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Review

Psycho-educational preparation of children for anaesthesia: A review of intervention methods

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ABSTRACT

Objective: To systematically review the different methods available for the psycho-educational preparation of children for anaesthesia induction.
Methods: Articles were searched in Academic Search Premier, OvidSP, Web of Science, and PsycINFO. Inclusion criteria were psychological and educational preparation of children for anaesthesia and anxiety reduction. The titles of papers and abstracts were reviewed and full copies of selected papers were scrutinized.
Results: Forty-four empirical studies were identified. Twenty-one articles described preoperative preparation programmes, twelve examined the effects of distractive techniques and eleven reported the effect of parental presence during anaesthesia's induction. Some general characteristics of the different interventions are discussed together with some key psychological and educational factors mediating anxiety in children undergoing anaesthesia.
Conclusion: The effectiveness of interventions were linked to several factors. Psychological and contextual aspects are discussed. Psycho-educational activities should be better described when reporting their effectiveness in children's preparation for an anaesthesia.
Practice implications: Patient and family characteristics together with organizational and systemic aspects are described in order to guide the choice of the most appropriate preparation method for diverse health care setting.

Contents

1. Introduction

The initial process of anaesthetization delivers a state of unconsciousness known as "anaesthesia induction". Most often

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unconsciousness is reached by intravenous injection of a short-acting anaesthetic agent or via an inhalational procedure [1]. This process can be distressing for both children and parents. In fact, the incidence of clinically significant anxiety during this preoperative period is as frequent as 40–60% [2], and often results in postoperative agitation and adverse behaviours that can persist past hospitalization [3–5]. Research has found several factors to be correlated with the incidence of preoperative anxiety in children. These include daily home routines, unfamiliar situations presented by the hospital setting, medically invasive or diagnostic procedures involving different parts of the child's body, uncertainty about how the surgery procedure is conducted, fear of pain and separation from parents [6,7].

In the last two decades surgery techniques, anaesthetic agents and nursing knowledge have greatly improved [8] and most paediatric surgical procedures are now performed as day cases [9] which may increase distress in children as it leaves them with less time to adapt [10,11].

Children of different ages suffer from different stressors during hospitalisation. Infants (0–1 years old) lack a rational understanding of why surgery is necessary [12,13] and may feel betrayed by those believed to protect them [14]. The greatest stress for them is probably parental separation [15,16]. Infants are particularly sensitive to the caregiver's reaction. In fact, one way infants learn how to behave in an unfamiliar situation is via social referencing, which means they use emotional information gained from a caregiver as a means to evaluate strange situations [17]. This phenomenon applies to anxiety as well. de Rosnay et al. [18] showed how the impact of an infant viewing a socially anxious interaction between his/her mother and a stranger, carried forward to his/her own interactions with that stranger.

Toddlers (1–3 years old), on the other hand, seem to suffer from social isolation and independence restrictions. Limited experience and inadequate knowledge of health care systems can add to a child's feelings of anxiety and fear resulting in an increased vulnerability to the stress of surgery [8,14,19]. Preschool children (3–5 years old) cannot use abstract logical thinking [20]. They have a limited concept of time, express fantastical beliefs [21], and may perceive hospitalisation as a punishment for wrong-doing [14].

Common hospital-related stressors at this age include painful procedures, immobilisation and separation from parents [21]. Sensitization of children with previous hospital experiences is often found in younger children and seems to decrease with age [22]. School-age children (6–10 years old) have improved language skills, increased logical thinking and improved perspective taking abilities [23,24]. These abilities result in the school-aged child experiencing different stressors in a more realistic way. Important issues for those children are their worries relating to the disease, the separation from peers and from families members [21,25]. Adolescents, on the other hand, demonstrate abstract thinking and can fully understand how their body is functioning, the nature of their problems and the reasons for invasive procedures [22]. They need more privacy and more independence. Common concerns for adolescents include fear of waking during the procedure, pain, and the possibility of death. Fear of loss of control is extremely important to adolescents and can lead to anxiety or distress [26,27].

Children face hospital-related stressors with different types of coping strategies. A form of adaptation, coping is, in fact, flexible and develops through the lifespan as a joint function of personality and environmental characteristics [28]. Children develop their abilities to cope with fear and stress in several ways, which can be summarized in the following way: while children younger than four years usually present a prevalence of distraction strategies [29], as they grow, coping shifts to cognitive-based and emotion-focused coping [30,31]. From age four and up, children also present a good ability to regulate the coping response, according to the stressful situation [29], and to use play as a means to anticipate what is going to happen [32]. From age 6 and up, emotion-focused forms of coping improve [33–35] together with age-related problem solving ability [29]. Another trend increasing with age is the ability to seek social support and to shift from seeking parent-centred help to peer support, especially for emotional problems [36].

In the last two decades there has been an increase in attention on the psychological aspects related to patient well-being [37], children's preoperative anxiety (CPA) and parental anxiety [4]. The response has been that many hospitals have designed new programmes that prepare children for medical procedures that require anaesthesia [9]. As noted by Hodges et al. [38], a great deal of confusion exists around the term *psycho-educational intervention* and this is merely due to the lack of a clear definition. On the other hand, when assessing interventions that involve the psychological or educational sphere, embracing a linear cause–effect and context-independent medical model often leads to insufficient or incomplete explanations of the observed phenomena [39]. A solution to this problem is suggested by Gutkin and Curtis [40], who affirm that in psychology the fundamental unit of analysis should be the interaction between internal states of the person and external environments. According to Bronfenbrenner's theory [41], such interaction can be effectively appreciated with the analysis of roles, relationships and activities occurring within a microsystem. In coherence with the above-mentioned propositions, throughout this paper we will consider a psycho-educational intervention as any type of action aimed at purposely modifying roles, activities or relationships of the different actors present in a given environment. In a medical setting, such interventions may be shaped in many different ways, such as providing information, medical play, distractive techniques, and parental presence, and also changing organisational and communication routines in order to better adapt to children's and families' needs.

Numerous studies in children's healthcare discuss the beneficial effects of psycho-educational interventions. The aim of these interventions are many, for example, reduce child and parental anxiety, improve patient coping and cooperation during medical procedures, enhance postoperative recovery, increase patients' self-control and enhance the relationship between patients, families and health care providers [22]. One important mediating factor in the management of the child's anxiety appears to be parental presence at time of anaesthesia induction. The rationale for allowing parents to assist during induction is that the presence of a trusted family member, whom children believe to be a source of protection, guidance, and encouragement, may help alleviate fear and feelings of anxiety and gives the child a feeling of familiarity, even if he is in an unfamiliar environment and surrounded by strangers [42]. Additionally, parents usually have a better knowledge of the child's responses and preferred coping style [43]. The presence of a consistent, responsive, and empathic caregiver ensures psychological holding of the child and eases adaptation to the unknown environment [44].

The present review synthesizes research on interventions based on the psycho-educational preparation of children designed to reduce CPA. In the process, the present review underlines what these interventions are, what the contribution of each intervention is, as well as the methodologies and research design and assessment tools used in them.

2. Method

2.1. Eligibility criteria

Clinical studies analysing different educational and/or psychological interventions for the preparation of children to undergo

anaesthesia and for the reduction of related anxiety were included. Participants between 1 month and 14 years of age receiving anaesthesia in a clinical setting were considered. Any type of educational or psychological intervention was considered for this review (i.e. clown or music therapy, distraction, parental presence at time of induction, informational intervention). The aim of these programmes could differ (e.g. reduced anxiety, improved perceived quality of care, patient and family empowerment). Clinical trials comparing only differing pharmaceutical interventions were excluded. Studies aimed at the preparation of children for a medical procedure not necessary involving anaesthesia were excluded. Because the aim of this study was also to account for different assessment methods used, no limitation was imposed on the outcome measures used in the studies.

2.2. Search

Articles were searched in Academic Search Premier, OvidSP, ISI Web of Science, and PsycINFO. These databases were selected because they include studies from multiple scientific disciplines relevant to the investigated topic (e.g. nursing and medical sciences, psychology, sociology, education, anthropology). The selected articles were all written in English. In order to account for dramatic changes in hospitalization practices and anaesthetic procedures during the last two decades, articles published between January 1990 and January 2015 were selected. The keywords 'children', 'preoperative anxiety', 'premedication', 'hospitalization', 'anaesthesia', 'induction', 'surgery', 'preoperative program', 'preoperative preparation', 'preoperative intervention', 'hypnosis' were used alone and in Boolean combinations. All USA and UK English variations of search terms were used. This search was extended by manually adding relevant articles presented in the reference section of those articles found using the above keyword search.

3. Findings

The initial keyword search generated 293 articles and 26 more were added through references inspection (Fig. 1). The screening of titles and abstracts and the elimination of duplicates resulted in 51 articles that were read and evaluated. Ultimately, 45 articles were found to be relevant to the research question and the above-mentioned eligibility criteria and were included in this review. These studies were independently assessed by the two authors and when the authors diverged in their assessment, consensus was reached by discussion.

Psycho-educational interventions for reducing CPA were divided into 3 main categories: preoperative preparation programmes, distractive techniques and parental presence (Table 1). Category assignment was based on what was explicitly written in the article or because it was inferred by the present authors reading of the described intervention.

Intervention categories reflect different theoretical and practical approaches and have been used to organise the review table (Supplementary Table S1).

A critical analysis was performed on the selected articles, following the PRISMA method [45], which provides both a structure and a process for systematically reviewing scientific literature. In order to create a proper data set to allow comparison and evaluation of the reviewed articles, two tables were created. Supplementary Table S2 is organised following the STROBE criteria [46] as suggested by Moher et al. [45]. STROBE is a widely used standard created to improve the quality of reporting observational studies. It provides general reporting recommendations in the form of a checklist. Table 2 is created in order to assess other important psychological, pedagogical and organisational issues in the preparation of the patient for anaesthetisation.

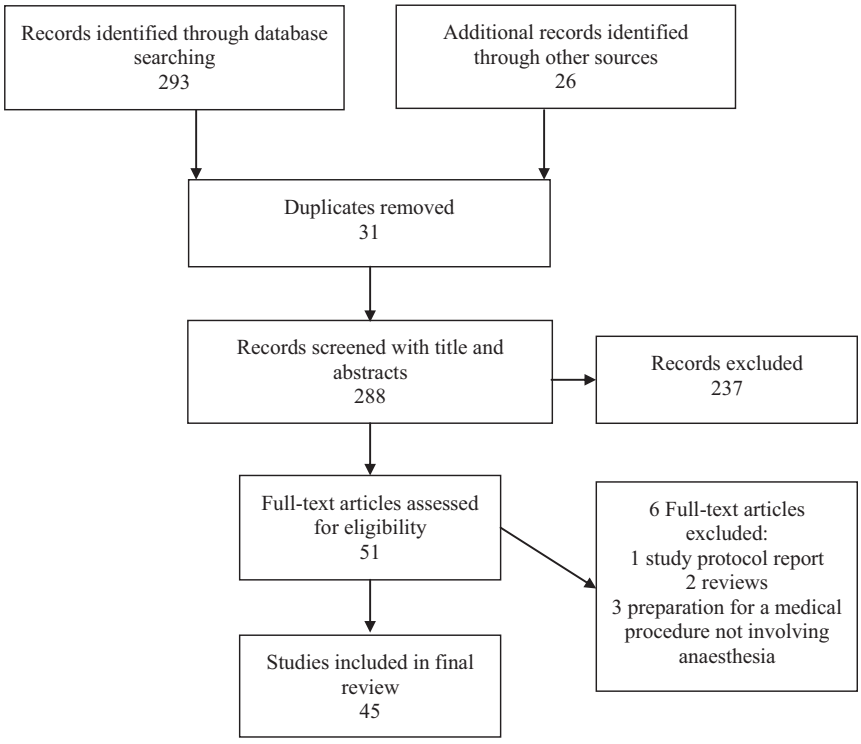

Fig. 1. Flow scheme of inclusion process (PRISMA guidelines) [45].

Table 1
Psycho-educational interventions categories in the reduction of preoperative anxiety in children.

Intervent. type	# Articles	Aim	Sub category (# articles)	Description	Rationale
Preoperative preparation programmes (PPP)	22	Reducing preoperative anxiety by giving information and teaching children coping skills to manage stress or anxiety	Preoperative preparation run at the hospital (19). Family-centred preparation program (3), of which one is run at home by parents	Children (and sometimes parents) are given a verbal, written or multimedia description of the procedure and are told what to expect; a video or a comic book is sometimes used to present the anaesthesia procedure. Play activities with medical equipment and peer-modelling are often used to prepare the subject to the use of specific instruments (e.g. breathing mask, oximeter). A tour of the relevant hospital rooms (e.g. pre-anaesthesia, recovery) may be given. Relaxation techniques and coping skills are taught children for managing stress	The main background is the theory of stress and coping [88]. Coping refers the cognitive, emotional, and behavioural response used to deal with stressful situations. Providing relevant information to children and teaching them coping skills, allows them to process, prepare for and understand the anaesthesia induction procedure gaining a sense of mastery over the stressful event
Distractive techniques (DT)	12	Redirecting child's attention from the stressful event to relaxing or entertaining stimuli	Self-administered tools such as toys, watch TV, videogame (5). Clown-based programmes (5). Music-based programmes (1). Hypnosis (1)	Children are exposed to distracting stimuli such as videogames, toys, cartoons, clowns, and music or even virtual reality glasses. This draws their attention away from the stressful environment	Engaging children's attention with distractions allows them to escape from what is happening, forgetting the surrounding, and refocusing attention on positive stimuli
Parental presence (PP)	11	Reducing anxiety-allowing parent to accompany their children during the anaesthesia induction		Parents accompany their children during anaesthesia induction and comfort them during the procedure as they fall asleep	Informed and calm parents can help children deal with stressful situations connected to the anaesthetisation, reinforcing their internal coping strategies. According to the Theory of Attachment [89,90], parents are considered the primary source of affection for the child and the best option for comforting during distress. Parents act as mediator for emotion regulation of the stressed child. This in turns empowers the child's coping abilities

3.1. Preoperative preparation programmes

Twenty-two studies (49%) were categorized as preoperative preparation programmes (PPP).

The therapeutic effects of PPP have been attributed to cognitive and physiological responses, including decreased pain due to muscle relaxation, habituation of body sensations, distraction, altered perception of the event, increased positive reinforcement, and enhanced sense of internal locus of control [22]. Today, the majority of these programmes aim to reduce CPA by giving information to children and actively involving parents, enabling them to anticipate events both on a cognitive and a behavioural level, facilitating the child's and parents' understanding, sense of control, and active coping.

Nineteen of the reviewed programmes were delivered by hospital personnel that provided in situ information about what to expect from the hospitalization experience, while the remaining three studies actively involved the family in this process. PPP run at the hospital employed different tools like videos, books, photo files, pamphlets, and it usually provided an orientation tour of the operating room (OR) and the recovery area, where medical equipment pertaining to the planned surgery was presented and demonstrated, either directly or through adult-initiated medical play. This kind of play activity provides children with the opportunity to play with and explore medical topics and equipment they are likely to experience when undergoing anaesthetisation [47]. The aim of such kind of play is to allow the child to become familiar with medical components and, therefore, experience less anxieties, fears, and misconceptions during upcoming medical procedures [48,49].

Three studies were classified as Family-centred preparation programmes because they emphasized the importance of the parent as a mediator in the child's preparation. In two separate studies, Kain and co-workers [50,51] adopted a family-centred program called ADVANCE (anxiety-reduction, distraction, video modelling and education, Adding parents, No excessive reassurance, coaching and exposure/shaping). Parents were instructed how to help their children during hospitalization, how to distract them before and during anaesthesia induction and how to use the induction mask kit to let the children become familiar with the induction process. The ADVANCE program has been found to have a positive effect in reducing the incidence of postoperative delirium, shortened discharge time and reduced analgesics use post surgery in comparison with the ordinary use of midazolam or with a simple use of parental presence. One of the Family-centred preparation programmes was home-based and was usually run one week before surgery [52]. In this program, parents received a video and an auxiliary workbook to be used at home. The video showed a 5-year old boy who was is in hospital for an inguinal hernia and the auxiliary workbook presented guidelines and exercises for preparing the child at home.

3.2. Distractive techniques

Twelve studies (27%) examined the effects of distractive techniques (DT) on CPA. DT attempt to reduce CPA by diverting children's attention to other pleasant stimuli. Five studies used self-administered tools to draw children's attention away from medical procedures. Some self-administered tools employ standard and predetermined stimuli like video games or cartoons,

while others present more unstructured stimuli, such as a toy or a playroom, where the child is free to self-determine in detail how to exploit the stimuli. Golden et al. [53] found that giving a toy before the anaesthesia induction is an easy, safe and economical way of reducing CPA and may reduce the dose of midazolam necessary to decrease anxiety. Similar results were reported by Patel et al. [54] who investigated the use of an hand-held videogame in the holding area and by Lee et al. [55] who reported that children who watched animated cartoons in the waiting areas had significantly lower anxiety scores than those in the control group. According to Lee et al. [55], waiting areas that are equipped with toys, games, and other compelling activities help the children refocus their attention and decrease stress during the waiting periods.

Clowns were used as a means of distraction in five studies. Hospital clowns attempt to give children a joyful experience, by stimulating healthy emotions and by mitigating adverse effects of a hospital stay [56]. In general Clown-based programmes appear to positively affect children's anxiety levels, but there are some unresolved issues. None of the five reviewed studies about clown-based programmes gave specific details of the distraction activity presented. Vagnoli et al. [57] reported that even if the majority of the medical staff recognized the effectiveness of this technique (78%), only a fraction were in favour of continuing the activity (28%) because it was believed that the presence of the clown interfered with the work of the medical practitioners. The authors conclude that medical personnel could be better informed regarding the benefits of the therapy. Golan et al. [58] found that when the anaesthetic mask was applied to the child's face, their anxiety levels were higher when accompanied by the clown than those children receiving oral midazolam or no intervention.

Music-based programmes have also been studied and used in treating anxiety in hospitalized patients. A study by Kain et al. [59], involved a complex, interactive music therapy session whose aim was to reduce children's preoperative anxiety through a process the authors described as "emotional projection" of feelings into stimuli and situations presented through song that allowed physical release by playing of instruments or making physical movements to music. This study did not prove the efficacy of music therapy as children who were treated with midazolam at anaesthesia induction were significantly less anxious than children in the music therapy and control groups. However, the authors found a "therapist effect" such that the music therapist and not the therapy was the key factor in reducing anxiety. The authors concluded that the intervention is quite expensive and recommends future research to identify the population that may benefit from music therapy. One study also investigated the use of hypnosis [60]. Hypnosis is defined as an altered state of consciousness characterised by concentrated but focused attention. The hypnotic intervention was carried out 30 min before surgery by the anaesthesiologist who would come in the child's room and establish a 'hypnotic relation' taking into account some of the child's personal belongings in the room and talking about the child's fear or favourite games. The hypnotic state was then maintained until the induction of anaesthesia. The authors found this intervention more effective than midazolam for preoperative anxiety.

3.3. Parental presence

Eleven studies (24%) report on the effect of parental presence (PP) during anaesthesia induction. These studies give a poor description of the specific tasks or roles parents may have during this step. During this intervention parents are usually informed about the procedure and then are allowed to accompany their child into the OR, comforting him while he falls asleep during anaesthesia induction [15,61]. Following induction, the parent is escorted back into the waiting room by a nurse or a child life therapist [62]. When an infant is being operating, parents may be allow to hold him during induction [61,62]. This group of studies often presents heterogeneous and inconclusive results. Some studies have found that children benefit from PP (e.g. [63,64]), although that benefit was only with specific cohorts, i.e. children older than 4 years, children who have a low baseline activity level as assessed by temperament, and children with parents who had a low trait anxiety (e.g. [3]). Other studies have found that PP does not positively affect child's anxiety (e.g. [61,65,66]).

One of the main variables determining PP's effectiveness is the parent's anxiety level. Letting an overly anxious parent into the OR not only does not benefit an anxious child but also actually increases anxiety in a calm child [64]. In a study by Bevan et al. [65], children accompanied into the OR by parents who in the waiting area had resulted extremely anxious (VAS = 77.2 ± 16.7), turned out to be more upset than those having a calm parent (VAS = 15.9 ± 12.6). Additionally, the high level of preoperative parental anxiety was reflected in the child's negative behaviour and fears one week after operation. The presence of calm parents, according to Bevan et al. [65], Palermo et al. [61] and Wright et al. [66], seems to have no impact on children's anxiety, while Messeri et al. [63] and Kain et al. [64] found PP to be to be beneficial for the child.

The relationship between PP, premedication and the reduction of CPA is not clear. Kain et al. [3] found that PP does not extend the duration of induction, nor prolong the time to discharge, has not effect on the use of postoperative analgesic and does not influence postoperative nausea and vomiting. According to the authors, premedication with midazolam was significantly more effective in reducing CPA. In subsequent research, Kain et al. [15] found that combining midazolam with PP was not better at reducing CPA than midazolam alone, while Messeri et al. [63] found that adding midazolam to PP was not better at reducing CPA than PP alone. Just to make matters even less clear Arai et al. [62] found that PP at anaesthesia induction enhances the effects of midazolam on child behaviour at emergence from anaesthesia. Children of all ages do not benefit equally from parental presence at anaesthesia induction. Kain et al. [3] found that children under 4 years of age were more anxious during induction in the presence of their parent than children who were alone. The group of children who benefited the most from PP at induction were those older than 4 years of age, with a low level of activity and with a parent with low trait level anxiety.

When parental self-efficacy has been assessed, studies generally report that parents wish to accompany the child into the OR when offered this option and report that they helped their child post-surgery [67]. Anaesthesiologists, however, have differing views regarding the value of PP during induction. In a study by Kain et al. [15], 68% of parents believed that their presence had made the anaesthetists' job easier, while the majority of anaesthesiologists believed that parents had either no effect (38%) or made the job more difficult (21%).

4. Discussion and conclusion

4.1. Discussion

Each intervention type has its own benefits and limits. Anxiety and behavioural reactions relating to anaesthesia induction have a composite and multifactorial origin [3]. The plethora of variables at play in the process make it difficult to isolate accurately single mediating factors, which can be comparatively reviewed in Supplementary Table S2 and Table 2. At a general level, some methodological aspects can be noted from these two tables.

Table 2
Overview of additional relevant qualitative and quantitative aspects.

Authors (date)	Bevan et al. (1990)	Kain et al. (1996a)	Kain et al. (1996b)	Kain et al. (1998a)	Kain, et al. (1998b)	(Margolis et al., 1998)	Hatava et al. (2000)	Zelikovsky et al. (2000)	Kain et al. (2000)
Reference #	[65]	[70]	[3]	[91]	[92]	[93]	[12]	[71]	[15]
Study #	1	2	3	4	5	6	7	8	9
Bioecological and educational variables									
(1) "Therapist" effect	0	0	1	0	0	0	0	0	0
(2) Parental psychological characteristcs	1	1	1	1	1	0	0	0	1
(2) Family culture	0	1	1	0	0	0	0	1	1
(3) Patient previous hospital experiences	0	1	1	1	0	1	1	0	1
(4) Adjustment based on children's age, gender	0	1	1	1	0	0	1	1	1
(5) Customisation based on child's preferences.	0	0	0	0	0	0	0	0	0
Research design and tools									
(6) Control Group	1	1	1	0	1	1	0	1	0
(7) Validated Tools	1	1	1	1	1	1	0	1	1
(8) Ad Hoc tools	0	0	0	0	0	0	1	0	1
Organisation of the intervention									
(9) Initial setup on the intervention (easy/medium/hard)	e*	h	h	h	h	m	e	h	h
(10) On going execution of intervention (easy/medium/hard)	e*	m*	m*	m*	m*	h*	m*	m*	m*
(11) N of sbj actively involved in intervention	P	1*	P	1*	P	1	2	2	P
(12) Intervention organisation burdens on hospital staff	0	1§	1	1§	1§	1	1	1	1§
(13) Intervention execution burdens on hospital staff	1	1§	1	1§	1§	1	1	1	1§
(14) Intervention requires extra staff	0	0	0	0	0	0	0	0	0
(15) Equipment involved[a]	x	me	me	ma me	me	b	me	me	me
(16) Location[b]	H	H	H	H	H	hm	H	H	H
(17) Time of intervention before surgery	30m*	1d-10d	1w	1d-10d	2-7d	1-3d	1d	1h*	1-7d
(18) Duration of the preparation	15m*	1h*	15m*	40m	15m*	£	1h*	1h	1h*
Evaluation									
(19) Parent's perception	1	0	1	0	1	1	0	0	1
(20) Children's perception	0	0	0	0	0	0	0	0	0
(21) Physician's perception	0	0	1	0	0	0	0	0	0
(22) Nurses perception	0	0	0	0	0	0	0	0	0
(23) Actor of the intervention perception ("therapist")	0	0	0	0	0	0	0	0	0
(24) Parent physiologic measure	0	0	1	1	0	0	0	0	0
(25) Child physiologic measure	0	0	1	1	0	0	0	0	0
(26) Parent psychological measure	1	1	1	1	1	0	1	0	1
(27) Child psychological measure	1	1	1	1	1	1	1	1	1

Authors (date)	Palermo et al. (2000)	Felder-Puig et al. (2003)	Kain et al. (2004)	Messeri et al. (2004)	Campbell et al. (2005)	Vagnoli et al. (2005)	Caldwell-Andrews et al. (2005)	Calipel et al. (2005)	Golden et al. (2006)
Reference #	[61]	[13]	[59]	[63]	[94]	[57]	[67]	[60]	[53]
Study #	10	11	12	13	14	15	16	17	18
Bioecological and educational variables									
(1) "Therapist" effect	0	0	1	0	0	1	0	1	0
(2) Parental psychological characteristcs	1	1	1	1	0	1	1	0	0
(2) Family culture	1	1	1	0	0	1	1	0	0
(3) Patient previous hospital experiences	0	1	1	0	0	0	1	0	0
(4) Adjustment based on children's age, gender	0	1	0	0	1	0	0	0	0
(5) Customisation based on child's preferences.	0	0	0	0	0	0	0	0	0
Research design and tools									
(6) Control Group	1	1	1	0	1	1	0	1	1
(7) Validated Tools	1	1	1	1	1	1	1	1	1
(8) Ad Hoc tools	0	1	0	1	0	1	0	0	0
Organisation of the intervention									
(9) Initial setup on the intervention (easy/medium/hard)	e	h*	m*	h	m*	e*	h	e*	e*
(10) On going execution of intervention (easy/medium/hard)	e*	h*	m*	e*	e*	e*	e*	m*	e*
(11) N of sbj actively involved in intervention	P	1	2	P	0	2	P	4	1

Table 2 (*Continued*)

Authors (date)	Palermo et al. (2000)	Felder-Puig et al. (2003)	Kain et al. (2004)	Messeri et al. (2004)	Campbell et al. (2005)	Vagnoli et al. (2005)	Caldwell-Andrews et al. (2005)	Calipel et al. (2005)	Golden et al. (2006)
(12) Intervention organisation burdens on hospital staff	0	1	0	1	1	0	1	0	1
(13) Intervention execution burdens on hospital staff	1	1	1	1	1	1	1	1	1
(14) Intervention requires extra staff	0	0	1	0	0	1	0	0	0
(15) Equipment involved[a]	x	b	m	x	ma	x	x	Hp	t
(16) Location[b]	H	H	H	H	H	H	H	H	H
(17) Time of intervention before surgery	30m*	1d	1h*	30m*	1h*	30m*	30m*	30m	30m*
(18) Duration of the preparation	15m*	30m*	25m*	15m*	30m*	15m	15m*	15m*	8m
Evaluation									
(19) Parent's perception	1	0	0	1	0	0	0	0	0
(20) Children's perception	0	0	0	1	0	0	0	0	0
(21) Physician's perception	0	0	0	0	0	1	0	0	0
(22) Nurses perception	0	0	0	0	0	1	0	0	0
(23) Actor of the intervention perception ("therapist")	0	0	0	0	0	1	0	0	0
(24) Parent physiologic measure	0	0	0	0	0	0	0	0	0
(25) Child physiologic measure	0	0	0	0	0	0	0	0	0
(26) Parent psychological measure	1	1	1	1	0	1	1	0	0
(27) Child psychological measure	1	1	1	1	1	1	1	1	1

Authors (date)	Patel et al. (2006)	Kain et al. (2006)	Li et al. (2007)	Kain et al. (2007)	Arai et al. (2007)	(Li & Lopez, 2008)	MacLaren & Kain (2008)	Golan et al. (2009)	(Karabulut & Arıkan, 2009)
Reference #	[54]	[64]	[95]	[50]	[62]	[96]	[72]	[58]	[97]
Study #	19	20	21	22	23	24	25	26	27
Bioecological and educational variables									
(1) "Therapist" effect	0	0	0	0	0	0	0	0	0
(2) Parental psychological characteristcs	0	1	0	1	0	1	1	0	1
(2) Family culture	0	1	0	1	0	1	1	0	1
(3) Patient previous hospital experiences	1	1	0	1	0	0	1	0	1
(4) Adjustment based on children's age, gender	0	0	0	0	0	1	0	0	0
(5) Customisation based on child's preferences.	1	0	0	0	0	0	0	0	0
Research design and tools									
(6) Control Group	1	1	1	1	0	1	1	1	1
(7) Validated Tools	1	1	1	1	1	1	1	1	1
(8) Ad Hoc tools	0	0	0	0	0	0	0	0	1
Organisation of the intervention									
(9) Initial setup on the intervention (easy/medium/hard)	e*	e*	h	h	e*	h	e	e*	e
(10) On going execution of intervention (easy/medium/hard)	e*	e*	m*	m*	e*	m*	m*	e*	m*
(11) N of sbj actively involved in intervention	0	P	2	3	P	1	1	2	1
(12) Intervention organisation burdens on hospital staff	1	0	1	1§	0	1	0	0	0
(13) Intervention execution burdens on hospital staff	1	1	1	1§	1	1	0	0	0
(14) Intervention requires extra staff	0	0	0	0	0	0	0	1	0
(15) Equipment involved[a]	ma	x	me	b t ma me	x	ma me	me	x	ma* b*
(16) Location[b]	H	H	H	hm	H	H	H	H	H
(17) Time of intervention before surgery	30m*	30m*	1w	2-7d	30m*	1w	1h*	30m*	1d
(18) Duration of the preparation	20m	15m*	1h	20m	15m*	1h	40m*	20-30m	20m*
Evaluation									
(19) Parent's perception	0	0	0	0	0	1	0	0	0
(20) Children's perception	0	0	0	0	0	0	0	0	0
(21) Physician's perception	0	0	0	0	0	0	0	0	0
(22) Nurses perception	0	0	0	0	0	0	0	0	0
(23) Actor of the intervention perception ("therapist")	0	0	0	0	0	0	0	0	0
(24) Parent physiologic measure	0	0	0	0	0	0	0	0	0
(25) Child physiologic measure	0	0	0	0	1	0	0	0	0
(26) Parent psychological measure	0	1	0	1	0	1	1	1	1
(27) Child psychological measure	1	1	1	1	1	1	1	1	1

Authors (date)	Wakimizu et al. (2009)	(Fernandes & Arriaga, 2010)	(Hosseinpour & Memarzadeh, 2010)	Vagnoli et al. (2010)	Wright et al. (2010)	Fortier et al. (2011)]	Vaezzadeh et al. (2011)]	Fincher et al. (2012)	Lee et al. (2012)
Reference #	[52]	[98]	[99]	[100]	[66]	[51]	[73]	[101]	[55]
Study #	28	29	30	31	32	33	34	35	36
Bioecological and educational variables									
(1) "Therapist" effect	0	1	0	0	0	0	0	0	0
(2) Parental psychological characteristcs	1	1	0	1	0	1	0	1	0
(2) Family culture	1	1	0	1	1	1	0	0	0
(3) Patient previous hospital experiences	1	1	0	0	1	1	0	0	0
(4) Adjustment based on children's age, gender	0	1	0	0	0	0	1	1	0
(5) Customisation based on child's preferences	0	0	0	0	0	0	0	0	1
Research design and tools									
(6) Control Group	1	1	1	1	1	0	1	1	1
(7) Validated Tools	1	1	1	1	1	1	1	1	1
(8) Ad Hoc tools	1	0	0	0	0	1	0	0	0
Organisation of the intervention									
(9) Initial setup on the intervention (easy/medium/hard)	h	e*	e	e	h	h	e	h	e
(10) On going execution of intervention (easy/medium/hard)	h*	e*	m*	e*	e*	m*	m*	h*	e*
(11) N of sbj actively involved in intervention	1	3	1*	3	P	3	1	2	0
(12) Intervention organisation burdens on hospital staff	0	0	1	0	0	1§	1	1§	1
(13) Intervention execution burdens on hospital staff	1	0	1	1	0	1§	1	1§	1
(14) Intervention requires extra staff	0	1	0	1	0	0	0	0	0
(15) Equipment involved[a]	ma b	x	t ma	x	x	ma b t	me	ma me	ma
(16) Location[b]	hm	H	H	H	H	hm&H	H	H	H
(17) Time of intervention before surgery	1w	30m*	30m	30m*	90m	2-7d	1d	1-10d	1d
(18) Duration of the preparation	£	15m	30m	15m	15m*	20m	1h	1h	15m*
Evaluation									
(19) Parent's perception	1	0	0	0	0	0	0	0	0
(20) Children's perception	0	0	0	0	0	0	0	0	0
(21) Physician's perception	0	1	0	0	0	0	0	0	0
(22) Nurses perception	0	1	0	0	0	0	0	0	0
(23) Actor of the intervention perception ("therapist")	0	0	0	0	0	0	0	0	0
(24) Parent physiologic measure	0	0	0	0	0	0	0	0	0
(25) Child physiologic measure	0	0	0	0	0	0	0	0	0
(26) Parent psychological measure	1	1	0	1	0	1	0	1	0
(27) Child psychological measure	1	1	1	1	1	1	1	1	1

Authors (date)	(Cuzzocrea et al., 2013)	(Kerimoglu et al., 2013)	(Lee et al., 2013)	Tunney & Boore, (2013)	(Dionigi et al., 2014)	(Fernandes et al., 2014)	(Karimi et al., 2014)	(Rasti et al., 2014)	(He et al., 2015)
Reference #	[102]	[103]	[104]	[105]	[106]	[107]	[108]	[109]	[110]
Study #	37	38	39	40	41	42	43	44	45
Bioecological and educational variables									
(1) "Therapist" effect	0	0	0	0	0	0	0	0	0
(2) Parental psychological characteristcs	1	0	0	0	1	1	0	0	1
(2) Family culture	0	0	0	0	0	1	0	1	1
(3) Patient previous hospital experiences	0	0	0	0	0	1	1	0	0
(4) Adjustment based on children's age, gender	0	0	0	1	1	0	0	0	0
(5) Customisation based on child's preferences.	0	0	1	0	0	1	0	0	0
Research design and tools									
(6) Control Group	0	0	0	1	1	1	1	1	1
(7) Validated Tools	1	1	1	1	1	1	1	1	1
(8) Ad Hoc tools	1	0	0	0	0	0	0	0	0
Organisation of the intervention									
(9) Initial setup on the intervention (easy/medium/hard)	e	e*	e	h*	e	e	e*	e	h
	m*	e*	e*	h*	e*	e*	m*	e*	m*

Table 2 (*Continued*)

Authors (date)	(Cuzzocrea et al., 2013)	(Kerimoglu et al., 2013)	(Lee et al., 2013)	Tunney & Boore, (2013)	(Dionigi et al., 2014)	(Fernandes et al., 2014)	(Karimi et al., 2014)	(Rasti et al., 2014)	(He et al., 2015)
(10) On going execution of intervention (easy/medium/hard)									
(11) N of sbj actively involved in intervention	1	0	0	2	2	0	1	P	1
(12) Intervention organisation burdens on hospital staff	1	1	1	0	1	1	1	0	0
(13) Intervention execution burdens on hospital staff	1	1	1	0	1	1	1	0	0
(14) Intervention requires extra staff	0	0	0	0	1	0	0	0	0
(15) Equipment involved[a]	ma me	vg ma	ma	b	x	ma	d	x	ma me
(16) Location[b]	H	H	H	hm&H	H	H	H	H	h/hm
(17) Time of intervention before surgery	1d	30m*	1d	1w*	30m*	30m*	1h*	1h*	3-7d
(18) Duration of the preparation	30m	15m	10m*	30m*	15m*	15m	30m*	15m*	1h
Evaluation									
(19) Parent's perception	1	0	1	0	0	0	0	0	0
(20) Children's perception	0	0	1	1	0	0	0	0	0
(21) Physician's perception	0	0	0	0	0	0	0	0	0
(22) Nurses perception	0	0	0	0	0	0	0	0	0
(23) Actor of the intervention perception ("therapist")	0	0	0	0	0	0	0	0	0
(24) Parent physiologic measure	0	0	0	0	0	0	0	0	0
(25) Child physiologic measure	0	1	0	0	0	1	0	0	0
(26) Parent psychological measure	1	0	0	0	1	1	0	0	0
(27) Child psychological measure	1	1	1	1	1	1	1	1	1

* = This value was not indicated in the paper and has been extimated by the present authors; § = the activity is run by a child life specialist. £ = duration of the intervention is set by the child himself. Setup and execution of the intervention: "e" = easy, "m" = medium, "h" = hard. P = Parent was involved in the intervention.
[a]Equipment: "x" = No equipement indicated but an extra person was present (parent or clown). "me" = medical equipment (medical play). "ma" = multimedia application such as video player, computer, cartoon, video game, photo file. "b" = booklet or pamphlet. "t" = toys. "vg" = video glasses. "d" = drawing set. "Hp" = hypnosys. "m" = music.
[b]Location "H" = hospital. "hm" = home. "hm/H" = home or hospital. "hm&H" = both home and hospital.

First, 90% of the presented studies employ validated tools, as can be seen from Table 2. Additionally, as can be seen in Supplementary Table S1, all the reported studies present a satisfactory introduction and key methodological description, with only one study failing to give account of the study size and two studies failing to fully present the statistical method employed. In addition, the presentation of the results reach the STROBE standard [46] in a large majority of cases. Some more in-depth analysis of data is presented by 26 studies. In terms of the discussion of the results, limitation of the study is discussed only in 29 studies, and only 25 of them address generalizability issues.

Secondly, as can be seen in Table 2, psychometrical accuracy is not accompanied by the same level of precision in the presentation and evaluation of more educational and individual variables. It seems as if the method to reduce anxiety and prepare children for an operation has been evaluated objectively, but not as a multifactorial intervention subject to different subjective interpretations. This has led researchers to neglect some bioecological and personal variables that should be considered when running a psycho-educational activity [41]. Those subjective variables are cultural, contextual, or individual perception of the intervention and should include different actors such as parents, ill children, nurses, doctors, and those actively in charge of running the intervention. Some characteristics of each of the three types of the Psycho-educational preparation methods are discussed below in more detail.

Preoperative preparation programmes represent half of the reviewed articles. Some programmes show that when parents are properly informed and involved in the caring process of their children, they become more emotionally available for them. However, as shown by several reviewed studies, specific family differences at play are quite diverse and include culture, rules of affect and emotional display, assertiveness, and ability to ask for information from the medical team. Only the role of parent's anxiety has been extensively investigated as a moderating factor so far. Preoperative preparation should begin with the assessment of the child and parents' current level of understanding of planned procedures and of their emotional response to them. Several other dimensions should then be evaluated, such as the child's developmental level and the coping style, the patient and parents' understanding of the medical condition and planned procedures [68–70]. This is also related to the current emotional, cognitive, and physical symptoms of the patients, as well as previous hospital experiences. Children familiarized with hospitalization may benefit the most from preparations that includes not only procedural information but also coping skills training like relaxation exercises [22,71]. For preschool children (3–5 years old), picture books explaining surgery and medical play kits are generally considered good tools for promoting understanding. Medical play accompanied with a simple and reassuring language represents a valid way to allow the child to express anxiety and to become familiar with the equipment that will be used during their hospitalization [72]. Hospital tours, preoperative classes, and medical play showing surgical procedures can help school-age children (6–10 years old) understand the meaning and reasons for therapy [73]. Adolescents may benefit from viewing peer-modelling videotapes. They need to be actively involved in the decisional processes and need to feel listened to when expressing concerns or requests.

Another important aspect to be assessed is the method in which information is best processed by the patient and their caregivers (verbal, visual, written, sensory), together with the family composition and specific coping styles, which often appear to be linked with cultural aspects [74]. When stress and pain reach

their peak level, relaxation techniques and coping strategies can be used in combination with parents' active involvement. Another important factor to be taken into consideration when programming a preoperative preparation is timing. In younger children (3–5 years), anxiety levels are managed most effectively with preparation the night before surgery, whereas older children (5–12 years) respond optimally when the information is presented one week before surgery [70]. On the other hand, when time before surgery and the age of children allow this, preparatory materials can be sent directly at home [52]. This method is also accompanied by a high rate of satisfaction of the caregivers involved.

Distractive techniques may be self-administered by the child (e.g. videogame, watch TV, play with a toy) or may involve external personnel. Self administered techniques are free from effects deriving from an external actor performing the distraction and are either stable over contexts or are directly self-regulated by the child himself. Clowning and music therapy, on the other hand, require an external performer and in this case, the risk of a bias connected to the specific characteristics of the therapist should be assessed by the research.

The fact that clown-based programmes have not always been well received by practitioners and even parents may be due to the fact that the clown attitude is that of an order-breaker [75], and in some specific settings like an OR or a waiting area such an attitude may not be the most appropriate one. Additionally, the specific type of action performed by the clown is an important confounding variable. For instance, if a clown plays magic tricks or makes soap-bobbles then this becomes the distracting factor and one could question what is the effective need for the clown itself. The specific actions performed by clowns are not documented in the reviewed studies. These features need to be better investigated and documented in future research.

Music has been used in a variety of medical settings for issues including pain and anxiety management, cancer-related care, psychiatric problems, and stress reduction [59]. While the relaxing effects of music have been objectively observed with physiological measures [76], its effectiveness as a preoperative distraction technique has not been confirmed by the study reviewed here. The study by Kain et al. [59] proves that a therapist effect may well be present in music therapy and this kind of variable should be examined in other studies involving external actors. All these techniques requiring the support of an external practitioner (i.e. clowning, music therapy, adult-initiated hypnosis) impact on the staff and incurs organisational cost and, therefore, their deployment should be carefully evaluated. The success of these techniques heavily rely on the therapist's ability to perform. When they are also poorly explained on the report, a high degree of objectivity and reproducibility is lost.

As shown by Table 2, items 9–14, when a distraction technique is self-administered, it is usually associated with lower costs and represents an easy method to reduce anxiety at anaesthesia induction, especially when preparation time is limited. Such techniques may be used in combination with other interventions such as premedication, considering the evidences that a good distracting process may decrease the dose of drugs necessary to reduce CPA. For toddlers, modelling and/or distraction can often be used effectively [22,27]. Distraction techniques that require the interventions of additional personnel should be carefully evaluated, as the effectiveness of this extra organisational and economical cost has not been proven superior to one of the other self-administered tools presented here. When preparation time is limited, distraction techniques may be more effective than other methods [22].

Concerning parental presence, this type of intervention has not always proven to be beneficial. We believe that the great number of variables involved in the process call for a more systemically approach when evaluating experimental effects of PP on CPA. Future studies should offer a better description of the different tasks or roles parents may take during anaesthesia induction. "Parents" and "child" cannot be seen as a uniform variable. For instance the child's age, family culture, baseline anxiety levels of the child and parents, use of premedication, type of surgery, type of anaesthesia induction, and even experience and preferences of the anaesthetist have all been found to influence the outcome of PP [77]. A research study by Vessey et al. [78] specifically investigated parents' reaction to anaesthesia induction of the child. The most upsetting factors for parents were: separation from the child after induction; seeing the child becoming limp during induction; observing the child's distress prior to induction; and remembering past negative experiences. Mothers reported a higher degree of upset than fathers. Having a single child and being employed in health care correlated with greater upset. The anaesthetist's view of parental upset only correlated with maternal self-assessment. Another research on PP at time of induction shows that in terms of parental perceived self-efficacy parents usually believe their presence at time of induction to be helpful both to their child and to the anaesthesia care providers [79]. However more objective measures of parental anxiety show that this can affect not only parents' motivation but also their ability to be effective aids to their children [67].

4.2. Conclusion

When the WHO [80] view of health promotion is applied to young people in hospitals, it calls for better professional networking and a better understanding of the developmental needs of children [81], and requires the development of patient education interventions aimed to promote children's active health and empowerment [37].

The present review revealed that linear and univariate cause–effect research design often leads to inconclusive or partial results. This happens because all the individual variables such as child temperament and attachment style, family culture and socio economic status, attitudes of the medical caregivers, skills of the professionals in charge of the child's preparations, are often overlooked. A more systemic approach, for example Bronfenbrenner's bioecological theory and process–person–context–time (PPCT) model for conceptualizing integrated developmental system and designing research related to human development [41] could effectively guide future research. Future studies should focus on a better documentation of the activity involved in the preparation with a clear definition of roles, relationships, timing, and a clear description of the social and cultural context in which the activity is carried out. As outlined by Table 2, some aspects such as the account of a "therapist effect" and a better customisation of the intervention based on the child's preferences could be added in the future. In line with a narrative medicine approach, the report of more psychological perceptions of the preparation activity by different actors involved should be further developed.

4.3. Practice implications

Children's healthy functioning and resilience is related to their perception of care and involvement with their surrounding environment [82] as well as with a plethora of protecting factors at different systemic levels [83]. Today's health care practitioners cannot be focused only on the curing of an illness but need to adopt an holistic approach caring for paediatric patients. Increasing children's resilience is essential, in line with WHO recommendation that defines health as "A state of complete physical, mental, and social well-being not merely the absence of disease" [84].

The first main message therefore for practitioners is that preoperative preparation can and should be done for children. Anxiety reduction and coping with the stress related to the incumbent operation should be one of the therapeutic objectives of the hospital. Some of the reviewed studies showed that even the incidence of postoperative problems can be reduced with preoperative preparation.

Practitioners can choose from a plethora of different activities to prepare children undergoing anaesthesia and even their parents. Some of the activities presented here can also be combined, but it should be noted that too much information may also have a counter productive effect.

Education and proper preparation may contribute to transforming a potentially negative and harmful experience into a formative and empowering one. Good psycho-education preparation helps the child to gain sense of the experience and replaces a feeling of powerlessness with a sense of mastery, thanks to active and effective coping skills. The choice of the proper preparation should be guided by several criteria and is related to the objective of the preparation. While anxiety reduction is often the common ground, several other variables may appear. Is cost-control also a necessity? Does the hospital also need to monitor and improve parents' satisfaction and good perception of the care? Is there a need also to improve the child's perception of the procedure? Is there the need to choose a practice that is also well accepted by the practitioners? Each of these questions leads one to different preparation methods as documented in this review and the proper choice should be carefully considered given the context.

In order to properly set a psycho-educational preparation for anaesthesia, practitioner's assessment of the temperament, culture and psychological functioning of each individual child is crucial. Children have different ways of seeking information and expressing emotions; they may present with specific phobias and have different abilities for relieving anxiety through play and all these need to be assessed. This means that while active involvement of the child is always important, the preparation procedure should be tailored to the child's specific characteristics.

Indeed, family is the main learning and modelling source for children and has a great influence when educating them about the reasons for hospitalisation, how to face the medical procedures and how to deal with their emotional states. Therefore, the assessment of parental experiences, emotions, and attitudes should also be a part of routine preoperative paediatric evaluation. As suggested by Himes et al. [85], inexperienced and anxious parents could be managed with an education and information programme providing information about commonly experienced emotions during induction and offering reassurance about the procedure and the physical and emotional responses of the child. Other items that may be included in parent's instruction may be an overview on the sequence of the medical-related events in anticipation of the sensory experiences of the child. This kind of information may be given in situ by a practitioner or may be provided ahead of the operation with written material. Also, allowing parents to actively take part in the explanation of the procedures to the child through play techniques may be helpful, and this too can begin at home with the submission of preparation materials, such as a video link on the web and brochures and activity books to be completed together with the child. Information given to children should include the fact that anaesthesia is a very deep type of sleep in which you cannot feel anything, that the child will get the anaesthesia during the entire operation to make sure he/she stays asleep and that he/she will wake up only once the medicine has stopped, that the anaesthetist will stay with the child the entire time to monitor his/her sleep and to make sure he/she is comfortable, that nothing can be eaten or drunk before the operation, that one's parents will be with the child (or in a room near the child, depending on how the local hospital is organised) when he/she goes to sleep and when he/she wakes up [86].

The researches reviewed here show that parental participation at induction is still a controversial matter. Outcomes of such activity are heterogeneous and subject to great variance. Practitioners should therefore carefully evaluate the decision to allow parent to accompany children into the OR. This practice should be initiated only if there is a general consensus among the hospital staff, if a local organisation allows such activity to be easily conducted, and if parental involvement is a key objective of hospital care. In this case, to make parents more self-confident and, therefore, provide good support for their children, families should be offered adequate information on what the surgical experience will involve and how to behave [42]. For instance, parents could be encouraged to actively talk to their child during induction, read them their favourite story, talk about a favourite child's activity they are going to do when the operation is over, sing the child a lullaby, etc. With this kind of preparation, parents may participate in the anaesthesia induction in a manner that is beneficial not only for children but also for themselves.

In organisational terms, practitioners should be aware of the fact that preoperative preparation of a child involves teamwork and a complex caring system. It this therefore crucial that the whole ward's team of different professionals in charge of the child's care have a voice and feel committed in the development and implementation of the programme [87]. Especially, the opinions and comments of those professionals who would be affected by the changes in the routines should be heard. Interpersonal differences among professionals involved in the processes of anaesthetisation and keeping the child calm appear to represent an important and sometimes even significant mediating variable and yet they have seldom been investigated. Teamwork ensures that the new practice is subject to systematic, steady, and continuing application and evaluation.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.pec.2015.09.004.

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