



Management of preoperative anxiety with non-pharmacological methods in pediatric patients in resource-limited settings: a literature review

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Background: Anxiety disorders are common in children and among the most prevalent psychiatric issues. Untreated preoperative anxiety can lead to increased complications and a higher risk for future anxiety disorders and major depression. Therefore, addressing preoperative anxiety in children is crucial to prevent perioperative and long-term adverse effects.

Objective: This review aimed to evaluate various articles and develop a management plan based on evidence for the prevention of preoperative anxiety in children using non-pharmacological approaches in areas with limited resources.

Methods: This systematic review was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) protocol. Databases, such as PubMed, Cochrane Library, and Google Scholar, were searched for high-quality evidence to draw appropriate conclusions.

Result: A total of 7669 articles were retrieved from the search engines. These articles were then filtered based on intervention, outcome, population data, inclusion and exclusion criteria, and methodological quality. After the filtration process, only 35 studies met the inclusion criteria for comprehensive review.

Conclusion: The Children's Emotional Manifestation Scale (CEMS) effectively assesses preoperative anxiety in children. Evidence suggests that non-pharmacological interventions such as clowning, music therapy, audiovisuals, virtual reality, and cognitive-behavioral therapy are effective in preventing preoperative anxiety. Practitioners can choose a suitable non-pharmacological approach based on availability and cost.

Keywords: audiovisual, clowning, music therapy, pediatric surgery, preoperative anxiety, virtual reality

Introduction

Preoperative anxiety associated with upcoming surgery presents distinct challenges for young patients owing to factors such as potential separation from their parents, feelings of loss of autonomy, physical and emotional distress, unfamiliar surroundings, and uncertainties about anesthesia. These manifest in various ways, including crying, anger, dissatisfaction, or alterations in speech^[1,2].

Preoperative anxiety is prevalent among children and adolescents and is marked by distress related to perceived dangers, which is exacerbated by the potential for pain and harm^[3-7]. About five million children in North America undergo elective surgeries annually, with nearly 75% experiencing significant

preoperative anxiety^[8]. In South Africa, the incidence of anxiety is 11%^[9], whereas a 2001 study in Ethiopia reported rates of 10% for males and 14% for females within the general pediatric population^[10]. A study conducted at the University of Gondar found that the level of preoperative anxiety among pediatric patients was 75.44%^[11].

Research has shown a strong association between preoperative anxiety, anesthesia management, and surgical outcomes. High baseline preoperative anxiety levels predict increased intraoperative anesthetic needs^[12-18] and are associated with more vasovagal incidents after spinal anesthesia^[19]. Additionally, elevated preoperative anxiety is linked to greater postoperative pain, higher analgesic consumption, sleep issues, and poor eating improvement in children^[20-22]. A study of pediatric patients aged 2–12 indicated that high preoperative anxiety, younger age, and long wait times contribute to the need for preoperative sedation^[13].

In today's society, many parents work long hours and find it difficult to mentally prepare their children for elective surgery. As a result, preoperative anxiety may develop, and if left unaddressed, may lead to an increased risk of anxiety disorders, panic attacks, and major depressive disorders. Therefore, a multimodal strategy is crucial for the prevention of preoperative anxiety. Most preventive measures are derived from developed countries, which can be challenging in resource-limited settings because of the lack of necessary resources and medications. Psychological interventions are the most studied treatment for anxiety disorders in children and adolescents^[15]. This review examined various non-pharmacological approaches to handle preoperative anxiety in children and aimed to scientifically validate these methods through literature reviews.

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Methods and materials

Literature search strategies

The review was conducted based on the Preferred Reporting Items for Systemic Reviews and Meta-Analyses (PRISMA) protocol^[23]. To identify studies for the review, articles published in English were searched in PubMed, Google Scholar, and Cochrane databases. Various types of studies were searched, including cross-sectional studies, prospective observational studies, randomized controlled trials (RCTs), and systematic reviews. The search was conducted using specific keywords, such as [(pediatrics OR infants OR toddlers OR children AND preoperative anxiety) AND (assessment OR modified Yale Preoperative Anxiety Scale OR children’s emotional manifestation scale OR non-pharmacological prevention OR music therapy OR audiovisual OR clowning OR cognitive behavioral therapy OR virtual reality)].

Scope of the guideline

This guideline focuses on the effectiveness of non-pharmacological methods in preventing preoperative anxiety in pediatric patients. This study aimed to review the latest evidence concerning non-pharmacological strategies for alleviating preoperative anxiety in children scheduled for surgery. The results are applied by healthcare providers (such as nurses, doctors, and anesthesiologists) to pediatric patients who are about to undergo surgical procedures.

Inclusion and exclusion criteria

Inclusion criteria: Studies that evaluated non-pharmacological interventions for managing children’s behavior or anxiety during the perioperative period were included. The interventions were compared with non-intervention (such as usual treatment or inactive controls), other interventions, or variations of the same intervention (active controls). The studies involved children (including infants, toddlers, and preschool children) and adolescents up to 18 years of age, who were undergoing surgical procedures and were not physically or mentally disabled.

Exclusion criteria: Studies that did not measure behavior or anxiety as outcomes were excluded from this review.

Critical appraisal

The eligibility of articles was assessed independently and determined by considering the methodological quality of the inclusion and exclusion criteria as well as the outcome variables. Following a thorough and comprehensive evaluation of the relevant literature, quality assessment was carried out by classifying the articles into different levels based on the principles of Good Clinical Practice (GCP) as defined by the World Health Organization in 2011^[24]. The conclusions were derived from the level of evidence presented (Table 1).

Result

A total of articles 6900 from Google Scholar since 1996, 823 from PubMed, and 946 from Cochrane Library were acquired from search engines and underwent a process of filtration based on the intervention, outcome, and data on population, inclusion and exclusion criteria, and methodological quality. Ultimately,

Table 1

Level of evidences and grades of recommendations.

Level of evidence	Grading criteria	Grade of recommendation
1a	Systematic reviews of RCTs including meta-analysis	A
1b	Individual RCT with narrow confidence interval	A
1c	All or none randomized controlled trials	B
2a	Systematic review of cohort study	B
2b	Individual cohort including low quality RCT	
2c	Outcome research study	C
3a	Systematic review of case control studies	C
3b	Individual case control study	C
4	Case series, poor quality cohort, and case control studies	C
5	Expert opinion without explicit critical appraisal, or based on physiology, bench research or “first principles”	D

35 studies met the inclusion criteria for comprehensive review (Table 2). The PRISMA flow chart (Fig. 1) presents a detailed and systematic approach for study selection.

Discussion

Assessment of anxiety

Studies have found approximately ten tools for assessing anxiety in hospitalized children, although many have limitations and often overlook certain age groups that are unable to express their feelings. Currently, the most commonly used tools are the Children’s Emotional Manifestation Scale (CEMS) and the Modified Yale Preoperative Anxiety Scale (mYPAS)^[25–27].

The Children’s Emotional Manifestation Scale is an observational tool that evaluates anxiety in children before surgery or during other stressful procedures. It includes five behavioral categories: facial expression, vocalization, activity, interaction, and level of cooperation, each scored from one to five. The total score ranges from 5 to 25, with higher scores indicating greater anxiety^[28]. A study with 82 children aged 2–7 examined the emotional manifestation scale, revealing high reliability coefficients and internal consistency. The inter-rater reliability was 0.96, and internal consistency had an alpha of 0.92^[28] [2c]. Another study focused on the Turkish version of the scale, finding a content validity index of 0.96 and an internal consistency ranging from 0.95 to 0.96 using Cronbach’s alpha^[29] [1c].

A study assessing the reliability and validity of the mYPAS in 120 children showed high sensitivity, specificity, and positive predictive values of 93.75, 92.86, and 92.86, respectively, confirming that mYPAS is a reliable observational questionnaire^[30] [1c]. Another investigation of 102 patients on the Korean adaptation of mYPAS found a sensitivity, specificity, positive predictive value, negative predictive value, and accuracy of 81.3%, 91.4%, 81.3%, 91.4%, and 88.2%, respectively^[31] [1c]. Other studies confirmed good to excellent inter-rater reliability at the scale level and moderate to good reliability at the item level^[32] [1c]. Overall, the Children’s Emotional Manifestation Scale is a valid assessment tool for pediatric anxiety evaluation compared to mYPAS based on evidence, and we recommend it for preoperative anxiety evaluation (B, C).

Table 2**Summary of included studies in the review.**

S/N	Author	Study title	Population	Sample size with design	Outcome	LOE
1.	Acta Paul Enferm. 2020;	Anxiety assessment tools in hospitalized children	Pediatrics	Systematic review of 33 RCTs	mYPAS and CEMS are used for assessment of pediatric anxiety	1a
2.	Zeev N, <i>et al</i> 1997	The Yale Preoperative Anxiety Scale	Pediatrics	Outcome study	Yale preoperative anxiety assessment tool is used to assess pediatric anxiety	2b
3	Cheryl H. T. Chow, <i>et al</i> , 2016	Children's Perioperative Multidimensional Anxiety Scale (CPMAS)	Pediatrics	Outcome study	CEMS is used to assess pediatric anxiety	2b
4	HCW Li and V Lopez, 2005	Children's Emotional Manifestation Scale (CEMS): development and testing	Pediatrics	A cross-sectional study of 82 children	CEMS is reliable and valid for the assessment of pediatric anxiety	2b
5	Selver Mete İzci, <i>et al</i> , 2020	A Turkish version of Children's Emotional Manifestation Scale: reliability and validity assessment	Pediatrics	Prospective cohort study of 62	CEMS is reliable and valid for the assessment of pediatric anxiety	2c
6	Hatipoğlu Z, <i>et al</i> , 2019	Validity and reliability of the Turkish version of the Modified Yale Preoperative Anxiety Scale	Pediatrics	Cohort study of 120 children	mYPAS has high sensitivity, specificity, and positive predictive value of 93.75, 92.86, and 92.86, respectively, in detecting anxiety	1c
7	Jung K, <i>et al</i> , 2016	Reliability and validity of a Korean version of Modified Yale Preoperative Anxiety Scale	Pediatrics	Non-randomized trial of 102 children	The value of Cronbach alpha for inter-observer's reliability was 0.939 and intra-observer reliability was statistically significant ($P < 0.001$)	1c
8	Kühlmann AYR, <i>et al</i> , 2019	What are the validity and reliability of the Modified Yale Preoperative Anxiety Scale-Short Form in children less than 2 years old	Pediatrics	Non-randomized trial of 129 infants	Internal consistency of mYPAS short form was excellent both at holding area and at induction of anesthesia.	1c
9	Bar-Haim Y, <i>et al</i> , 2011	Training anxious children to disengage attention from threat	Pediatrics	Randomized controlled trial of 34 children	Children in the ABM condition reported less state anxiety relative to controls	1c
10	Caruso TJ, <i>et al</i> , 2018	A Retrospective review of a bed-mounted projection system for managing pediatric preoperative anxiety	Pediatrics	Retrospective cohort study of 686 children	There was a reduction of 14.7 minutes in preoperative patient readiness associated with BERT ($P = 0.001$)	1b
11	Goettems ML, <i>et al</i> , 2017	Non-pharmacologic intervention on the prevention of pain and anxiety during pediatric dental care	Pediatrics	Systematic review of 21 trials	They used the techniques such as viewing positive images related to dental care, virtual reality, music, and magic tricks could facilitate compliance, obtain improvement in child behavior, and decrease anxiety perception	2b
12	Jennifer Z, <i>et al</i> , 2020	The effects of interrupting sitting time on affect and state anxiety in children of healthy weight and overweight	Pediatrics	A randomized crossover trial of 61 children	State anxiety was lower in the children of healthy weight after interrupted sitting (vs. continuous sitting; $\beta = -0.8$; 95% confidence interval, -1.5 to 0.0 , $P = 0.05$)	1a
13	Chow CHT, <i>et al</i> , 2015	Audiovisual interventions for reducing preoperative anxiety in children undergoing elective surgery	Pediatrics	Systematic review of 14 RCTs	AV interventions are a cost-effective tool in helping to ameliorate children's preoperative anxiety	1b
14	Hatipoglu Z, <i>et al</i> , 2018	Effects of auditory and audiovisual presentations on anxiety and behavioral changes in children undergoing elective surgery	Pediatrics	RCT of 99 children	MYPAS scores were significantly lower in audiovisual than in auditory and control groups (with the value of 27.4 ± 7.1 , 39.3 ± 19.2 , and 73.1 ± 18.0 , respectively)	1b

(Continues)

Table 2
(Continued).

S/N	Author	Study title	Population	Sample size with design	Outcome	LOE
15	Hu W, <i>et al</i> , 2021	Effect of media distraction (audiovisual and music) for pain and anxiety control in patients undergoing shock-wave lithotripsy	Pediatrics	Systematic review and meta-analysis of 11 RCTs	Pooled analysis indicated a statistically significant reduction of anxiety scores with the use of media distraction (MD: -3.91 ; 95% CI: $-6.44, -1.38$; I $^2 = 77.7\%$)	1a
16	Jin Y, <i>et al</i> , 2021	Self-produced audiovisual animation introduction alleviates preoperative anxiety in pediatric strabismus surgery	Pediatrics	RCT of 100 children	The value of mYPAS was 35.6 ± 6.28 at T1, 45.3 ± 9.75 at T2 and 45.4 ± 13.4 at T3 in the control group and 35.4 ± 7.06 at T1, 38.2 ± 10.45 at T2, and 42.3 ± 8.58 at T3 in the audiovisual group	1b
17	Könsgen N, <i>et al</i> , 2019	Clowning in children undergoing potentially anxiety-provoking procedures	Pediatrics	A systematic review and meta-analysis of 11 RCTs	Compared with midazolam, children's anxiety was significantly lower in preoperative time (MD -7.60 ; 95% CI $-11.73, -3.47$), but not in the induction room (MD -9.63 ; 95% CI $-21.04, 1.77$)	1a
18	Kocherov S, <i>et al</i> , 2016	Medical clowns reduce preoperative anxiety, postoperative pain, and medical costs in children undergoing outpatient penile surgery	Pediatrics	RCT of 80 children	Anxiety was lower preoperative anxiety index upon ($P = 0.0319$) and after surgery ($P = 0.0042$), required less induction time for anesthesia ($P < 0.001$)	1b
19	Sridharan K, <i>et al</i> , 2016	Therapeutic clowns in pediatrics	Pediatrics	A systematic review and meta-analysis of 11 RCTs	Hospital clowns play a significant role in reducing stress and anxiety levels in children	1b
20	Rimon A, <i>et al</i> , 2016	Medical clowns and cortisol levels in children undergoing venipuncture in the emergency department	Pediatrics	A pilot study of 55 children	Medical clown was able to reduce anxiety subjectively in children undergoing a painful procedure in ED	1b
21	Ilán U, <i>et al</i> , 2018	Disaster zones—should we be clowning around?	Pediatrics	A systematic review and meta-analysis of 8 RCTs	Clown intervention has a great effect on reducing children's preoperative anxiety	1a
22	Walkup JT, <i>et al</i> , 2008	Cognitive behavioral therapy, sertraline, or a combination in childhood anxiety	Pediatrics	RCT of 488 children	Reported treatment response rates of 81% for sertraline + (CBT) combination therapy, 60% for CBT monotherapy, and 55% for sertraline monotherapy	1b
23	Weersing VR, <i>et al</i> , 2017	Brief behavioral therapy for pediatric anxiety and depression in primary care	Pediatrics	RCT of 185 youths	Youths in the BBT group had significantly higher clinical improvement 56.8% vs. 28.2% ($P < 0.001$; number needed to treat 4), great reduction in symptom and better functioning (mean [SD], 68.5 vs. 61.9	1b
24	Christ C, <i>et al</i> , 2020	Internet and computer-based cognitive behavioral therapy for anxiety and depression in adolescents and young adults	Pediatrics	Systematic review and meta-analysis of 24 RCTs	Computer-based cognitive behavioral therapy is beneficial for reducing posttreatment anxiety and depressive symptoms in adolescents and young adults compared with passive controls	1a
25	Rozenman M, <i>et al</i> , 2019	Improvement in anxiety and depression symptoms following cognitive behavior therapy	Pediatrics	Non-randomized clinical trial of 137 youths	Youth in the CBT group reported anxiety and depression symptoms decreased in a linear fashion over the course of CBT	2b
26	Sağlık DS, <i>et al</i> , 2019	The effect of parental presence on pain and anxiety levels during invasive procedures in the pediatric emergency department	Pediatrics	RCT of 111 cases	Anxiety levels of children during the procedure were not affected in all groups; however, the children of parents with high trait anxiety levels had higher pre-procedural trait anxiety levels	1b
27	Rasti-EmadAbadi R, <i>et al</i> , 2017	The effects of preanesthetic parental presence on	Pediatrics	RCT of 60 children	Results shows that there is no significant difference between children's anxiety in	1b

(Continues)

Table 2
(Continued).

S/N	Author	Study title	Population	Sample size with design	Outcome	LOE
		preoperative anxiety of children and their parents			the intervention (70.83) and control (70.39) groups in the pre-anesthetic period	
28	Kain ZN, <i>et al</i> , 1998	Parental presence during induction of anesthesia versus sedative premedication: which intervention is more effective?	Pediatrics	RCT of 88 children	Result shows that children anxiety in the oral midazolam group was significantly less compared to parental presence and control groups	1b
29	Kain ZN, <i>etal</i> , 1996	Parental presence during induction of anesthesia	Pediatrics	RCT of 84 children	Result shows that while comparing the control group to the intervention group, there were no significant differences in any of the behavioral or physiologic measures tested in the holding area or during induction time	1b
30	Franzoi MAH, <i>et al</i> , 2016	Music listening for anxiety relief in children in the preoperative period	Pediatrics	RCT of 52 children	The result showed that the value of mYPAS at arriving and after 15 minutes was 35.37 and 32.38, respectively, in the control group and 40.77 at arrival and 28.26 after 15 minute music intervention in music groups	2b
31	da Silva Santa IN, <i>et al</i> , 2021	Music interventions in pediatric oncology	Pediatrics	A systematic review and meta-analysis of 11 RCTs	There were benefits to using music when compared with the control group, and it was also noted that music interventions favored reduced anxiety compared to the control group (SMD – 1.12; CI 95 % – 1.78 – 0.46 N = 199 = I ² = 77 %)	1a
32	Eijlers R, <i>et al</i> , 2019	Systematic review and meta-analysis of virtual reality in pediatrics effects on pain and anxiety	Pediatrics	A systematic review and meta-analysis of 17 RCTs	The overall weighted standardized mean difference (SMD) for VR was and 1.32 (95% CI, 0.21–2.44) on patient-reported anxiety (based on 7 studies)	1a
33	Han SH, <i>et al</i> , 2019	Effect of immersive virtual reality education before chest radiography on anxiety and distress among pediatric patients	Pediatrics	RCT of 99 children	The mean (SD) score for parental satisfaction (9.4 versus 8.6) was higher in the virtual reality group than in the control group	1b
34	Dehghan F, <i>et al</i> , 2019	The effect of virtual reality technology on preoperative anxiety in children	Pediatrics	RCT of 40 children	The result revealed that the medical treatment using virtual reality technology, as well as distraction and drowning in the virtual reality reduced preoperative anxiety in children	1b
35	Stewart B, <i>et al</i> , 2019	Use of interactive distraction versus oral midazolam to reduce pediatric preoperative anxiety, emergence delirium, and postanesthesia length of stay	Pediatrics	RCT of 102 children	Concluded that tablet-based interactive distraction was more effective than oral midazolam in reducing preoperative anxiety in children	2b

Abbreviations:- LOE: level of evidence.

Non-pharmacological prevention of preoperative anxiety in pediatrics

Traditionally, pharmacological interventions have been used to manage preoperative anxiety, but they can cause mucosal irritation, postoperative nausea, delirium, and longer hospital stay^[33]. Therefore, non-pharmacological interventions are effective in reducing anxiety and have been integrated into perioperative care^[34]. Providing targeted information helps decrease

preoperative anxiety in children before surgery and is as effective as medication^[35].

A randomized controlled trial (RCT) with 34 pediatric patients aged 8–14 years examined the impact of attention bias modification (ABM) using an emotional attention spatial cuing task. Anxiety and depression were measured before and after training, revealing lower state anxiety in the ABM group than in the controls^[36] [1b]. In a retrospective cohort study, the BERT

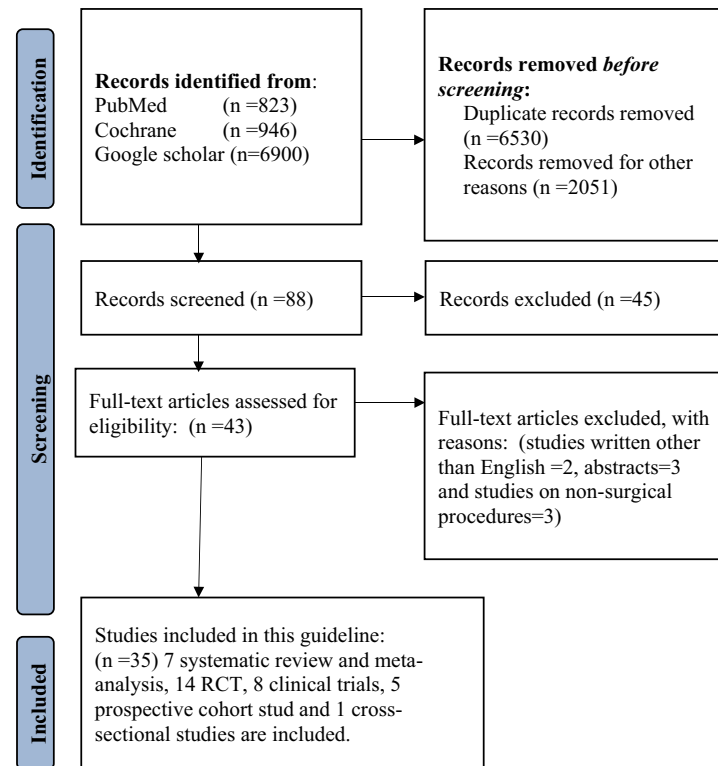


Figure 1. PRISMA flow chart. Sources: adapted from the PRISMA 2020 statement: an updated guideline for reporting systematic reviews, 2021.

group was less cooperative and more playful than those receiving anxiolytics, with a 14.7-minute reduction in preoperative readiness linked to BERT^[37] [2b].

Various psychological strategies exist to help children manage their anxiety, allowing them to develop coping skills. Systematic reviews have shown that non-pharmacological approaches during medical procedures effectively reduce pediatric anxiety. Techniques such as positive imagery, virtual reality, music, and magic tricks promote compliance and improve behavior^[38]. Overall, non-pharmacological interventions serve as effective alternatives to medications for managing preoperative anxiety in children.

Audiovisual interventions

The specific mechanism and impact of computers and audiovisual technologies, including video glasses and smartphone apps, on reducing preoperative anxiety in children and managing related postoperative outcomes remain unclear^[8]. A systematic review and meta-analysis assessing AV interventions for children undergoing elective surgery found a significant reduction in preoperative anxiety scores compared with standard care. This suggests that AV interventions could be effective and cost-efficient in alleviating preoperative anxiety and improving other adverse perioperative outcomes in children^[8] [1a]. In one study, ninety-nine participants aged 5–12 were randomly assigned to audiovisual (Group V, $n = 33$), auditory (Group A $n = 33$), or control (Group C, $n = 33$) groups, supporting the findings of the review. MYPAS scores were notably lower in the audiovisual group than in the auditory and control groups, with values of 27.4 ± 7.1 , 39.3 ± 19.2 , and 73.1 ± 18.0 , respectively^[39] [1b].

Similarly, a systematic review and meta-analysis of 11 randomized controlled trials found that media distractions, such as audiovisual and music, effectively reduced anxiety in pediatric patients undergoing surgery, showing a significant decrease in anxiety scores (MD: 3.91; 95% CI: 6.44, 1.38; $I^2 = 77.7\%$)^[40] [1a].

In another study of 100 children aged 3–6 undergoing strabismus surgery, the participants were divided into two groups: Group A received a self-created audiovisual introduction, while Group B served as a control. Preoperative anxiety was measured using mYPAS at three time points: the night before surgery (T1), in the preanesthetic holding area (T2), and just before anesthesia (T3). The control group's scores were 35.6 ± 6.28 at T1, 45.3 ± 9.75 at T2, and 45.4 ± 13.4 at T3, whereas the audiovisual group showed 35.4 ± 7.06 at T1, 38.2 ± 10.45 at T2, and 42.3 ± 8.58 at T3, indicating that the audiovisual introduction effectively reduces preoperative anxiety, which are consistent with other previous studies^[41] [1b]. We recommend using audiovisual methods to prevent anxiety in pediatric patients undergoing surgery (A).

Clowning

The involvement of trained clowns before surgery can significantly reduce anxiety in children^[42]. This approach is part of patient-centered care in pediatric patients and serves as a new distraction technique in healthcare^[43]. Medical professionals regard clowning as a communication skill that enhances a patient's well-being. Clowns use methods, such as silly mimicry, magic, music, and storytelling, to distract patients from the hospital environment, pain, and anxiety^[44,45]. Several studies

have indicated that clowning effectively lowers preoperative anxiety in children^[46–49]. A systematic review found that children undergoing clowning experienced less preoperative anxiety than those with only parental presence or no intervention. Moreover, compared with midazolam, children's anxiety was significantly lower preoperatively, but its effectiveness waned during mask application^[50] [1a].

A randomized controlled trial examined the effect of medical clowns on preoperative anxiety in 80 children aged 2–16 years undergoing meatotomy, divided into two groups. One group had a medical clown as part of the medical team, whereas the other did not. The results showed that the first group experienced lower preoperative anxiety, shorter anesthesia induction times, reduced operating room duration, and quicker recovery. The study concluded that medical clowns lessen children's preoperative anxiety and shorten hospital stay^[47] [1b]. Additionally, a systematic review found that therapeutic clowns significantly reduced stress and anxiety in pediatric patients^[51] [1b]. A recent RCT found that medical clowns effectively reduced anxiety in children undergoing blood tests or intravenous (IV) cannulation in the pediatric emergency department (ED)^[52] [1b]. Similarly, a systematic review and meta-analysis of eight studies showed that despite variability, preoperative clown therapy significantly decreased anxiety in children and parents^[53] [1a]. Thus, medical clowns are an effective non-pharmacological approach for lowering preoperative anxiety in pediatric patients, and we recommend their use (A).

Cognitive behavioral therapy (CBT)

Cognitive behavioral therapy (CBT) is effective for various mental health disorders, particularly anxiety, and has been linked to an improved quality of life for patients. Typically considered a short-term, skills-based treatment, CBT aims to alter unhelpful emotional responses by changing thoughts or behaviors^[54]. A study with 488 children aged 7 to 17 years diagnosed with separation anxiety, generalized anxiety, or social phobia found that a combination of sertraline and CBT produced an 81% treatment response rate, compared to 60% for CBT alone and 55% for sertraline alone, indicating that combination therapy is more effective^[55] [1b].

A two-centered randomized controlled trial found that brief behavioral therapy (BBT) resulted in greater clinical improvement (56.8% vs. 28.2%), symptom reduction, and improved functioning than assisted referral to care (ARC)^[56] [1b]. A systematic review showed that computer-based cognitive behavioral therapy (cCBT) effectively reduces anxiety and depressive symptoms in adolescents and young adults compared to passive controls, with an effect size of $g = 0.52$ (95% CI 0.33–0.71, $P < 0.001$)^[57] [1a]. Another trial indicated a consistent decrease in anxiety and depression symptoms among youth undergoing cognitive behavior therapy^[58] [2b]. Thus, the evidence supports the use of BBT, CBT, and cCBT to prevent preoperative anxiety in pediatric patients (A).

Parental presence during induction of anesthesia

Anesthesia induction often causes stress and anxiety in pediatric patients and their parents, leading to negative psychological effects and potential discomfort during recovery. The presence of parents during this process (PPIA) is considered effective in managing pediatric anxiety^[59–61]. A randomized controlled trial with 111

participants divided into three groups (parental involvement, parental presence, and parental absence) found no impact on children's anxiety levels during the procedure. However, children with parents who had high trait anxiety displayed higher preprocedural anxiety^[62] [1b]. A separate trial with 60 children aged 2–10 also found no significant difference in preoperative anxiety between children with and without parental presence^[63] [1b]. A controlled trial with 88 children divided them into three groups: parental presence, oral midazolam (0.5 mg/kg), and a control group, to study the effects on children's anxiety. Results indicated that anxiety levels were significantly lower in the oral midazolam group than in the other groups^[64] [1b]. Another trial found no significant differences in behavioral or physiological measures related to parental presence during anesthesia induction^[65] [1b]. Therefore, evidence suggests that parental presence does not reduce preoperative anxiety in children and is not recommended as an anxiety prevention method (A).

Music therapy

Music therapy is an effective non-pharmacological alternative to medication that helps individuals process emotions and enhance their emotional well-being. Research shows that music triggers the release of dopamine and endorphins in the brain, contributing to pleasure and euphoria, while reducing anxiety^[66]. The duration of music therapy sessions can vary from less than 15 minutes to several hours^[67–69].

A randomized clinical trial explored the impact of listening to music on anxiety relief in 52 children undergoing elective surgery divided into an experimental group ($n = 26$) and a control group ($n = 26$). Anxiety was measured using the Modified Yale Preoperative Anxiety Scale, with scores of 35.37 at arrival and 32.38 after 15 min in the control group, while the music group had scores of 40.77 at arrival and 28.26 after 15 min of music intervention. This demonstrates that music significantly reduces anxiety levels after 15 min^[67] [2b]. Additionally, a systematic review and meta-analysis of 11 studies involving 429 children aged 0 to 18 years found that music interventions were effective in lowering anxiety compared to control groups^[70] [1a]. Overall, music therapy appears to reduce preoperative anxiety, and we recommend at least 15 min of music therapy before surgery for pediatric patients (A).

Virtual reality (VR)

Virtual reality technology effectively diverts children's attention from challenging situations, reduces fear, and promotes cooperation during medical procedures^[71,72]. It is safer, less embarrassing, and more cost-effective than real-life situations, providing a sense of presence for participants in distressing scenarios^[73,74].

A systematic review and meta-analysis evaluated VR's effectiveness of VR as a distraction to reduce anxiety in pediatric patients undergoing various medical and surgical procedures. VR served as a distraction in 16 studies for venous access, dental work, burn treatment, or oncological care and as exposure in one study before elective surgery under general anesthesia. Most previous studies have focused on burn care. The overall weighted standardized mean difference (SMD) for VR was 1.30 (95% CI, 0.68–1.91) for patient-reported pain (14 studies) and 1.32 (95% CI, 0.21–2.44) for anxiety (seven studies).

Limited observational data exist on VR’s effect of VR on pediatric anxiety^[75] [1a].

A prospective randomized clinical trial involving 99 children aged 4–8 years who underwent chest radiography assessed the impact of virtual and concluded that it reduced anxiety and procedure time while enhancing parental satisfaction^[76] [1b]. Another study with 40 children aged 6–12 years found that virtual reality technology significantly reduced preoperative anxiety by 30% during exposure therapy (VRET)^[77] [1b]. Additionally, a study comparing tablet-based interactive distraction (TBID) with oral midazolam in 102 children aged 4–12 years showed that TBID was more effective in reducing preoperative anxiety^[78] [2b]. Overall, evidence suggests that virtual reality is effective and comparable to pharmacological methods for preventing preoperative anxiety in children, and its use is recommended as a preventive measure (A and B).

Limitation of review

The analyzed reviews included high-quality randomized controlled trials with a considerable number of participants alongside meta-analyses published in recent years. However, there are some limitations due to language barriers and the diverse behavioral assessment tools employed. Moreover, the review focused exclusively on preventing preoperative anxiety in elective pediatric patients. It does not evaluate the efficacy of non-pharmacological interventions compared to pharmacological interventions. While non-pharmacological approaches cannot completely eliminate post-traumatic stress disorders, they may help minimize their occurrence, although further research is necessary. Additionally, the review did not consider the crucial role of a specialist in delivering services, which can significantly impact the efficacy of such treatments.

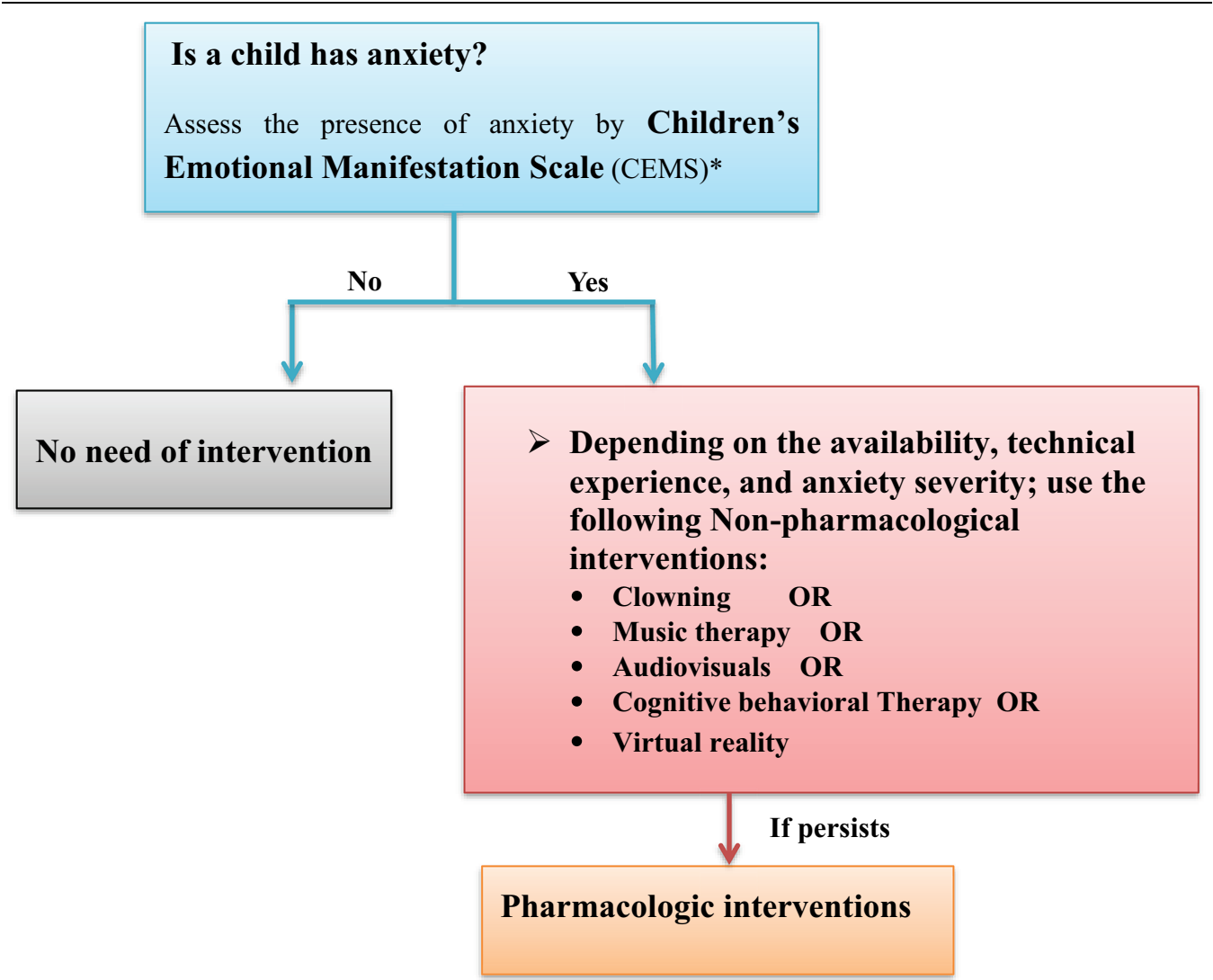


Figure 2. Flow chart for assessment and prevention of preoperative anxiety in children. *Children’s Emotional Manifestation Scale: Illustrated in Table 3.

Conclusion

Based on a review of existing evidence, non-pharmacological approaches, such as clowning, cognitive behavioral therapy, music therapy, audiovisual aids, and virtual reality, have proven effective in preventing preoperative anxiety in children. This literature review highlighted the effectiveness of these methods in pediatric psychiatry.

The implementation of these non-pharmacological techniques is feasible in both rural and urban settings. No evidence was found to suggest any superiority or inferiority among the various preventive techniques, allowing practitioners to select any non-pharmacological strategies for preventing pediatric preoperative anxiety based on factors such as availability, expertise, and cost-effectiveness (Fig. 2).

Table 3
Children's Emotional Manifestation Scale for anxiety assessment in pediatrics.

Components	Definition*
Facial expression	Score 1: if the child smiles most of the time during the procedure Score 2: if the child has a relaxed face and makes eye contact Score 3: if the child shows neutral facial expression during the procedure Score 4: if the child has a worried facial expression, with eyebrows lowered and mouth pursed Score 5: if the child shows facial grimacing or twisted facial expression with cheeks raised
Vocalization	Score 1: if the child does not cry or moan the entire time Score 2: if the child has watery eyes but does not moan and no tears fall Score 3: if the child whimpers or audibly moans or sobs Score 4: if the child cries and has a tearful face most of the time Score 5: if the child shows hard crying with tears or screams non-stop
Activity	Score 1: if the child lies quietly without any unnecessary body movement Score 2: if the child shows facial or body tenseness with slight body twisting Score 3: if the child occasionally squirms or shifts back and forth Score 4: if the child shows non-stop movement, with body shifting back and forth or from side to side Score 5: if the child shows vigorous movement, needs restraint, or has to be held down for the procedure
Interaction	Score 1: if the child has verbal interaction and no verbal protest Score 2: if the child shows no verbal interaction but responds to instructions Score 3: if the child shows no response to instructions or avoids interaction (e.g. turns back on person talking) Score 4: if the child avoids interaction and verbally protests Score 5: if the child shows strong verbal protest or complaint
Cooperation	Score 1: if the child shows complete cooperation, including active participation in and assistance with the procedure Score 2: if the child obeys instructions or only passively participates Score 3: if the child shows mild resistance or withdraws from any procedure Score 4: if the child shows extreme resistance to any procedure or strong avoidance of caregivers Score 5: if the child shows behavior that disrupts the procedures

* Each category is scored on a 1–5 scale, resulting in a total score of 5–25

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Consent

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Author's contribution

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