risk factors is collected during a health check.

4.4 Question 3 Summary: Are there differences in outcomes for screened and non-screened individuals?

Looking at differences in diagnoses between those who attended and did not attend a health check, data were available on the number of patients diagnosed with diabetes, CKD, hypertension, hypercholesterolemia, non-diabetic hyperglycaemia and IHD. For all conditions in 2013-2014, those who attended for an NHS Health Check were more likely to

be diagnosed than those who were invited but did not attend. However, it is not possible to know if this diagnosis was part of a health check.

The use of Read codes for assessments (diabetes, hypertension, fasting cholesterol, and impaired fasting glycaemia/impaired glucose tolerance) for those who attended and did not attend a health check was sparse with the exception of assessment for serum creatinine (kidney function test). Those who attended for a health check were five times more likely to be assessed for serum creatinine than those who did not attend between 2011-2014. Meaningful analyses on the other assessments could not be completed due to the small numbers coded between 2011-2014.

People who attended for an NHS Health Check in 2013-2014 were more likely to have significantly lower (i.e. healthier) risk factor recordings for diastolic blood pressure readings, BMI, waist circumference and AUDIT scores compared to those who did not attend for a health check. In addition, they were more likely to be categorised as being active and non-smokers.

4.4.1 Question 3: Discussion and recommendations

These findings reiterate those of Questions 1 and 2, however, further recommendations are:

- General practices should be encouraged to refer anyone who attends the practice with a raised CVD risk factor to have a full health check, if eligible.
- Further research into how to increase uptake within the potentially 'at-risk' population.

4.5 Question 4 Summary: What are the impacts on prescribing?

When considering the impact of health checks on prescribing, Read codes for prescription data were only available for statins. The number of people prescribed statins has increased steadily since 2008 with no noticeable change/increase since the implementation of the NHS Health Check in 2011 (from 2011-2012 to 2013-2014 there was only an increase of 1% from 23% to 24%). Looking at those who attended for an NHS Health Check (and those who were invited but did not attend), the percentage of people being prescribed statins decreased between 2012-2013 and 2013-2014. The overall trend of a slight increase in prescribing is likely to be explained because of the number of people who were not eligible for a health check, because they were already identified as having an increased risk of CVD.

4.5.1 Question 4: Discussion

No obvious impact on the prescribing of statins was seen as a result of the NHS Health Check in Salford. However, previous economic modelling of the NHS Health Check has suggested that prescribing statins is cost effective over the lifetime, and there is also a social gain in respect of QALYs[29] (see Appendix 1) (DH, 2008). The analysis in this report was limited, as data were only available for statins; other drugs for hypertension (e.g. ACE inhibitors) and diabetes may provide a different picture, and similarly as with statins have been shown to be cost effective over the lifetime (Appendix 1).

4.5.2 Question 4: Recommendations

- Improve ability to access individual data on prescriptions of relevant medications to allow for a thorough evaluation on the impacts on prescribing.

4.6 Question 5 Summary: Is there information available on onward referral to other lifestyle services?

Data for advice and referrals to other lifestyle services were sparse with the exception of smoking cessation. Those who attended a health check were more likely to be given lifestyle advice (most commonly smoking cessation advice) compared to those who did not attend but were invited for a health check. Only 1.5% of those who attended for a health check in 2013-2014 were coded as being given weight management advice, although over 60% of those who attended a health check in this year were overweight. Referral data were only available for smoking; people who attended for a health check were four times more likely to be referred to a smoking cessation service compared to those who did not attend. Out of those who attended a health check in 2013-2014, 24% were coded as being a smoker, however only 0.5% were referred to smoking cessation services.

4.6.1 Question 5: Discussion

The reasons for poor referral to lifestyle services are not known, and cannot be ascertained from FARSITE data. However, previous research (Research Works, 2013) has indicated that *"those GPs that have lifestyle services within their practice have been able to tie in NHS Health Checks smoothly into those services, enabling them to continue the dialogue and offer appropriate follow up pathways to at-risk patients"* (Research Works Limited, 2013, p. 26). However, they also found that for some GPs there is limited access to such services. It is not known how far any of the lifestyle recommendations from the NHS Health Checks influence patients to take up services aimed at risk reduction. Again, as above for

[29] QALY=quality-adjusted life year (measure of disease burden, in terms of quantity and quality of life)

prescribing, the economic modeling has shown cost effectiveness and QALY gains for lifestyle referral (see Appendix 1) (DH, 2008).

4.6.2 Question 5: Recommendations

- Consistent usage of referral Read codes in all health checks, with the potential to follow behaviour/behaviour change.
- Explore barriers and facilitators to lifestyle referral services for general practices (including for example communicating risk, training needs etc. (PHE, 2014a, 2014c).

4.7 Question 6 Summary: How complete is the information in terms of risk factors for CVD being recorded on the system and coding of health checks?

On the whole recording of CVD risk factors was high for those attending a health check in 2013-2014; over 85% of people had a recording for blood pressure, cholesterol, BMI and smoking status. However, recording for waist circumference, GPPAQ and AUDIT was significantly lower. It should be noted that through the FARSITE system, it is not possible to know if the risk factors were recorded as part of a health check or at a later date.

In order to generate a 10-year CVD risk score, a number of elements of 'risk' need to be calculated. Whilst it is best practice to have all of the CVD risk factors recorded, including for example, ethnicity and waist circumference, it is possible to calculate a risk score using a number of key variables (age, gender, systolic and diastolic blood pressure, total and HDL cholesterol and smoking status). In this respect, sufficient data to calculate a 10-year CVD risk factor score were available for 89.5% (n=3518) of those who attended for a health check in 2013-2014; however, only 73% (n=2561) of these has a corresponding CVD risk score recorded on FARSITE. This equates to 65.1% (n=2561) of the total number of people who attended for a health check in 2013-2014 (n=3933).

4.7.1 Question 6: Discussion

PHE (2014) sate that, *"An incomplete risk assessment may lead to an inaccurate calculation of their risk score and therefore have clinical implications and in turn, reputational implications for the programme"* (PHE, 2014c, p. 16). Therefore, the finding that almost 35% of those who attended a health check in 2013-2014 did not have a CVD risk score is of concern.

4.7.2 Question 6: Recommendations

- Following PHE recommendations, *"Staff delivering the NHS Health Check should be trained in communicating, capturing and recording the risk score and results, and*

understand the variables the risk calculators use to equate the risk" (PHE, 2014c, p. 20).

- Further research into methods to improve accurate and consistent inputting of data; for example, pay incentives; targets of completeness of data recording; setting standards to define the components of a complete dataset (PHE, 2014b).
- Continuous quality assessment of the health check programme in Salford.

4.8 Conclusions

This report has highlighted that the number of health checks carried out, as percentage of those invited is quite high. However, although attendance at NHS Health Checks has been increasing over the past three years in Salford, the attendance rate (from the eligible population) is still fairly low (6.8% in 2013-2014). In respect of the CVD risk factors, 'attenders' were found to be 'healthier' than 'non-attenders'; attenders also included a greater percentage of women than men, although the evidence shows that men are more at risk of CVD compared to women. This would indicate that the 'worried well' are more inclined to take up the opportunity to have a health check. In respect of prescribing data, the only available data for this analysis were in respect of statins, and while the trend is for a slight increase in the overall prescribing of statins, attending a health check does not seem to relate to this increase.

The available evidence for onward referral to lifestyle services was limited, and showed low levels of referral, e.g. 24 people were referred to smoking cessation services in 2013-2014, and 59 people were referred to weight management services, although over 2500 people were found to be overweight in the same year. This could potentially be the result of a lack of referral, or a lack of coding of referrals. The health checks were found to be sufficiently complete to calculate a CVD score for 65% of those who attended. While this is encouraging, recommendations have been made to encourage more consistent reporting or collecting of more of the risk factor variables needed to calculate a CVD risk score.

Recommendations have been made to ensure; consistent and greater use of Read codes; and the adoption of one CVD risk calculator across practices, to enable more in-depth analysis to be carried out in the future. In addition further research is recommended to explore: reasons for attendance/non-attendance, particularly in practices where uptake is high; the potential value of alternative locations for health checks (e.g. workplaces); barriers to attendance for at risk groups; and continuous quality assessment of the NHS Health Check programme in Salford.

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Appendix 1

Lifetime costs and QALYs for each intervention (DH, 2008)

Intervention	Age	Gender	Lifetime cost (£)	Lifetime QALYs
IGR lifestyle intervention	25-44	All	-398	0.63
	45-54	All	493	0.63
	55-64	All	1821	0.53
	65-74	All	2637	0.39
Statins	40-49	Male	2374	0.47
	50-59	Male	2241	0.30
	60-69	Male	2092	0.18
	70-79	Male	1695	0.08
	40-49	Female	2658	0.35
	50-59	Female	2633	0.27
	60-69	Female	2517	0.17
	70-79	Female	2113	0.08
Anti-hypertensives	40-49	Male	1020	0.79
	50-59	Male	894	0.71
	60-69	Male	815	0.60
	70-79	Male	641	0.57
	40-49	Female	1047	0.88
	50-59	Female	899	0.74
	60-69	Female	826	0.60
	70-79	Female	605	0.45
Smoking cessation	All	All	177	0.39
Exercise intervention	All	All	33	0.17
Weight management	All	All	51	0.01
Earlier detection of diabetes	40-49	All	452	0.12
	50-59	All	-296	0.17
	60-69	All	-111	0.18
	70-75	All	-111	0.18