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Non-pharmacological methods of reducing perioperative anxiety in children

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Learning objectives

By reading this article, you should be able to:

- Identify common non-pharmacological methods of reducing perioperative anxiety in children.
- Characterise the specific components of educational, behavioural, and complementary and alternative strategies that are effective in reducing anxiety.
- Explain the roles that healthcare providers, parents, and technology can play in implementing non-pharmacological techniques to reduce anxiety.

Key points

- Non-pharmacological methods are widely supported for use in reducing perioperative anxiety in children.
- Educational preparation for surgery helps children develop realistic and manageable expectations for their perioperative course.
- Targeting and developing successful coping behaviours in both children and parents contributes to better perioperative outcomes.
- Complementary and alternative medicine offers an array of potentially anxiety-reducing options that should be offered to families as available and appropriate.
- Advances in web-enabled technologies allow increased use and ease of access for existing non-pharmacological methods.

Millions of children undergo surgery annually in the United States alone, and the majority are at risk of significant anxiety throughout the pre-, intra-, and postoperative stages, known as perioperative anxiety.[1] Perioperative anxiety in paediatric patients is characterised by tension, irritability, and increased autonomic nervous system activity.[2] High levels of perioperative anxiety have been associated with a multitude of negative outcomes, including prolonged induction of anaesthesia, increased incidence of postoperative delirium, new onset negative postoperative behaviour changes related to anxiety, increased postoperative pain, and increased use of analgesics.[3] These outcomes can also translate into lower ratings for family experience and increased healthcare costs for families in the form of extended stays in recovery areas and increased need for postoperative care.

Given the high amount of surgery performed in children, reducing perioperative anxiety is critical to optimise outcomes for both child and parents. To this end, it is helpful to use a conceptual framework that places anxiety within the

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context of a patient's risk factors and outcomes (Fig. 1). Factors related to the patient, parents and healthcare providers, interventions, and treatments can all influence perioperative anxiety and related outcomes. Tailored treatment for perioperative anxiety that targets the predictors and outcomes most relevant to a patient can use either pharmacological or non-pharmacological methods, often in tandem. The use of anxiolytic premedication in particular is valuable for certain groups, but this subject has been covered recently in this journal.[4] This article focuses specifically on non-pharmacological approaches to reducing perioperative anxiety in children.

Non-pharmacological modalities comprise education, behavioural techniques, parental presence at induction of anaesthesia (PPIA), and complementary and alternative medicine (CAM) techniques, with each category including an array of effective strategies for reducing anxiety. These methods are cost-effective, minimally invasive, and carry a low risk for adverse effects, contributing to their continued and widespread implementation. Furthermore, recent strides to integrate Internet-based interventions and mobile health (mHealth) technology (i.e. tablets, cellular phones, and other web-enabled devices) as tools for reducing anxiety provide preliminary evidence that these modalities are received well by parents and are useful for the individual tailoring of treatment components.

Educational approaches

An educational approach to reducing perioperative anxiety consists of providing information and preparation relevant to a child's forthcoming surgical procedure. Preoperative preparation is a long-standing practice that was initially introduced not only to give patients and their families the opportunity to learn about the process of surgery, but also to

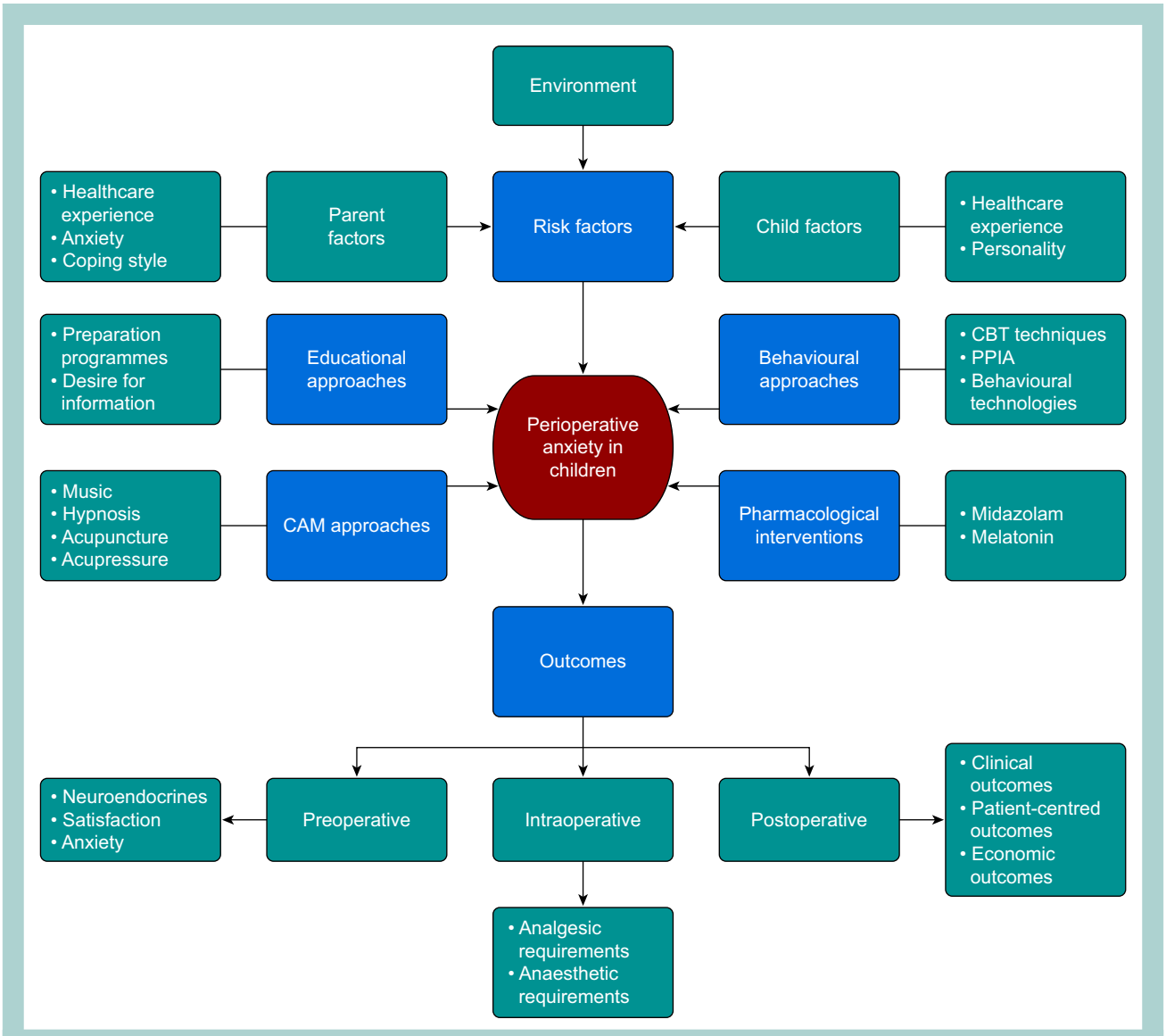

Fig 1 Model of predictors of perioperative anxiety, interventions, and outcomes.

build rapport with the healthcare providers when surgery would require a prolonged stay in the hospital.[5]

Preoperative education can address gaps in a patient's or family's understanding of procedures and outcomes, thus helping to calibrate their expectations for surgery and reduce anxiety. That is, with realistic and manageable expectations for the perioperative course, children can better prepare for and cope with both inpatient and outpatient surgeries. Further study is needed to identify the precise mechanisms by which these programmes reduce underlying anxiety, and for whom these programmes are most effective.

Educational preparation programmes often include a tour of the operating theatre and PACU, orientation to medical equipment and their functions, and descriptions or visual depictions of perioperative procedures. Such programmes are still currently used for both inpatient and outpatient surgical procedures. The relevance of educational methods is highlighted further by research indicating that children desire comprehensive perioperative information, including procedure- and outcome-related details.[6]

Healthcare providers should detail the course of a surgery (i.e. what will happen to a child), mention who will be involved (i.e. which doctors, nurses, and practitioners will work with a child), and describe sensory aspects (i.e. what the procedure will feel like).[7] Because a child's processing of preparatory information may be affected by multiple factors, including previous experience in the surgical environment and developmental level, his or her understanding should be validated periodically by healthcare providers. The timing of preparatory information may also influence how much is retained; whilst the optimum timing is not known, early work suggests information should be given at least 5 days in advance for children aged >6 yrs and no more than a week in advance for children below 6 yrs of age.[7]

The challenge with these educational methods is that with the proliferation of outpatient surgery, it is expensive and time-consuming to conduct a live tour of the operating theatre for the parent and child. Within this context, mHealth (discussed later) has evolved as an alternative to these live tours.

Behavioural approaches

Several strategies focus on targeting behavioural factors to reduce perioperative anxiety. Amongst the most widely used of these strategies are interventions that use cognitive behavioural therapy (CBT) techniques.

As mentioned, preparation for surgery can consist of providing families with educational resources as relevant to a child's upcoming procedure. In addition to simply providing information, comprehensive preparation programmes can also include the modelling and enhancement of behavioural coping skills. Cognitive behavioural interventions focus specifically on helping children develop and effectively use such skills as a primary means of reducing their procedure-related anxiety, as opposed to relying only on the provision of information or medication. Cognitive behavioural therapy components can be adapted to the specific needs of children undergoing surgery and may be used in tandem with other techniques to reduce anxiety. In fact, the teaching and development of coping skills are the most effective methods of reducing perioperative anxiety, followed by the modelling of these skills via role play or a video depicting another child undergoing surgery.[8] Coping skills are especially helpful when children are provided with training ahead of their surgery, with the opportunity to build competence through rehearsing skills. However, most preparation programmes currently implemented in hospitals are limited to the provision of information, as it is the easiest and most cost-effective method.

Distraction is one example of an effective cognitive coping skill that may be used by children undergoing surgery. This skill encourages children to divert their attention away from distressing or threatening aspects of the perioperative process, towards engaging in more calming and pleasant activities or thoughts. As with other CBT techniques, purposeful active distraction can be taught to children and rehearsed before their procedure, and generally benefits from parents or providers serving as coaches to encourage skill usage throughout the perioperative process.[9] It may be particularly helpful for children to be provided with appropriate distraction tools, such as toys or games, by parents or providers in waiting or recovery areas.

Coping skills within the CBT framework that promote relaxation are also effective in alleviating perioperative anxiety. Diaphragmatic breathing and progressive muscle relaxation can be used by children as young as 4 yrs of age, and guided imagery exercises can be used by school-age children to manage procedure-related distress.[9,10] Diaphragmatic breathing, also referred to as conscious breathing and deep breathing in the literature, is a behavioural therapy that involves deep, controlled inhalation and exhalation using the diaphragm. Progressive muscle relaxation similarly involves the controlled relaxation of targeted muscle groups, as directed by a provider or parent, until complete physical relaxation of the body has been achieved. Guided imagery is a cognitive therapy during which children recall or reconstruct sensory and affective experiences (i.e. visual, auditory, olfactory, and emotional stimuli), and are encouraged to strategically recreate or return to that mental image during moments of high distress in the perioperative setting. These behavioural and cognitive relaxation skills work to minimise anxiety in a way similar to distraction, by giving children a specific, non-procedure-related task to focus on, and can be used together as a multicomponent 'package' to maximise opportunities for a positive therapeutic effect.[11] Training on techniques for breathing, muscle relaxation, and imagery can be delivered by providers either in person, through video, or *via* audio recording; these are repeatable exercises that do not require additional material once children sufficiently learn and practice the skills.[11] Parents can also be educated in these techniques to coach children through appropriate exercises. As such, these relaxation-promoting CBT techniques are an incredibly cost-effective method for reducing anxiety. The overall dynamic and adaptive nature of the CBT techniques discussed can also be particularly helpful for children who undergo multiple surgical procedures and may need novel therapeutic experiences to achieve an anxiolytic effect.

Cognitive behavioural skills do not have to be taught directly to children by a provider, and in-person skills training may not actually be possible in some cases because of time constraints. The use of a live or filmed model, often of a similar age, demonstrating coping skills and positive behaviours for children has been consistently found to be effective in reducing preoperative anxiety and improving postoperative outcomes.[5,9] This practice is rooted in social learning theory, which posits that children will learn and benefit from observing a peer work successfully through the sequence and emotions, including fear and anxiety, of an anticipated event, such as surgery.[9] Coping skills used by models can include

positive self-talk (e.g. 'I know I can do this'), distraction, and relaxation exercises, as discussed. After the observation of a peer model successfully utilising coping skills, and active rehearsal of coping strategies that were demonstrated, children should be able to use appropriate coping strategies for their own perioperative anxiety. Peer modelling may be most useful for children who have no prior surgical experience, or who are undergoing a novel procedure and therefore do not have a pre-existing concept of which coping strategies will be most effective.

Behavioural skills training should be appropriately tailored to childrens' understanding and developmental stage to optimise the usefulness of these strategies, as it is not known for which children this will be most beneficial. Teaching a variety of CBT techniques to children during their preparation for surgery is useful in that children can rehearse, then use, the strategies they find most salient when they encounter perioperative distress. Children can thus play an active role in their own anxiety management, promoting an internal locus of control and overall more successful coping.

Parental presence at induction of anaesthesia

In addition to helping their child through cognitive behavioural exercises, PPIA may influence children's perioperative anxiety. Many parents elect to be present with their child during the induction of anaesthesia when offered the option. There is an intuitive expectation that the involvement of one or both parents in preparation for surgery, including induction of anaesthesia, would reduce a child's anxiety. Indeed, early literature on PPIA noted links to increased cooperation and reduced anxiety for children, particularly separation anxiety.[12] However, subsequent studies have not consistently found PPIA to be effective compared with other non-pharmacological methods.

Many published RCTs that compared PPIA with other preinduction techniques did not demonstrate a significant incremental benefit over and above premedication or comprehensive non-pharmacological interventions.[13] This does not necessarily mean that there is no merit to implementing PPIA, or that there are no RCTs supporting the use of PPIA in certain circumstances. Rather, this trend in the literature hints that the nature of RCTs and the reality of clinical practice can be markedly different.

In the United States, parental presence is allowed and encouraged purely at the discretion of the anaesthesiologist, rather than routinely or indiscriminately recommended.[5] This is important to keep in mind when examining contemporary empirical research that does not appear to strongly favour the use of PPIA over alternative techniques. An RCT involving PPIA, by design, assigns children and their parents to a group condition (i.e. parents being present at the induction of anaesthesia *vs* parents being absent) regardless of personal characteristics, or whether clinical judgement would differ from that assignment. Thus, conclusions from such studies involving PPIA may not be highly externally valid. Indeed, non-experimental research examining perioperative anxiety amongst children who had PPIA indicates that PPIA benefits certain children.[14]

Evidence suggests that anxious children with calm parents may benefit from PPIA, whereas children with anxious parents may actually experience heightened anxiety.[14] Providers should take both the child's and parent's characteristics into account when determining whether or not PPIA would be effective. Whilst there may not be a definitive influence of PPIA on children's perioperative anxiety, it seems appropriate for providers to provide parents the option of being present if there is no anticipated detriment in doing so.

CAM approaches

Complementary and alternative medicine offers yet another option for providers and families exploring non-pharmacological methods for reducing perioperative anxiety in children. As the title of this classification implies, CAM approaches are designed to be used in conjunction with other techniques, or alone as an alternative method, although this is increasingly infrequent. Complementary and alternative medicine strategies that have been studied in children include music therapy, hypnosis, parental acupuncture, and patient acupressure. Each strategy has unique aspects that should be considered for an individual child undergoing surgery.

Interactive music therapy is set apart from passive music listening or appreciation because of its characteristic encouragement of emotional expression in children.[15] Musical expression, as guided by a licensed music therapist, can be a successful tool for children to use in communicating and resolving feelings of anxiety that they experience throughout the perioperative period. Whilst research has not consistently found interactive music therapy to be significantly more effective at reducing anxiety than traditional methods, interactive music therapy does still appear helpful for some children upon separation from parents and entering the OT, inclusive of the effect of the therapist.[15] There is further promise in studies amongst adults, which indicate that patients who are allowed to passively listen to music before and throughout surgery can exhibit decreased levels of perioperative anxiety compared with patients who are not offered a music intervention option.[16] Studies in adults also indicate that preoperative introduction of music can improve postoperative anxiety.[17] Because interactive music therapy may not always be a viable option depending on the available personnel and resources of a given institution, providers can offer the option of passive music listening to children—this has the advantage of being a low-to-no-cost intervention when the institution or child has an existing music playing device that can be used.

Hypnosis has also been studied as a potential anxiety reduction strategy, and research indicates that this technique can be as effective as premedication with midazolam before surgery.[18] Hypnosis induced by providers has been found to be particularly effective during the induction of anaesthesia in children, and by maintaining a state of inwardly focused attention, it may result in more positive memories for children. This has implications for future interactions in the surgical environment, as past experience is a noted factor that influences a patient's current experience and outcomes. Most studies that have shown promise for hypnosis in reducing analgesic requirements and decreasing perioperative anxiety have been primarily in adults, but it is still appropriate to offer hypnosis to children. It is a non-invasive technique with no known adverse effects, and as with music therapy, can be done at low to no cost to families. Of note, limitations of significant findings for hypnosis in relation to perioperative anxiety, such as sample size and external validity, should be considered before implementing hypnosis into care plans.

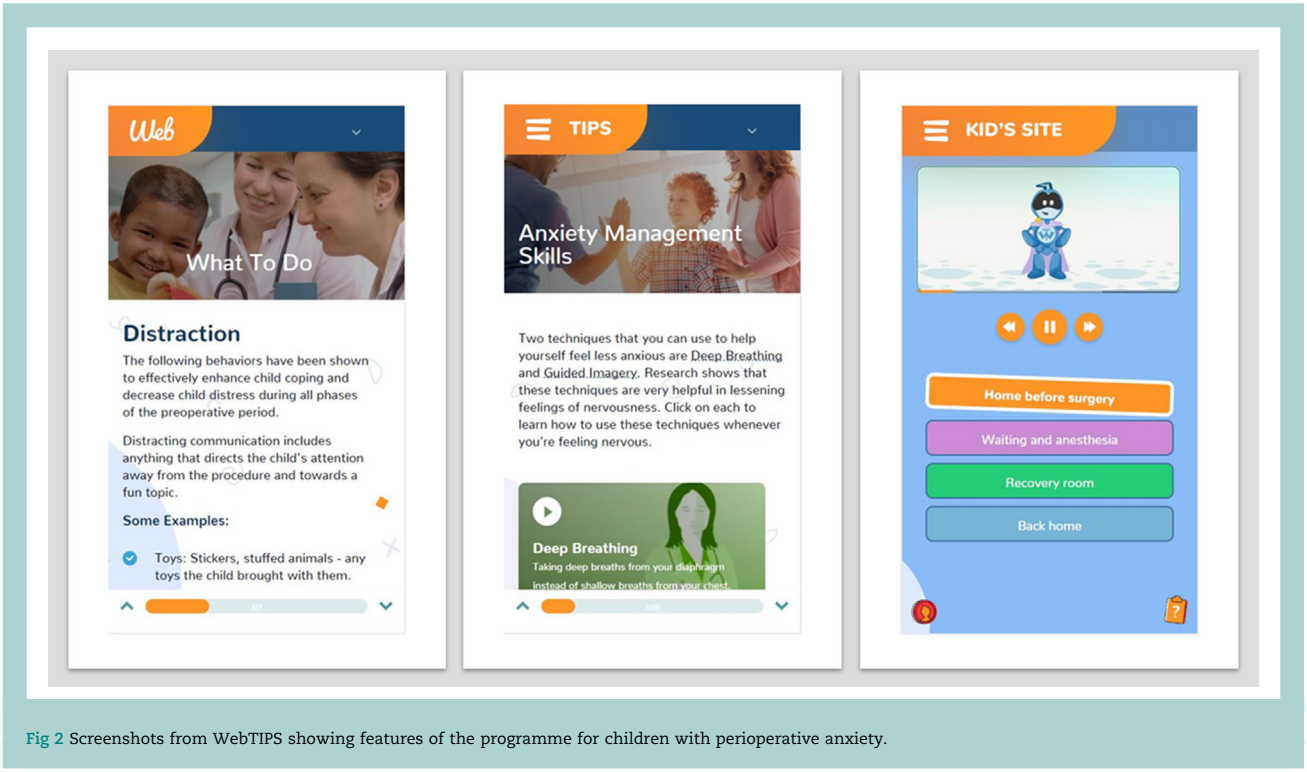

Fig 2 Screenshots from WebTIPS showing features of the programme for children with perioperative anxiety.

Acupuncture, which originated as a key component of traditional Chinese medicine, involves the insertion of specialised needles at strategic points throughout the body to alleviate tension. Using acupuncture for children can be a challenge attributable to children's lack of willingness to participate, and therefore, research in the perioperative context has focused on acupuncture for parents. Specifically, auricular (external ear) acupuncture at three points known to reduce state anxiety has been studied.[19] The placement of acupuncture press needles at the master cerebral point, hypertension point, and tranquiliser point on the external ear may lower anxiety for anxious parents of children undergoing surgery.[19] Children, in turn, may benefit from receiving PPIA from parents who are calmer after auricular acupuncture. In the same vein, acupressure—the non-invasive stimulation of an acupuncture point—has been examined as an appealing alternative to acupuncture for children. There is potential for the reduction of anxiety by way of stimulating the Extra-1 acupuncture point with a pressure bead, but it is important to note that the supporting literature is scant.[20] Indeed, the paucity of large-scale empirical research into perioperative CAM methods is a recurring theme, although this does not reflect negatively on providers and families who believe these techniques to be an appropriate fit for a child's clinical situation.

Using technology to reduce perioperative anxiety

With the ubiquity of the Internet and the steady increase in accessibility to smart technologies, including cellular phones and tablets, health research has made great strides to take advantage of these tools to improve outcomes. Audiovisual (AV) programmes have been developed to integrate and deliver existing non-pharmaceutical intervention techniques (e.g. training in coping skills) to support or supplement the standard of care for perioperative anxiety. Audiovisual programmes may use a selection or combination of virtual reality (VR) experiences, websites, and web-based mobile applications.

Audiovisual interventions for children are media based and typically comprise a video component to be used as preoperative educational preparation.[21] Audiovisual interventions may also use an audio component, such as a guided imagery audio recording, or an interactive video game, to provide children with opportunities for relaxation or distraction, respectively, in the face of procedure-related anxiety. Children who receive an AV intervention generally experience significant reductions in preoperative anxiety compared with children who receive only standard care, which may include PPIA, sedative premedication, or a combination of the two depending on the medical institution.[21,22] In addition to being an effective method of delivering anxiety-reducing education and coping techniques, AV interventions also have implications for increased patient and parent satisfaction with perioperative care. By allowing children and their parents to use AV programmes at their convenience, from the comfort of their own home, they may as a result be more receptive and able to retain procedure-related information and skills training.[21]

Given that VR exposure research has found VR to be effective in treating specific phobias, recent studies have also begun to examine its potential for improving perioperative anxiety outcomes in children.[23,24] In addition to providing distraction from stress-provoking stimuli for children, VR technology can be used to provide exposure *via* virtual tours to the operating theatre and other relevant areas in the medical setting in anticipation of a scheduled surgery. In the same

vein as educational interventions helping children to form realistic expectations for their surgery, VR exposure to a realistic depiction of unfamiliar areas, medical equipment, and sensory stimuli related to an upcoming surgery may help children successfully anticipate and cope with their worries during their actual procedure. A recent RCT indicates that VR exposure to the operating theatre can reduce preoperative anxiety in children compared with peers who do not receive the same exposure.[24] However, more research is needed to form a definitive stance on the issue, as there are also findings that do not suggest an incremental benefit of VR exposure on perioperative anxiety compared with standard of care.[23] Suggestions for future work in the area include examining influences of the timing and duration of VR exposure, and determining which patients it is most beneficial.

Lastly, websites and other web-based interventions that serve as tools for preoperative preparation and coping skill training are effective in reducing perioperative anxiety in children.[22] One key advantage of web-based interventions is the potential for real-time adjustment and tailoring of treatment components according to individual factors. Programmes, such as the Web-based Tailored Intervention Preparation for Surgery (WebTIPS) (Fig. 2), use input from the patient and parent (e.g. type of surgery, child's trait anxiety, and parental preferences for information) to return only the most relevant procedure-related information and coping techniques.[25] Because this tailoring of intervention components can be done automatically, without a patient having to wait for approval or confirmation from the physician, web-based programmes are especially adaptable and convenient for children and their parents. Web-based programmes also have the appeal of allowing children to access educational resources and anxiety-reducing strategies from the comfort of their own home.

Whilst not every medical institution or provider has a comprehensive, evidence-based web-enabled programme for their patients to use for their perioperative anxiety, the nature of such mHealth programmes being built on a platform that is accessible to the general population (i.e. the Internet) shows promise for broader implementation in the future. Future work in the field can focus on rigorous testing and validation of mHealth interventions for subsequent scaling and adoption at new institutions. More research is also needed to assess possible barriers to adoption of these programmes and which methods of delivery are most effective or appropriate for children.

Conclusions

Several non-pharmacological methods may be useful for reducing perioperative anxiety in children. Paediatric patients have been shown empirically to benefit from methods across educational, behavioural, and CAM modalities, particularly when methods are chosen and implemented with individual factors and the surgical context in mind. The personal preferences of children and their families can also play a large role in the planning and execution of these strategies, and thus should be considered by providers.

Declaration of interests

The authors declare that they have no conflicts of interest.

MCQs

The associated MCQs (to support CME/CPD activity) are accessible at www.bjaed.org/cme/home by subscribers to BJA Education.

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