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Article type : Review

Full title: A mixed-method systematic review of the effectiveness and acceptability of preoperative psychological preparation programmes to reduce paediatric preoperative anxiety in elective surgery

Running head: Preoperative psychological preparation for paediatric preoperative anxiety: mixed method systematic review

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Acknowledgements: None

Conflict of Interest: No conflict of interest has been declared by the authors.

Funding: This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

This article has been accepted for publication and undergone full peer review but has not been through the copyediting, typesetting, pagination and proofreading process, which may lead to differences between this version and the Version of Record. Please cite this article as doi: 10.1111/jan.13713

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ABSTRACT

Aim: To explore the effectiveness of preoperative psychological preparation programmes aimed to reduce paediatric preoperative anxiety and the potential factors that could have an impact on parent and children's acceptance of such interventions.

Background: Various preoperative psychological preparation programmes are available to address paediatric preoperative anxiety. No mixed-method review has been conducted to explore the effectiveness and acceptability of these programmes.

Design: A mixed-method systematic review.

Data sources: Seven bibliographic databases were searched from inception to September 2016, complemented by hand searching of key journals, the reference lists of relevant reviews, search for grey literature and the contacting of associated experts.

Review methods: The review process was conducted based on the framework developed by the Evidence for Policy and Practice Information and Co-ordinating Centre. A narrative summary and a thematic synthesis were developed to synthesise the quantitative and qualitative data respectively, followed by a third synthesis to combine the previous syntheses.

Results: Nineteen controlled trials and eleven qualitative studies were included for data synthesis.

The controlled trials reveal that educational multimedia applications and web-based programmes may reduce paediatric preoperative anxiety, while the effectiveness of therapeutic play and books remains uncertain. Qualitative studies showed parent-child dyads seek different levels of information.

Conclusions: Providing matched information provision to each parent and child, actively involving children and their parents and teaching them coping skills, may be the essential hallmarks of a successful preoperative psychological preparation. Further research is necessary to confirm the effectiveness of therapeutic play and books.

Keywords: anxiety, child, nursing, parents, preoperative psychological preparation, systematic review.

SUMMARY STATEMENT

Why is this review needed?

- Paediatric preoperative anxiety is prevalent around the globe and preoperative psychological preparation may reduce paediatric preoperative anxiety if designed and implemented properly.
- There are various approaches to preoperative psychological preparation, yet the effectiveness of some interventions remains uncertain.
- No systematic review has combined quantitative and qualitative studies to explore the effectiveness and acceptance of the psychological preparation intervention.

What are the key findings?

- Educational multimedia applications and web-based programmes may reduce paediatric preoperative anxiety, while the effectiveness of therapeutic play and books remains debatable.
- Preoperative psychological preparation that identifies the individual coping styles of children and parents; gives children realistic information; and provides coping skills training, may be most effective in reducing paediatric preoperative anxiety.

How should the findings be used to influence policy/practice/research/education?

- Evidence-based preoperative psychological preparation programmes for children should be introduced.
- More rigorous research is needed to establish the effectiveness of books and therapeutic play as strategies to reduce preoperative anxiety in children.
- Designers of preoperative psychological programmes should consider individual children and parent coping styles and deliver tailored interventions that contain realistic information for children.

INTRODUCTION

Paediatric preoperative anxiety (PPA) is a global concern, regardless of the country, procedure or healthcare system (Chow *et al.* 2016). PPA refers to children's subjective feelings of nervousness, apprehension and tension regarding the events that take place before surgery (Ben-Amitay *et al.* 2006, Kain *et al.* 1996). PPA can activate children's stress response, leading to an immediate release of neuroendocrine hormones such as cortisol and catecholamine, which can contribute to negative nitrogen balance and catabolism, delayed wound healing and increased postoperative pain (Chieng *et al.* 2014, Kain *et al.* 1999). Besides the short-term harm, PPA can also cause long-term behavioural changes such as feeding difficulty, new onset of enuresis, withdrawal, apathy, loss of temper and negative behaviour associated with health care (Li *et al.* 2007a, Kain *et al.* 2006).

Preoperative psychological preparation (PPP) programmes, which primarily consist of information provision and coping skills training to parent-child dyads prior to anaesthesia induction, are the main non-pharmacological approach used by various paediatric healthcare facilities to reduce PPA (Capurso & Ragni 2016). Yet the implementation of PPP programmes varies in different countries and hospitals and the most effective means of implementing this intervention remains unclear.

Several systematic reviews (Chieng *et al.* 2014, He *et al.* 2015a, Chow *et al.* 2016) explore the effectiveness of different PPP programmes to alleviate PPA, yet none of them consider qualitative evidence. It is increasingly accepted that effectiveness alone is not sufficient to inform policy change or decision-making. Policy makers and review users are interested in the effectiveness of interventions, the acceptability of them and factors that are influential in implementing them (Thomas & Harden, 2008). Among these factors, the acceptability of PPP is difficult to be assessed by quantitative studies, yet could be explored from qualitative studies. To produce a specific, comprehensive and useful evidence-base for practitioners, a mixed-method systematic review approach that included both quantitative and qualitative research was employed to address the review questions.

Background

During recent years, much work has been undertaken to investigate new PPP programmes across the globe. The approaches taken to PPPs include the use of leaflets (Setoodeh *et al.* 2010), story books (Tunny & Boore 2013), videos (Kain *et al.* 2007), therapeutic play (Li *et al.* 2007b), family-centred programmes (O'Conner-Von 2008), interactive applications (Hee *et al.* 2012) and web-based programmes (Kain *et al.* 2015). Yet the effectiveness of some strategies remains uncertain. Moreover, not every child could benefit from the same programme (Wakimizu *et al.* 2009, He *et al.* 2015a). One possible reason is that the majority of current PPP fails to take different influencing factors such as the cultural, contextual and individual interpretation of the intervention, into consideration (Capurso & Ragni 2016).

THE REVIEW

Aims

This systematic review aimed to explore which PPP programmes might work and further evaluate which interventions worked and were acceptable to individual parents and children.

From this, two specific objectives were developed:

- (1) To assess the effectiveness of different approaches of PPP interventions;
- (2) To explore individual parent and children's experiences and acceptability of PPP

programmes.

Design

This review adopted the mixed method for systematic reviews developed by the Evidence for Policy and Practice Information and Co-ordinating (EPPI) Centre to address the review question. This approach begins with a broad review question followed by separate sub-questions, which are then used to develop parallel syntheses to address the sub-questions. The separate syntheses are then combined together into a 'meta-synthesis' to answer the broad review question in its entirety (Gough *et al.* 2012). In this review, a narrative summary of the effectiveness of different PPP interventions was implemented, alongside a thematic synthesis of the qualitative evidence of children and/or their parents' experiences and perspectives towards PPP, before completing a 'meta-synthesis' to juxtapose the findings of each separate synthesis. This approach enabled us to address the acceptability of each PPP intervention from the children and parent perspectives. The review process is listed in Figure 1.

Search methods

Seven bibliographic databases including PubMed, MEDLINE, CINAHL, The Cochrane Library, PsycINFO, Academic Search Premier and CNKI - the largest Chinese integrated database covering the medical and nursing area (CNKI 2016) – were searched without time or study design limit. The

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search terms, including appropriate subject headings and wildcards of paediatric patient, preoperative psychological programme and preoperative anxiety, were combined in MEDLINE and adjusted according to the indexing systems of other databases (see Supplementary appendix 1 for detailed search strategy of MEDLINE). In addition, bibliographic registers such as Zetoc, ExLibris Primo, SCOPUS and NICE Evidence Search were searched to track relevant conference proceedings. A hand search of *Paediatric Anaesthesia* (from inception to September 2016) was undertaken to identify relevant articles. Reference lists of the existing systematic reviews were scanned to identify potentially missed primary studies in PPP. Theses and dissertations were identified through the ProQuest database. Key authors (n = 4) were also contacted for further studies to review.

Search outcome

A total of 2,072 papers were retrieved and imported into EPPI Reviewer 4 – an online software programme developed by the EPPI Centre to facilitate the systematic review process (Brunton & Thomas 2012). After 341 duplicates were removed by EPPI Reviewer 4, the titles and abstracts of 1,731 articles were screened by one reviewer for eligibility and relevance according to the inclusion and exclusion criteria (see Table 1). Papers that did not meet the selection criteria were removed. Two reviewers then independently screened the full articles to make decisions regarding the final inclusion of the papers. There was no disagreement regarding the screening process. Of the 113 obtained full-text papers, 38 studies being judged as eligible for mapping and quality appraisal.

Quality appraisal

To answer the two sub-questions of this review separately, we divided the included studies into experimental, qualitative studies for quality appraisal. The quality of experimental studies was appraised using the tool developed for and used by an EPPI-Centre intervention review which judges the quality of experimental studies from three facets – selection bias, attrition bias and reporting bias (Shepherd *et al.* 2010). To be judged as a sound experimental study, the study had to avoid the

above-mentioned three biases (Shepherd *et al.* 2010). The quality of qualitative studies was undertaken using the EPPI Centre for qualitative studies (Harden *et al.* 2009). This assesses the quality of reporting of the included studies' aims, context, rationale, methods and findings; use of strategies to increase the reliability and validity; and the extent to which the study's findings reflected the participants' perspectives and experiences. To be judged as 'sound' a sound qualitative study had to meet at least seven out of the twelve criteria listed above (Harden *et al.* 2009). The detail of the two quality appraisal tools was presented in Supplementary appendix 2.

There is one mixed-method study included after screening (He *et al.* 2015c). The quantitative component and qualitative component of this study were appraised using the two above mentioned tools accordingly.

After quality appraisal, five experimental studies were excluded due to high selection bias (Hatava *et al.* 2000; Hee *et al.* 2012; Czzocrea *et al.* 2013; Dai *et al.* 2016; Lyu *et al.* 2016), two due to high attrition bias (Felder-Pulg *et al.* 2002; Margolis *et al.* 1998). One qualitative study (Tabrizi *et al.* 2015) was judged as having low quality and thus was excluded. In all, 30 studies were included for data synthesis. The literature selection flowchart is presented in Figure 2.

Data extraction

Two data extraction forms were designed for the experimental and qualitative studies in this review respectively. The extraction form for experimental studies included the study population, the content of the intervention, research design, outcome measurement and potential biases relevant to the quality appraisal (see Supplementary appendix 3). For qualitative studies the aims, study design, context, study participants, research method and the quality appraisal score of each criterion, were extracted onto another data extraction form (see Supplementary appendix 4). The first author used the two forms to extract the data. A second reviewer checked this against the original studies.

Data synthesis

The heterogeneity of participants' ages, approaches to the PPP, outcome measurements and varied primary and secondary time points made it challenging to conduct meta-analysis. Following Thomas and his colleagues' suggestions (2012), a narrative summary was conducted to synthesise findings from the experimental studies. After the characteristic of each experimental study was tabulated, they were divided into different groups according to the specific interventions each PPP involved. The findings of each study were then presented and analysed to see if they have similar or divergent findings. Finally, an overall conclusion of the effectiveness of PPP was drawn.

A thematic synthesis of findings from the qualitative studies was undertaken to explore children and/or their parents' experiences and perspectives towards PPP. In keeping with Thomas and Harden's (2008) guidance, all the results and findings of the included qualitative studies were imported verbatim into QSR's NVivo (11.0 version) software and then coded line-by-line to capture the meaning of each sentence. Next, these initial codes were compared and contrasted and then put into different groups with a theme describing each group's characteristic. Then, the 'descriptive' themes were employed to respond to the second review question by illuminating children and parents' experiences of coping with stressful surgery and what they understood to be effective strategies to reduce their anxiety.

Finally, the narrative summary and thematic synthesis were entered into a matrix to identify the matches and mismatches between current PPP and individual parent and children's perceived way of handling preoperative anxiety and their acceptance of PPP. This was important to further explain why some PPP interventions worked while others are not so effective.

RESULTS

Study characteristics

The 19 included experimental studies involved 2,111 children (aged between 2 to 14 years old) or their parents, or both. The specific PPP interventions conducted in these studies include therapeutic play, books/booklets, videos, web-based programmes/applications and multi-component programmes.

The detailed characteristics of the included experimental studies are listed in Table 2.

The included eleven qualitative studies involved children undergoing ENT, dental/minor plastic, ophthalmology, genital-related, stoma, scoliosis and congenital heart disease-related surgery. Two studies used grounded theory (Wennström *et al.* 2008, Bray *et al.* 2012) to explore participants' experiences of undergoing surgery and what it meant to them, two studies used a phenomenological approach to investigate parents' experiences of taking care of their children undergoing surgery (Wu & He 2011, He & Chen 2013), while other studies did not specifically state the methodological approach used. The detailed characteristics of the included qualitative studies is listed in Table 3.

Effectiveness of different interventions

Therapeutic play and theatre orientation

Five studies investigated the effectiveness of therapeutic play in particular (Li *et al.* 2007, Vaezzadeh *et al.* 2011, Sabaq & El-Awady 2012, He *et al.* 2015b, Dai *et al.* 2016). The core elements of this intervention included three facets: demonstration of the anaesthesia induction process by employing a doll or manikin similar to the child's age; then, children were encouraged to imitate the process afterwards under the supervision of the investigator or other qualified professionals; finally, questions and concerns raised during the process would be answered (Li *et al.* 2007a; He *et al.* 2015b). Four studies (Li *et al.* 2007, Vaezzadeh *et al.* 2011, Sabaq & El-Awady 2012, Dai *et al.* 2016) combined therapeutic play with theatre orientation by bringing children and their parents into the operation department to familiarise them with the theatre environment. Children were allowed to

touch and explore the medical equipment involved in the induction process. All studies suggested therapeutic play could reduce children's preoperative anxiety and negative manifestations during induction.

Instead of combining therapeutic play with theatre orientation, He *et al.* (2015b) used photographs to show children the theatre environment and equipment and reported that while anxiety scores of those children that received therapeutic play fell more than those of children that did not receive this intervention prior to and post-surgery, there was no statistically significant difference between the two groups ($p=0.427$). They argued this might be caused by the lack of theatre orientation in their study (He *et al.* 2015b). Another possible explanation was the extended age range of participants (6–14 years) compared with participants (aged 6-12 years) in other four studies. Thus, the effect of therapeutic play and the relationship between the impact of therapeutic play and theatre orientation remains uncertain. Further robust, large population trials are needed to investigate the effect of therapeutic play, as well as the relationship between therapeutic play and theatre orientation.

Regarding to children's compliance during induction, two studies (Li *et al.* 2007, He *et al.* 2015b) found children that received therapeutic play exhibited less negative emotional behaviours compared with the those in the control group ($p<0.001$ and $p<0.01$ respectively). Sabaq & El-Awady (2012) also found that children in the therapeutic play group showed significantly higher compliance compared with those in control group (65% vs 33%, $p = 0.001$). Dai *et al.* (2016) found that the compliance score in the intervention group were higher than in the control group ($t=2.614$, $p=0.013$), which indicated therapeutic play could enhance children's compliance during anaesthesia induction.

Books/booklets

The impact of books/booklets on PPA was explored by the following studies. Tunney & Boore (2013) found that the anxiety level of children who read a surgery related story book was significantly lower than those who did not read the book ($p=0.001$); and the story book was more effective for girls ($p=0.035$) and children aged around 7 years old ($p=0.001$). Mancindo *et al.* (2015) showed that preschool children (3–6 years) who read a 3-D story book containing surgery-related knowledge exhibited significantly lower anxiety level compared with those who received face-to-face verbal teaching of the similar information contained in the 3-D book ($F=10.05$, $p=0.036$). On the other hand, Tabrize and colleagues (2015) provided school age participants (8–10 years) and their parents in the intervention group a booklet containing anaesthetic information plus oral education and routine preparation to the control group. They found there was no statistical significance between the anxiety level of experimental and control groups ($p=0.1$) (Tabrize *et al.* 2015). Since only Mancindo *et al.* (2015) provided a detailed account of the information contained in the book and how the oral education was conducted, it was challenging to judge whether the content of the book or booklet used in the other two studies was comparable to the 3-D story book. Hence the effectiveness of the book/booklet is unclear and further high quality RCTs with larger sample sizes are needed.

Videos

Videos used in PPP programmes involve electronic medium displaying moving visual media and could be carried on magnetic tape, optical discs, computer files and network streaming. Setoodeh *et al.* (2009) reported that the anxiety level in the experimental group and the control group were 37.22 (SD 6.37) and 46.60 (SD 8.24) respectively ($p<0.001$) after the intervention, which indicate that providing surgery related video plus booklet to school-aged children and their parents is more effective in reducing PPA than preparing them only with routine brochures. Fernandes *et al.* (2014) found that school-aged children who received surgery-related educational material reported less preoperative anxiety compared with children in the control group who received entertaining material ($p<0.001$) and different formats of surgery-related educational material (booklets, videos and board

games) have the same effectiveness in reducing children's preoperative anxiety (all $p > 0.05$). The results of the two studies suggest that surgery-related video plus booklets are more effective than brochure in reducing preoperative anxiety; and booklets, videos and board games is of the same effectiveness for school-aged children in reducing preoperative anxiety.

Web-based programme/applications

Two studies explored web-based programmes/applications on children and their parents' preoperative anxiety. Fernandes *et al.* (2015) showed that the educational application group reported a significantly lower level of worries regarding hospitalization, medical procedures, illness and negative consequences than those in the comparison (played an entertaining video game) and the control (no intervention) groups (all $p < 0.001$); and the comparison group reported a lower level of worries about illness and negative consequences compared with those in the control condition ($p = 0.024$). Fortier and her colleagues (2015) found that when entering the theatre and introducing the anaesthesia mask, children who played the Web-based programme were less anxious than those who received standard care ($p = 0.02$ and 0.01 respectively). Regarding parents' anxiety, both the parental anxiety in the educational application group and entertaining video group were lower than in the control group ($p = 0.033$), yet the difference between educational application and entertainment video group was nonsignificant ($p = 0.805$) (Fernandes *et al.* 2015). Fortier *et al.* (2015) reported that parental anxiety was less severe in the Web-based programme group than in the control group when in the holding area - a place where parents and children are kept temporarily before transfer to the theatre ($p = 0.002$). The difference of the effectiveness on parental anxiety may be due to the difference between the two programmes: the educational application only involved children while the Web-based programme involved both children and their parents.

Children's physical responses and postoperative pain were also examined in the two studies.

Fernandes *et al.* (2015) found that children's heart rate and blood pressure were not significantly different among the educational application group, the video game group and the control group (all $p>0.05$) and Fortier *et al.* (2015) reported no differences existing in children's postoperative pain between the intervention group and the control group after surgery (with pain scores being 0 ± 0.67 and 0.38 ± 1.76 , respectively, $p=0.3$), or analgesic consumption (all $p>0.1$).

Multi-component preoperative psychological preparation programmes

Five studies (Kain *et al.* 1998; Jin 2006, Kain *et al.* 2007; Wakimizu *et al.* 2008, Fincher *et al.* 2012) employed three or more different approaches including the use of photographs, booklets and videos, theatre orientation and therapeutic play for children and/or their parents to reduce preoperative anxiety in the 2–14 year-old age group; four of the following studies concluded that the multi-component programme was effective in reducing child and parental preoperative anxiety. Kain *et al.* (1998) provided a theatre tour, a theatre tour plus video tape and a theatre tour combining video tape and child-life preparation to three different groups of participants; and found that both children and their parents that received the theatre tour combined with video tape and child-life preparation exhibited significantly less anxiety in the holding area compared with other two groups ($p=0.02$ and 0.025 respectively), yet no differences in behaviour or physical responses were observed among all the three groups during the anaesthesia induction. Kain *et al.* (2007) then reported the children and parent anxiety levels in a family-centred programme named ADVANCE was significantly lower compared with other groups (34.4 SD 16 vs. 39.7 SD 15; $p=0.007$) when they were in the holding area, as well as during anaesthesia induction (44.9 SD 22 vs. 51.6 SD 25 and 53.6 SD 25, respectively; $p=0.006$). Jin (2006) reported that children in the PPP group experienced less anxiety compared with control group when entering the theatre (32.4 SD 9.1 vs. 58.7 Sd 11.2, $p<0.01$) and during anaesthesia induction (33.6 SD 9.3 vs. 66.9 SD 12.0, $p<0.01$). Wakimizu *et al.* (2008) found the anxiety level of the children who received PPP programme was significantly lower than in the control group in the preoperative period (1.30 SD 1.42 vs. 2.06 Sd 1.89, $p=0.02$).

However, Fincher *et al.* (2012) designed a preoperative visit which included a photo file containing procedural information, experiencing therapeutic play and a theatre tour and receiving a tool kit of calico doll, name bracelet, disposable hair cap and mask to take home to play; while the control group only received standard information provision. They found that the anxiety score of the children in the experimental group was lower than the control group, but without statistical significance ($p=0.07$) and concluded that this may be due to the fact that 35% of families could not attend the prescheduled PPP suitable for the child's age, instead joining a PPP for another age group (Fincher *et al.* 2012). Another possible reason is that both Wakimizu *et al.* (2008) and Fincher *et al.* (2012) did not mention how long before surgery the above anxiety value was measured, thus it is difficult to tell whether a multi-component PPP programme is effective at the same time points.

Regarding children and parents' physical responses, Kain *et al.* (1998) found that parents who received the PPP had lower systolic and diastolic blood pressure compared with parents in other groups (all $p \leq 0.01$). Jin (2006) reported that the cortisol level in PPP group were significantly lower than control group during anaesthesia induction (14.09 SD 7.58 vs. 38.07 Sd 15.30, $p < 0.01$) and after operation (11.87 SD 6.25 vs. 33.58 Sd 14.56, $p < 0.01$). The difference of norepinephrine level between PPP and the control group was also significant during induction (470.03 SD 105.16 vs. 747.40 SD 167.07, $p < 0.01$) and after surgery (459.68 SD 68.68 vs. 663.78 SD 163.64, $p < 0.01$) (Jin 2006).

Two studies explored children's compliance during anaesthesia induction. Kain *et al.* (1998) reported no statistical difference of children's compliance were observed between PPP group and control group (44.9 Sd 22 vs. 42.9 Sd 24; $p = 0.904$), while Jin (2006) found the compliance score was significantly lower between PPP and control group (6.87 Sd 2.1 vs. 3.24 SD 1.4, $p < 0.01$).

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Wakimizu *et al.* (2008) reported that some parents suggested watching the educational video repeatedly made their children feel more anxious about the forthcoming surgery. Kain *et al.* (1998) explored the relationship between children's coping strategy and their preoperative anxiety and found that children with an information-seeking coping style could actively engage in the intervention and benefit more from the programme. These results indicate that not every child could benefit from the PPP.

Thematic synthesis of qualitative studies

Regarding to parent-child dyads' experiences towards PPP, two themes were identified from the thematic synthesis of the qualitative studies: children and parents may seek different levels of information and strategies to reduce preoperative anxiety.

Children and parents seek different levels of information

Both children and their parents seek information to gain an understanding of surgery-related procedures. However, not every child or parent sought the same degree of information. Some children perceived limited information, such as the time of surgery, as sufficient as they found too much information overwhelming (Wennstrom *et al.* 2008, Bray *et al.* 2012, Vejsovic *et al.*, 2015). Other children, on the other hand, sought detailed information about hospitalisation and surgery (Wennestrom *et al.* 2008, Vejsovic *et al.* 2015). Rullander *et al.* (2013) suggest provision of standardized information to all children undergoing scoliosis surgery would sometimes aggravate their anxiety. Regarding parents, Reid (1999) reported that some parents sought detailed information regarding the surgery related events and when given insufficient information, would feel anxious and powerless; while some parents experienced anxiety due to concerns about the risk and potential complications of surgery and the long-term impact that the disease and surgery could have on their child (Wu & He 2011, He & Chen 2013). There is then, strong support that information provided to children and their parents should be tailored to their individual needs.

Perceived ways to reduce anxiety

Both children and parents pointed out several strategies to reduce their anxiety, including hospital-related story books, leaflets, theatre orientation and therapeutic play (Buckley & Savage 2010, Bray *et al.* 2012, Smith & Callery 2005). Consulting with a nurse specialist or doctor and directly asking questions was perceived as an effective strategy for gaining information by parents (Reid 1999, Bray *et al.* 2012, He & Chen 2013). Some parents suggested that hospitals should create a more child-friendly environment and provide additional toys and books which could be used to distract their child during hospitalisation (Wollin *et al.* 2004).

Do current preoperative psychological preparation programmes match with child–parent dyads’ needs

The findings of narrative summary and thematic synthesis were combined together to identify matches and mismatches between existing PPP and children and parents’ views towards them. Several points emerged from this synthesis.

Some of the children and their parents’ needs were met in current PPP programmes. The thematic synthesis indicates children value receiving realistic information about surgery. In fact, several PPPs informed their participants about potential pain or other uncomfortable feelings and taught them how to cope with them (Fortier *et al.*, 2015; Macindo *et al.* 2015; Setoodeh *et al.* 2009). Children and their parents also suggested several methods to be acceptable for them to receive the information and reduce PPA. These interventions included child-centred leaflets, medical-related story books, a visit to hospital or photographs of the environment of the hospital, therapeutic play, communication with positive role-models, building a child-friendly environment and coping skills training (Bray *et al.* 2012; Buckley & Savage, 2010; Smith & Callery, 2005; Wollin *et al.* 2004). Most of these elements have already been adopted in current PPPs.

Yet there are gaps between parents and their children's perceived proper level of information and the amount of information they actually received from some PPPs. The thematic analysis highlights the importance of providing information tailored to each child–parent dyad's characteristics and individual needs. Yet only one study (Fortier *et al.* 2015) used validated scales to identify children's temperament and preliminary anxiety and parental coping strategy and then using them as the basis to develop tailored interventions for each child. General PPP that ignores parents and their children's differing needs for information could provide more information than wished for by those who are information-avoidant and may thus increase their anxiety and fear. Wakimizu *et al.* (2008) reported several parents complained that the PPP they received led to heightened anxiety in their children.

DISCUSSION

This review is the first using mixed-method approach to investigate the effectiveness of different interventions of PPP and consider the acceptability of PPP from paediatric patients' view. Among various approaches to PPP, Web-based programmes and applications and surgery-related video seems to be effective in reducing PPA, while the effectiveness of therapeutic play, books/booklets are inconclusive. The combination of experimental and qualitative studies showed that children and their parents seek different levels of information, yet only a few studies have taken children's as well as their parents' individual information-seeking needs, coping styles and preferences into consideration. None had developed PPPs highly tailored to each child's characteristics and their parents' individual needs (Fortier *et al.*, 2015; Kain *et al.*, 2015). Other PPPs are generic and may be more beneficial for patients who cope with stressful surgery by seeking detailed information and have the necessary time and ability to get access to the programme (Fortier *et al.*, 2015; Kain *et al.*, 1998).

Recently several systematic reviews have been conducted to explore the effectiveness of interventions implemented at different periods of hospitalization to reduce PPA. Chow *et al.* (2016) implemented a meta-analysis on the effectiveness of the audio-visual interventions such as videos,

multi-faceted Internet programmes and interactive video games, which were conducted before or during induction and they suggest that audio-visual interventions may reduce children's preoperative anxiety - findings that concur with those reported in this review.

He *et al.* (2015a) explored the effectiveness of therapeutic play in their narrative systematic review and found out the impact of this intervention on children's perioperative anxiety, maladaptive behaviours and postoperative pain is controversial and suggesting more rigorous studies to be conducted in future, which is consistent with the findings of this review. And this review takes one step further to question which element is truly effective - therapeutic play or theatre orientation. This review also found another important issue worthy of further consideration: although the effectiveness of therapeutic play in reducing PPA is uncertain, all the included studies that investigated children's compliance concluded this intervention was effective in enhancing children's compliance during anaesthesia induction. However, it remains uncertain if compliant behaviour reflects reduced anxiety as a compliant and quiet child may still be anxious. It is important that the outcomes being measured are meaningful to children.

Although the previously reported reviews shed new light into the effectiveness of PPP interventions, none of them take qualitative evidence into consideration. Mitton and Patten (2004) suggest that when deciding which PPP should be adopted to reduce children's preoperative anxiety, a health authority will not only need to consider the efficacy of the intervention, but parents and their children's views, preferences and acceptance towards the PPP. This systematic review investigates the effectiveness of the existing various PPP interventions conducted before anaesthesia induction and acceptance of PPP from patients' view. By exploring matches and mismatches between participants' needs and the actual PPP practice, several gaps in practice and research have been revealed.

Limitations of this review

As this review includes only literature written in English or Chinese, it may be subject to language bias. Furthermore, most included trials failed to use power analysis to calculate the minimum sample size and most results were reported with P value without the estimates of precision such as confidence intervals, hence the findings of this review should be treated with caution. Nonetheless, the narrative cross-study synthesis demonstrated that there was some consensus between the quantitative and qualitative findings, providing some evidence for the introduction of PPP in practice alongside robust evaluation and research studies to determine the feasibility, effectiveness and acceptability of this intervention.

CONCLUSIONS

The effectiveness of therapeutic play and books/booklets remains uncertain, while web-based programmes and videos may be effective to reduce PPA. PPP that identify children's coping styles as well as their parents' coping styles, give children realistic information and provide coping skills training, may be most effective in reducing PPA. Meanwhile, more sound, large scale RCTs are necessary regarding the need for PPP intervention tailored to individual children and parent coping styles and therapeutic play and books.

Author Contributions:

All authors have agreed on the final version and meet at least one of the following criteria (recommended by the ICMJE*):

- 1) substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data;
- 2) drafting the article or revising it critically for important intellectual content.

* <http://www.icmje.org/recommendations/>

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Table 1 Inclusion and Exclusion Criteria

	Inclusion Criteria	Exclusion Criteria
Participants	Children younger than 18 years undergoing general anaesthesia for elective or day surgery, and/or their parents.	Children who need emergency surgery.
Interventions	Non-pharmacological intervention conducted prior to anaesthesia induction, involving information provision and/or teaching of coping strategies, conducted at hospital or home.	Interventions implemented during anaesthesia induction, since this has been reviewed elsewhere (Manyande et al., 2015). Only involve pharmacological interventions to reduce PPA.
Comparisons	Any other intervention.	None
Outcomes	Children and/or their parents' perioperative anxiety, children's compliance during anaesthesia induction, postoperative maladaptive behaviour, postoperative pain, children and/or parents' physical responses such as heart rate, cortisol level etc.	None
Study designs	Experimental studies, i.e. randomised controlled trials (RCTs) or controlled trials; and qualitative studies.	Cross-sectional survey focusing on indicators of preoperative anxiety.
Languages		Not published in English or Chinese, due to the lack of time and financial resources for the translation of other languages.

Table 2 Characteristics of included experimental studies

Intervention category/ Number of included studies	Study design	Country	Setting	Participants' age	Elements of intervention	Duration of intervention	Comparison	The time point to conduct the intervention	Study ID	Key Results: mean \pm SD/ MD [95%CI] (Experimental VS. Control group)
Therapeutic play & Theatre orientation (6)	RCT:4, Quasi: 1, Mixed: 1	China :2, Iran:2, Egypt :1, Singapore:1	Hospital/home	6-14 years old	A theatre orientation tour + A doll to demonstrate the anaesthesia induction + Routine information preparation	20-120 minutes	Routine information preparation	On or at most 7 days before the surgery	He et al. (2015b) Li et al. (2007)	CA: 17.02 \pm 3.43 vs. 48 \pm 4.52, -1.58[-3.20, 0.04] CC: 6.53 \pm 1.91 vs. 8.66 \pm 3.3, -2.13[-3.22, -1.04] CA: 34.36 \pm 8.09 vs. 38.6 \pm 8.53, -4.24[-6.53, -1.95] CC:10.46 \pm 3.79 vs. 13.63 \pm 4.49, -3.17[-4.31, -2.03]
									Sabaq & El-Awady (2012)	CA: 30.8 \pm 6 vs. 34.1 \pm 6.7, -3.30[-6.27, -0.33]
									Vaezzadeh et al. (2011)	CA: 31.44 \pm 5.87 vs. 38.31 \pm 7.44, -6.87[-9.25, -4.49]
									Dai et al. (2016)	CC: 2.41 \pm 1.14 vs. 3.4 \pm 1.27, -0.99[-1.74, -0.24]
Books & Booklets (3)	RCT:2, Quasi: 1	UK, Philippines,	Hospital/home	4-11 years old	A story/3D book highlight the various	Unclear/15-20	Coloring book	1 day before the	Tunney & Boore (2013)	CA: 70.58 \pm 24.82 vs. 82.35 \pm 20.96 -11.77[-21.84, -1.70]

		Iran		stages of the theatre journey in a non-threatening manner	minutes	surgery	Mancindo <i>et al.</i> (2015)	CA: 28.73 ± 7.67 vs. 39.16 ± 6.44 , -10.43[-16.65, -4.21] Children's surgical knowledge: 8.67 ± 1.16 vs. 7.13 ± 0.64 , 1.54[0.75, 2.33]		
							Tabrize <i>et al.</i> 2015	CA: 30.8 ± 6 vs. 34.1 ± 6.7 -3.30[-7.68, 1.08] PA: 35.6 ± 9.5 vs 42.8 ± 14 , -7.20[-15.76, 1.36]		
Videos (2)	RCT:1, Quasi:1	Iran, Portugal	Hospital	8-12 years old	A videotape providing procedural and sensory information	15-20 min	Entertaining video	Short before the surgery	Setoodeh <i>et al.</i> (2009)	CA: 37.22 ± 6.37 vs. 46.6 ± 8.24 , -9.38[-11.43, -7.33]
									Fernandes <i>et al.</i> (2014)	CA: 0.47 ± 0.03 vs. 1.35 ± 0.15 , -0.88[-0.96, -0.80]
Web-based programmes & application (2)	RCT	Portugal USA	Hospital/home	2-12 years old	An online educational multimedia application	15 min	Entertaining video game	On or at most 7 days before the surgery	(Fernandes <i>et al.</i> 2015)	CA: 0.46 ± 0.18 vs. 1.56 ± 0.73 , -1.10[-1.37, -0.83] PA: 1.89 ± 0.54 vs. 1.85 ± 0.50 , 0.04[-0.22, 0.30]
									Fortier <i>et al.</i> (2015)	CA: 43.5 ± 21.7 vs. 57 ± 21.2 , -13.50[-23.35, -3.65] PA: 43.8 ± 13.4 vs. 47.2 ± 12.8 , -3.40[-9.16, 2.36]

Multi-com ponent PPPs (6)	RCT	USA: 2,Chi na:2,J apan: 1,Aus tralia: 1	Hospita l/home	2-12 years	A theatre orientation + A model videotape	15-60 min	Theatre orientat ion	1-10 days before the surgery	Kain <i>et al.</i> (1998)	CA: 52(23-100) vs. 44(23-100), 8.00[-23.94, 39.94] CC: 44.9±22 vs. 42.9±24 2.0[-10.88, 14.88] Children's serum cortisol level: 15 ± 5.5 vs. 14 ± 4.7, 1.00[-1.87, 3.87] PA: 44 ± 12.2 vs. 52 ± 11.0 -8.0[-14.51, -1.49] Parental blood pressure: 119 ± 25.93 vs. 140 ± 16.30 -21.00[-33.18, -8.82]
									Kain <i>et al.</i> (2007)	CA: 43 ± 23 vs. 52 ± 26, 0.54[0.78, 0.30] PA: 43.3 ± 10 vs. 46.2 ± 12, -2.90[-6.00, 0.20]
									Jin (2006)	CA: 33.6±9.3 vs. 66.9±12.0 -33.30[-42.71, -23.89] CC: 6.87±2.1 vs. 3.24±1.4 3.63[2.07, 5.19] Children's serum cortisol level:14.09±7.58 vs. 38.07±15.30, -23.98[-34.56, -13.40]
									Wakimizu <i>et al.</i> (2008)	CA: 1.30±1.42 vs. 2.06±1.89 -0.76[-1.29, -0.23]
									Fincher <i>et al.</i> (2012)	CA: 6.8±2.96 vs. 7.5±5.93 -0.59,[-1.23, 0.06]

Note: CA: Children's anxiety, CC: Children's compliance, PA: Parental anxiety.

Table 3 Characteristic and quality assessment of included qualitative studies

Study	Aims	Methods	Study location	Sample size	Participants type	Gender & age	Surgery type	Ethnicity
Bray <i>et al.</i> (2012)	To explore preoperative experiences	using face-to-face semi-structured interview	UK (North England)	17	Children and their parents	Male = 9 Female = 8	Continent stoma surgery	Not stated
Buckley & Savage (2010)	To identify children's preoperative information	interviews supported by a write and draw technique	UK (Ireland)	9	Children	Age: 6-9 yrs.	Elective tonsillectomy	Not stated
He <i>et al.</i> (2015c)	To test the effectiveness of therapeutic play	A mixed method study using sequential design	Singapore	22	Parents	Female = 20; Male = 2 Age: 33-53 yrs.	ENT = 77.1%; Orthopedics = 8.3%; General surgery = 14.6%	70% Chinese; 18.2% Malay; 9,1% Indian
Reid (1999)	To explore children's psychological needs during perioperative period	Face to face interviews to collect parents' perceptions towards surgery	UK (Ireland)	21	Parents	Gender and age: not stated	ENT surgery, specifically tonsillectomy, adenoidectomy and the insertion of grommets	Not stated
Rullander <i>et al.</i> (2013)	To describe adolescents' narrated experiences in surgery.	individual interviews with open and semi-structured questions	Sweden	6	Children	Female=4, Male=2. Age: 15-18 years	Scoliosis surgery	Not stated
Smith & Callery (2005)	To explore the information needs relating to surgery	Qualitative research using interview with the write and draw technique	UK (Liverpool)	9	Children	Gender: not stated Age:7-11yrs.	Day surgery and prolonged stay surgery	Not stated
Veizovic <i>et al.</i> (2015)	To illuminate children's experiences prior to colonoscopy	Qualitative research using interviews to collect data	Sweden	17	Children	Boys= 5 Girls= 12 Age: 10–17 yrs.	Elective first colonoscopy	Not stated

Wennström <i>et al.</i> (2008)	To explore what it means for children to attend hospital for day surgery	employing semi-structured interviews, participant observations	Sweden	20	Children	Boys= 15, Girls= 5 Age: 6–9 yrs.	Day surgery	Not stated
Wollin <i>et al.</i> (2004)	To explore children's perceptions	Cross-sectional survey utilising structured interviews	Australia	120	Children and parents	Boys= 68 Girls= 52 Age: 5-12 yrs.	Elective surgery	Not stated
He & Chen (2013)	To explore the experiences of mothers whose children with CHD	semi-structured interviews to collect the data	China	16	Mothers	Female Age:23-38 yrs.	Congenital heart disease-related surgeries	Not stated
Wu & He (2011)	To explore the experience of parents whose children have hypospadias	employing semi-structured interviews to collect the data	China	8	Parents	Male= 3, Female= 5 Age: 24-46 yrs.	Hypospadias- related surgeries	Not stated

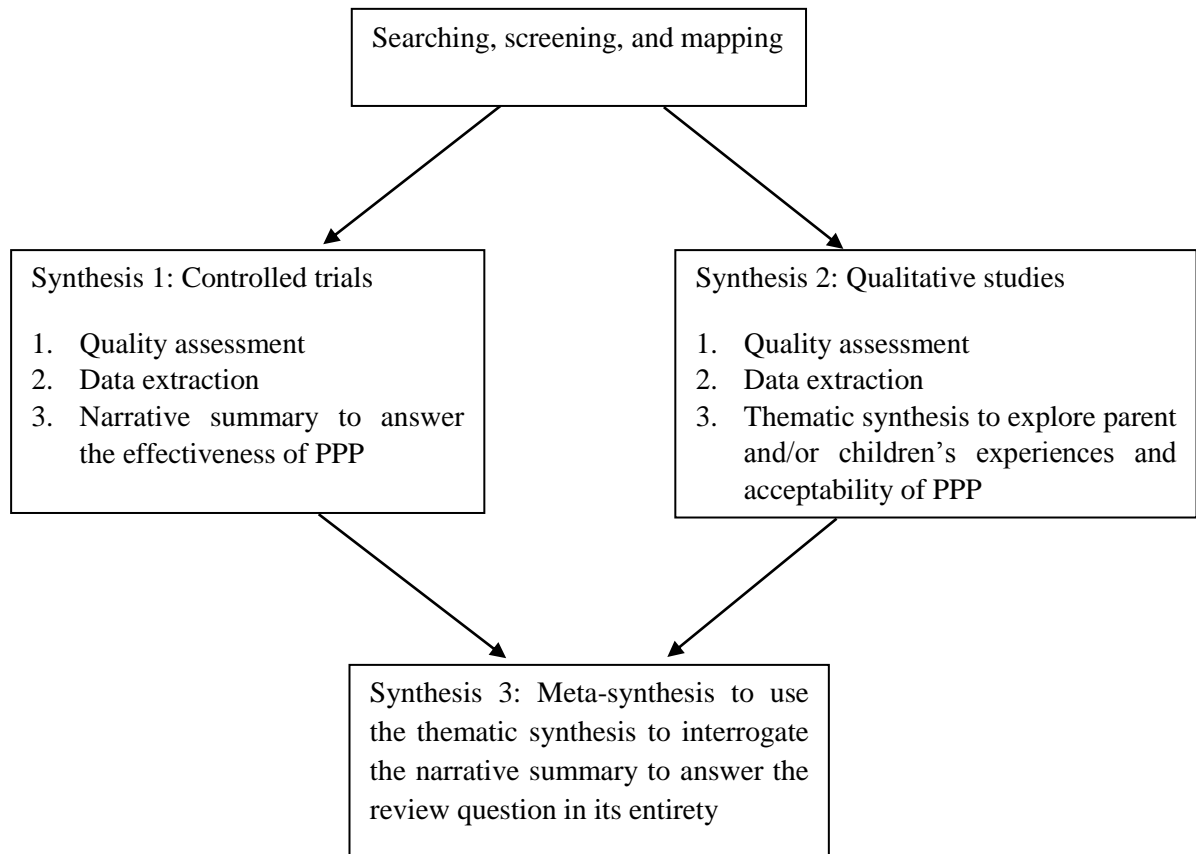


Figure 1. The review process (Source: Gough et al., 2012)

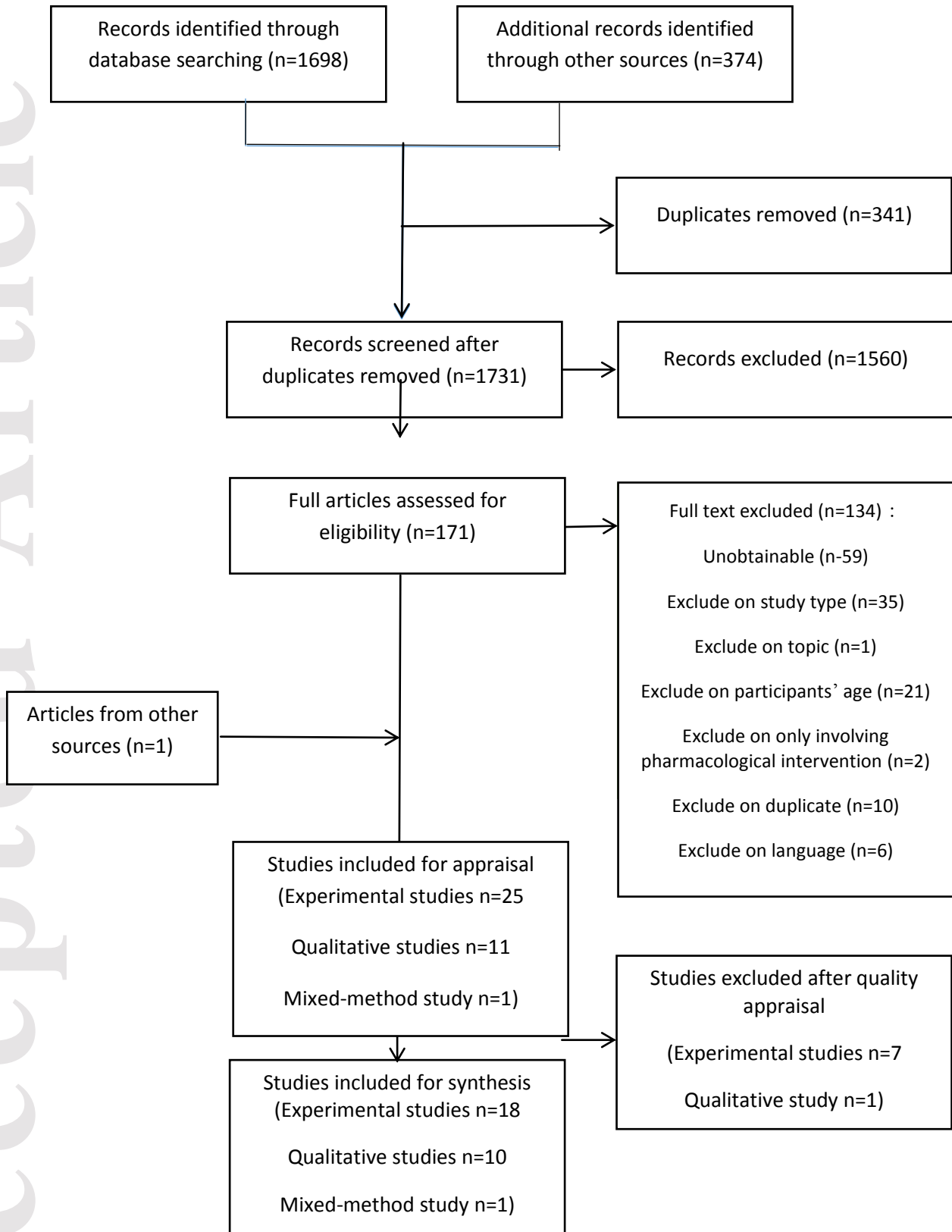


Figure 2 The PRISMA flowchart