

Nonpharmacological interventions used in the perioperative period to prevent anxiety in adolescents: a scoping review

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ABSTRACT

Objective: The objective of this scoping review was to examine and map the range of nonpharmacological interventions used in the perioperative period to prevent anxiety in adolescents.

Introduction: Undergoing surgery involves experiencing fears and uncertainties that lead to an increase in anxiety levels. The interventions used to prevent anxiety in the perioperative period in adolescents must be appropriate to their developmental stage.

Inclusion criteria: Studies involving adolescents (10 to 19 years of age) undergoing any type of surgical procedure and specifying any nonpharmacological interventions administered to prevent anxiety, implemented in the perioperative period, were included in this review.

Methods: A comprehensive search strategy using multiple databases was employed to find relevant studies. The databases search included MEDLINE via PubMed; CINAHL Plus with Full Text via EBSCO; Cochrane Central Register of Controlled Trials; LILACS; Scopus; Library, Information Science and Technology Abstracts; PsycINFO; JBI Connect+; and Cochrane Database of Systematic Reviews. Sources of unpublished studies and gray literature were TDX – Tesis Doctorals en Xarxa (Spain); RCAAP – Repositório Científico de Acesso Aberto de Portugal; OpenGrey – System for Information on Grey Literature in Europe; and MedNar. Studies published in English, Spanish, or Portuguese were included. There was no date restriction, or geographical or cultural limitation applied to the search. The relevant studies and their reported outcomes were organized and analyzed.

Results: The database search yielded 1438 articles, and three additional records were added after hand searching. Title, abstract, and full-text review identified 11 papers that met the inclusion criteria. The final data set represented 947 participants. The data were analyzed according to the type of nonpharmacological intervention, population, concept (outcome measured and tool used), context (physical location; preoperative vs. postoperative), frequency and duration of the intervention, and which professional team member implemented the intervention. Eight nonpharmacological interventions were identified, applied either in the preoperative or postoperative context. The nurses were the main professionals administering the nonpharmacological interventions to the adolescents.

Conclusions: A variety of nonpharmacological interventions were used in the perioperative period to prevent anxiety in adolescents. The most common interventions were music/musicotherapy and hypnosis/guided imagery. However, other interventions such as therapeutic play, preoperative preparation program, mothers' presence during the anesthesia induction, distraction, relaxation training, massage therapy, and reading were also identified. These interventions were used alone or in a combination of two interventions, either preoperatively or postoperatively. The adolescents in the early stage (10 to 14 years) were the most studied group and the adolescents in the late stage (17 to 19 years) were the least studied. Future research should focus on the implementation of nonpharmacological

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interventions in the perioperative period involving adolescents, particularly late adolescents. A systematic review on the effect of nonpharmacological interventions for anxiety management in adolescents in the perioperative period should be conducted.

Scoping review registration: Open Science Framework: <https://osf.io/jhwca/>

Keywords: adolescent; anxiety; complementary therapy; perioperative care

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Introduction

It is estimated that more than 5 million adolescents in the United States^{1,2} and 65,000 in Canada³ undergo a surgical procedure every year. In 2018, there were 17,482 surgeries performed in pediatric patients (up to 15 years of age) in Portugal.⁴ These data did not differentiate between children and adolescents, neither did they include individuals 16 to 19 years of age. Data from the rest of Europe is sparse. A 2013 questionnaire answered by 251 of 431 pediatric surgery centers from 25 European countries reported a mean of 177,000 children younger than 14 years treated at the centers. However, there was a wide range among countries (92,000 to 475,000).⁵ There are no available data about the prevalence or incidence per annum of specific surgical procedures performed in the adolescent population by country or worldwide.

The World Health Organization defines adolescence as the period between 10 and 19 years of age.⁶ It is recognized as a transitional stage of physiological and psychological development from puberty to adulthood.⁷ According to the developmental characteristics, adolescence can be divided into three stages, namely early adolescence (10 to 14 years), mid adolescence (15 to 16 years), and late adolescence (17 to 19 years).⁸ During adolescence, abstract thinking begins. Adolescents can understand how the body functions, the nature of the problem, and the reason for the surgery.⁹ They want to be involved in decisions about their health as much as possible.^{9,10} Empirical¹⁰ and interventional^{11–15} studies of adolescents in the perioperative period include participants from a wide range of ages and developmental characteristics.^{10–15}

Surgery makes individuals feel anxious, regardless of the type of procedure. The anxiety may result from fear of the unknown, fear of inability to wake up or death after anesthesia, loss of control, pain, being isolated, the obligation to leave loved ones, and being isolated from social life.^{16,17} Although there are

differences among surgical procedures, there are similarities in adolescents' experiences and manifestations of anxiety owing to their developmental characteristics.¹⁸ Some adolescents experience nightmares, sleeping difficulties, and waking with an intense sense of fear and anxiety after the procedure that last for a long time after the recovery period.¹⁹

The perioperative period corresponds to three different phases of a surgical procedure: preoperative, intraoperative, and postoperative.²⁰ The preoperative phase starts with the scheduling of the surgery and finishes when the patient arrives in the anesthesia induction room. It is during this phase that all the preoperative physical and psychological evaluation occurs, and all preventive care interventions should take place.^{21,22} During this period, the multidisciplinary team must get to know the adolescent, including his or her concerns, fears, and previous health care experiences to minimize anxiety symptoms or associated clinical manifestations, such as pain or maladaptive behaviors.²³

The intraoperative phase involves the surgery itself. When the surgery ends, the patient is awakened from the anesthesia and is transferred to the post-anesthesia care unit. The postoperative phase begins with admission into the post-anesthetic recovery unit and ends when the patient is discharged from the surgical procedure.²³

The preoperative preparation of adolescents for surgical procedures provides a challenge to nurses and other health care providers due to the heterogeneity of this group. Physical, cognitive, and psychological maturation differs greatly among the three stages of adolescence.²⁴ Although surgery is planned and may be perceived as “easy” by the health care providers, it represents one of the most stressful medical procedures that an adolescent can experience.² This stress is generally reflected as anxiety, fear, or anger¹⁵ with undesirable consequences for their health and well-being.²⁵

Anxiety can be defined as an unpleasant emotion when a person is in a tense and apprehensive state, arising from the anticipation of both internal and external danger.²⁶ In the perioperative period, anxiety increases with tension, irritability, and heightened activity of the autonomic nervous system.¹⁵ In a pilot study developed in the United States, 80% of adolescents who underwent outpatient surgery reported significant anxiety in the preoperative period.²⁷ The signs and symptoms described by some adolescents in the perioperative period were present for weeks or months before the surgery,²⁸ peaking at the time of anesthesia induction,²⁷ and persisted for months after the surgery.^{19,27,29}

Another important issue is postoperative pain. According to previous studies,³⁰⁻³² there is a positive association between anxiety and pain in the perioperative period, and the level of anxiety varies according to age, maturity, temperament, previous surgical experiences,²⁷ history of pain,³³ and parental anxiety levels.^{2,11,12}

It is therefore imperative that health care professionals who work with adolescents in the perioperative period are aware of and use nonpharmacological interventions – appropriate to the adolescent developmental stage (early, middle, or late)²⁹ – in order to reduce anxiety and related consequences. Nonpharmacological interventions were found to create a peaceful and pleasant state that helps to reduce anticipatory anxiety, separation anxiety,¹⁸ and preoperative anxiety.¹⁵

Nonpharmacological interventions are characterized as psychological, environmental, social, communicational, or other therapies. Psychological interventions help adolescents alter unstable behavior and provide insight into the origins and development of emotional difficulties, leading to an increased capacity to take rational control over their feelings and behavior.³⁴ These interventions include a variety of psychological and educational components such as relaxation training, cognitive and behavioral coping strategies, education/information sessions, distraction, or hypnosis.³⁵

Examples of environmental interventions may include use of an induction room before surgery, or allowing the patient to keep their own clothes on, especially underwear. Social interventions are related to parental presence or a supportive person and health care professionals in the induction room. Finally, interventions related to communication with

health care members include the tone of voice and neutral or positive language.

The authors are unaware of any reviews that present and appraise the nonpharmacological interventions used in adolescents to prevent anxiety in the perioperative period. Most of the existing information is mixed with data on younger children.^{36,37} To fill this gap, the purpose of the scoping review was to establish whether there is sufficient literature concerning the adolescent population in the perioperative period to develop a systematic review about the effectiveness of nonpharmacological interventions for anxiety in adolescents in the perioperative period. This scoping review will also serve to identify which nonpharmacological interventions are used that can be later included in a program to evaluate their efficacy in the prevention of anxiety in adolescents in the perioperative period.

In an initial search of the *JBI Database of Systematic Reviews and Implementation Reports*, *Cochrane Database of Systematic Reviews*, *MEDLINE* (via PubMed), *CINAHL* (via EBSCO), and *Epistemonikos*, it was revealed that currently there is no scoping review (published or in progress) on this topic. The objective of this scoping review was to examine and to map the range of nonpharmacological interventions used in the perioperative period to prevent anxiety in adolescents.

Review questions

The main review question incorporated the elements of the patient, concept, and context to guide the development of specific inclusion criteria, facilitate the literature search, and provide a robust structure for the development of the scoping review.^{38,39}

The main question of this review is:

- i) Which nonpharmacological interventions are used in the perioperative period to prevent anxiety in adolescents?

The following sub-questions were also added to unveil particular attributes about the nonpharmacological interventions:

- ii) Which adolescent population (10 to 14 years, 15 to 16 years, 17 to 19 years) has been the object of the nonpharmacological interventions used to prevent anxiety in the perioperative period?
- iii) Which anxiety-related effects (pain, discomfort, maladaptive behaviors) have been reported by adolescents in the perioperative period?

- iv) What are the contexts (preoperative, intraoperative, postoperative) in which nonpharmacological interventions are delivered to prevent anxiety in adolescents?
- v) What are the characteristics (duration, dose, frequency) of these interventions?
- vi) Who are the professionals (nurse, anesthesiologist, psychologist) who deliver nonpharmacological interventions to prevent anxiety in adolescents in the perioperative period?

Inclusion criteria

Participants

This scoping review considered studies that include adolescents aged 10 to 19 years who underwent a surgical procedure, regardless of the type of surgery, and to whom nonpharmacological interventions were administered in the perioperative period. The interventions could be delivered by any health care professional.

Concept

Studies that included the following interventions were considered: cognitive behavioral intervention, complementary therapy, or variations of specific nonpharmacological interventions such as guided imagery, distraction, music, virtual reality, hypnosis, Reiki, massage, or communication. All studies that aimed to prevent perioperative anxiety in adolescents were also considered, regardless of whether nonpharmacological interventions were used alone or in combination with pharmacological interventions.

Interventions delivery on an individual basis, face-to-face, or using technological devices were included in this review as well as group sessions with adolescents only or together with their parents.

The main focus of the review was the interventions, delivered by any member of the health care team, namely registered nurses, psychologists, and child specialists, among others. Studies related to interventions delivered in a non-surgical context were excluded.

Context

The context of this review included hospital departments where perioperative care was delivered. This included, but was not limited to, the operating room, post-care anesthesia unit, or surgical ward.

Types of sources

This scoping review considered for inclusion quantitative, qualitative, and mixed methods study designs. Systematic reviews and text and opinion papers were considered.

Methods

This review was conducted in accordance with the JBI methodology for scoping reviews,^{39,40} and prepared using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR).⁴¹ The review follows an a priori protocol.⁴²

Search strategy

The search strategy aimed to locate both published and unpublished primary studies, reviews, and text and opinion papers. An initial limited search of MEDLINE (via PubMed) and CINAHL (via EBSCO) was undertaken to identify articles on the topic. The text words contained in the titles and abstracts of relevant articles, and the index terms used to describe the articles were used to develop a full search strategy. The search strategy, including all identified keywords and index terms, was adapted for each included information source and a second search was undertaken on September 1, 2019. Finally, the reference lists of the full-text articles included in the review were screened for additional papers.

The databases searched included MEDLINE (via PubMed); CINAHL Plus with Full Text (via EBSCO); Cochrane Central Register of Controlled Trials (via EBSCO); LILACS; Scopus; Library, Information Science and Technology Abstracts; PsycINFO (via EBSCO); JBI Connect+; and Cochrane Database of Systematic Reviews (via EBSCO). Sources of unpublished studies and gray literature searched included TDX – Tesis Doctorals en Xarxa (Spain); RCAAP – Repositório Científico de Acesso Aberto de Portugal; OpenGrey; and MedNar.

Papers published in English, Spanish, or Portuguese were considered. No date restrictions, or geographical or cultural limitations were applied. The full search strategy and results are provided in Appendix I.

Study selection

Following the search, all identified records were collated and uploaded into EndNote v.X8 (Clarivate

Analytics, PA, USA) and duplicates removed. Titles and abstracts were screened by two independent reviewers (MPS and RP) for assessment against the inclusion criteria for the review. Possible relevant studies were retrieved in full and their citation details imported into the JBI System for the Unified Management, Assessment and Review of Information (JBI SUMARI; JBI, Adelaide, Australia). The full-text papers that did not meet the inclusion criteria were excluded, and reasons for their exclusion are provided in Appendix II. Any disagreements that arose between the reviewers were resolved through discussion or with a third reviewer.

Data extraction

Seven charting tables were developed as part of the protocol: one for each review question and another one to extract the characteristics of the included studies. Data from the selected papers were extracted by two independent reviewers (MPS and RP) using the data extraction tool developed by the reviewers in the protocol.⁴² After the data extraction, the authors conferred to check the data extracted and avoid any disagreements or transcription errors.

Data analysis and presentation

The results are summarized and presented in a tabular form aligned with the objective of this scoping review. A narrative summary accompanies the tabulated results and describes how these relate to the review's objective and questions.

Results

Study inclusion

The database searches identified 1438 records, and an additional three records were found through other sources. After the removal of 276 duplicates, 1165 titles and abstracts were screened against the inclusion criteria and 1111 studies were excluded. The remaining 54 studies were retrieved in full and screened. Subsequently, 43 were excluded as they did not meet the inclusion criteria. Of the excluded studies, 38 had ineligible population, four studies had an ineligible concept, and one had an ineligible context (Appendix II). A total of 11 studies were included in the final scoping review. Search results and study selection are presented in a Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram (Figure 1).⁴³

Characteristics of included studies

All 11 studies included in the review are primary research studies. Six were randomized controlled trials (RCTs),⁴⁴⁻⁴⁹ three used an experimental design,^{15,50,51} one was a mixed methods study,⁵² and the other was a quasi-RCT.⁵³ Ten studies used a quantitative design and one study⁵² used a mixed methods design. Of the 11 studies, five were published after 2016,^{15,46-48,51} and four before 2014.^{45,49,52,53} Two studies were published before 2000.^{44,50} Four studies were developed in the USA^{44,46,48,50} and two in Turkey.^{15,51} The other studies were developed in Hong Kong,⁴⁹ Sweden,⁵² Egypt,⁵³ France,⁴⁷ and Canada.⁴⁵ All of the studies were published in English. The full characteristics of included studies are presented in Appendix III.

Review findings

Nonpharmacological interventions

The 11 studies revealed eight nonpharmacological interventions implemented in the perioperative period to prevent anxiety in adolescents. The interventions were music/music therapy,^{44,46,51,52} hypnosis/guided imagery,^{45,47,50} therapeutic play,⁴⁹ preoperative preparation program,⁵³ mothers' presence during the induction,⁵³ distraction,¹⁵ relaxation training,⁴⁶ and massage therapy and reading.⁴⁸ Eight studies^{15,44,45,47,49-52} developed and evaluated a single nonpharmacological intervention. The others three studies^{46,48,53} implemented and evaluated a combination of two nonpharmacological interventions.

Population

The population samples varied in size between 20 participants⁴⁴ and 203 participants.⁴⁹ The total number from all the included studies was 947 participants. Eight of the 11 studies included adolescents from the early to late stage of adolescence (ie, 10 to 19 years of age).^{15,44-48,50,51} Nine studies^{15,44-48,50-52} included adolescents from the early to middle stage of adolescence (ie, 10 to 16 years of age). All 11 studies included participants in the early stage of adolescence (10 to 14 years). Only three studies⁴⁵⁻⁴⁷ were developed exclusively with an adolescent population. Of the 11 studies, five included more females than males.^{45-47,50,53} In three studies, the samples were balanced, with similar ratio of male to female participants.^{15,48,52} Two studies had more male than female participants,^{49,51} and one study did

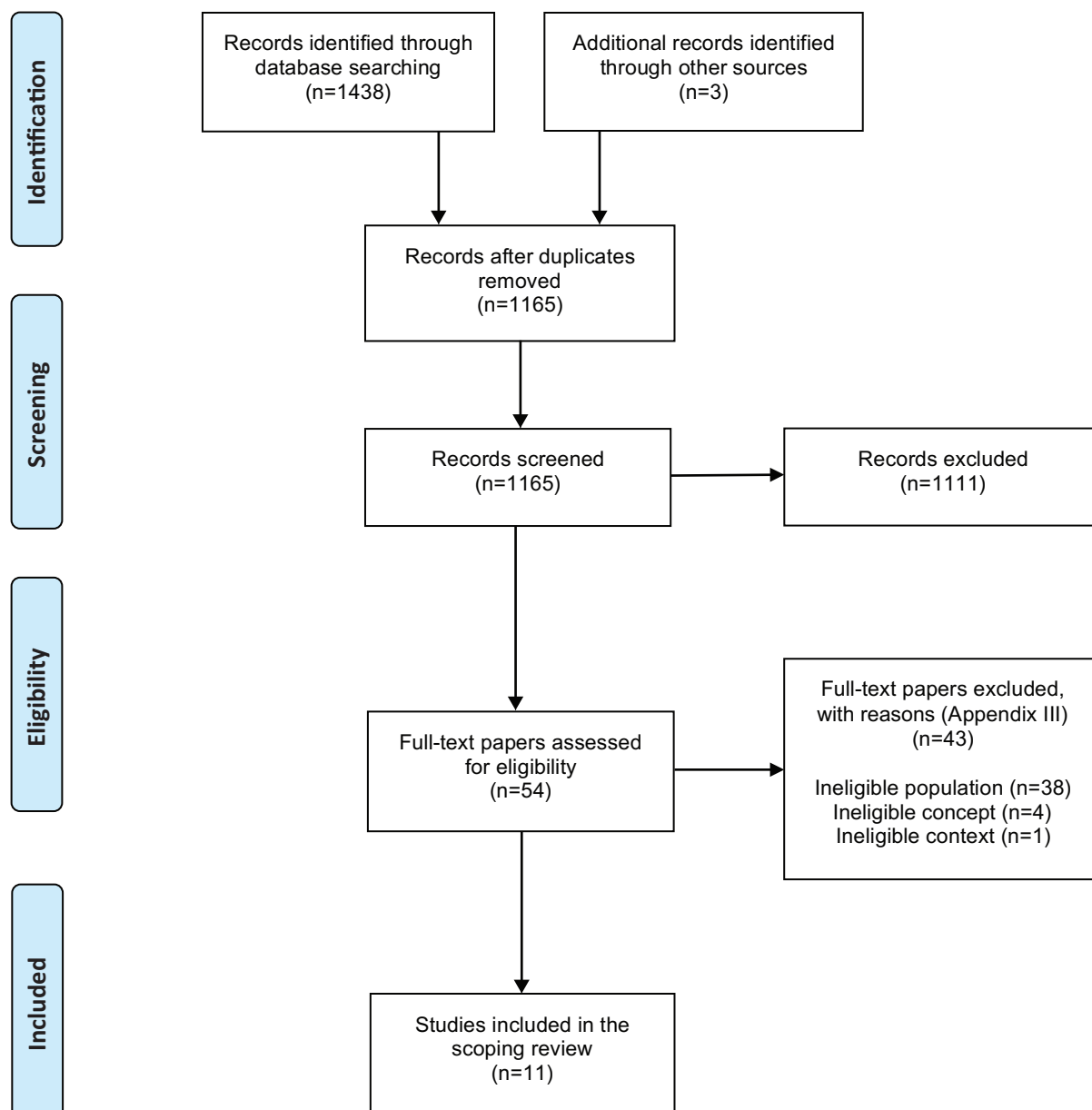


Figure 1: Search results and study selection and inclusion process⁴³

not report the sex of participants.⁴⁴ The differences between sexes in the outcomes were not evaluated. In this review, the authors mapped the interventions and characteristics of the samples. The differences between males and females in the outcomes will be analyzed in a future systematic review study.

All studies were developed with adolescents who had scheduled surgery: four studies of elective

surgery,^{15,48,50,53} three for elective day surgery,^{49,51,52} three for major surgery/spinal fusion surgery,⁴⁵⁻⁴⁷ and one study was developed with adolescent burn patients for reconstructive surgery.⁴⁴

Table 1 presents the population characteristics. The reviewers changed the table proposed in the protocol⁴² and added the types of surgery and the population per study.

Table 1: Participant ages and types of surgery in included studies

Study	Population (age range) No. of males (M)/females (F) per group Type of surgery	Population age		
		10-14 years	15-16 years	17-19 years
Aytekin <i>et al.</i> , ¹⁵ 2016	N = 83 (9-18 years) Experimental group: n = 40, 21M/19F; Control group: n = 43, 23M/20F Elective surgery (abdominal, urinary, perianal, gastrointestinal)	X	X	X
Charette <i>et al.</i> , ⁴⁵ 2014	N = 40 (10-20 years) Experimental group: n = 20, 2M/18F; Control group: n = 20, 5M/15F Spinal fusion surgery	X	X	X
Duparc-Alegria <i>et al.</i> , ⁴⁷ 2018	N = 118 (10-18 years) Experimental group: n = 59, 19M/40F; Control group: n = 59, 15M/45F (1 dropout; not stated whether the participant was male or female) Major orthopedic surgery	X	X	X
Karakul <i>et al.</i> , ⁵¹ 2018	N = 130 (9-17 years) Experimental group: n = 65, 40M/25F; Control group: n = 65, 40M/25F Day surgery	X	X	X
Lambert <i>et al.</i> , ⁵⁰ 1996	N = 52 (7-19 years) 20M/32F Elective surgery	X	X	X
Li <i>et al.</i> , ⁴⁹ 2008	N = 203 (7-12 years) Experimental group: n = 97, 67M/30F; Control group: n = 106, 73M/33F Elective day surgery	X		
Nelson <i>et al.</i> , ⁴⁶ 2016	N = 41 (10-19 years) Experimental group: n = 19, 1M/18F; Control group: n = 22, 3M/19F Spinal fusion surgery	X	X	X
Nilsson <i>et al.</i> , ⁵² 2009	N = 80 (7-16 years) Experimental group: n = 40, 20M/20F; Control group: n = 40, 20M/20F Day surgery	X	X	
Robb <i>et al.</i> , ⁴⁴ 1995	N = 20 (8-20 years) Experimental group: n = not reported; Control group: n = not reported Reconstructive surgery (patients with burn injury)	X	X	X
Sabaq <i>et al.</i> , ⁵³ 2012	N = 120 (9-12 years) Experimental group: n = 60, 26M/34F; Control group: n = 60, 25M/35F Elective surgery (appendectomy and herniorrhaphy)	X		
Staveski <i>et al.</i> , ⁴⁸ 2018	N = 60 (6-18 years) Experimental group: n = 36, 14M/22F; Control group: n = 24, 15M/9F Elective surgery (congenital heart surgery)	X	X	X

Concept

All the reviewed studies evaluated anxiety levels before and after delivery of the nonpharmacological intervention. Several instruments to measure anxiety were used. The State-Trait Anxiety Inventory for Children was the instrument used most often.^{15,44,48,50,51,53} Other instruments to measure anxiety levels included the short-form State-Trait Anxiety Inventory,⁵² the State-Trait Anxiety Inventory form Y,⁴⁵ the Visual Analogue Scale for Anxiety,⁴⁷ a zero to 10 numeric rating instrument,⁴⁶ and the Chinese version of the State Anxiety Scale for Children.⁴⁹ In all the studies, the authors implemented the interventions assuming that all adolescents undergoing surgery were at risk of anxiety (selective prevention).

Pain levels were also evaluated in six studies.^{45-48,50,52} Beyond anxiety and pain, other outcomes measured were distress,⁵² coping strategies,⁴⁵ separation scoring,¹⁵ morphine consumption/opioid exposure,^{47,48} and vital signs.⁵¹ The nonpharmacological interventions used to prevent anxiety (and related concepts) are presented in Table 2.

Context

Of the 11 studies, five implemented nonpharmacological interventions in the preoperative period only.^{15,47,49,50,53} In four studies, nonpharmacological interventions were applied both in the pre- and postoperative period.^{44,46,51} In the other two studies,^{48,52} the interventions were implemented in the postoperative period. No interventions were applied in the intraoperative period in the included studies.

The physical location where each intervention took place was related to the nature of the intervention. The most common place was the hospital (one week before surgery,^{49,50} the day before surgery,⁴⁵ or just before going to the operative room¹⁵), cardiology intensive care unit/cardiology ward,⁴⁸ recovery room/post-anesthesia care unit,^{51,52} and induction or operative room.⁴⁷ The music-assisted relaxation and training,^{44,46} therapeutic play intervention,⁴⁹ and preoperative preparation program⁵³ took place in more than one place.

Table 3 presents the contexts where the nonpharmacological interventions were implemented.

Duration and frequency of nonpharmacological interventions

The duration of the nonpharmacological interventions depended on their specifications and where

they were implemented. The interventions delivered in the induction room were usually shorter than the ones delivered on the day before the surgery. These generally concerned a preoperative educational program implementation. The frequency of the interventions ranged from one session^{15,44,46,47,49-53} to three sessions per week.^{45,48} The duration ranged from five to 10 minutes⁴⁷ to two hours.⁵³ The frequency and duration of the interventions are presented in Table 4.

Professionals

Nurses were the main professional group who led the nonpharmacological interventions for adolescents in the perioperative period. Nurses generally implemented the intervention alone^{15,47,49,52,53} or collaborated with other professionals, including child life specialists,⁵⁰ physiotherapists, psychologists,⁴⁵ or music therapists.⁴⁶ In one study, the intervention was implemented by the massage therapists,⁴⁸ and two studies^{44,51} did not report which professionals implemented the nonpharmacological interventions.

Discussion

To the authors' knowledge, this is the first scoping review developed to examine and map the range of nonpharmacological interventions used in the perioperative period to prevent anxiety in adolescents. Eight nonpharmacological interventions were identified. Music/music therapy and hypnosis/guided imagery were the most common interventions used. Adolescents in the early stage of adolescence were the most-studied group. All the studies were developed with adolescents who had scheduled surgeries. The prevention of pain was the concept most often associated with anxiety prevention. The preferable context to implement and evaluate the interventions was preoperatively and took place either one week before, one day before, or on the day of the surgery. Some of the interventions continued in the postoperative period. The frequency of the interventions ranged from one to three sessions, and the duration ranged from five to 10 minutes, to two hours. Nurses were the main professional group leading the nonpharmacological interventions.

This review found that there are some studies on nonpharmacological interventions for anxiety in the perioperative period conducted only in an adolescent population or presenting specific results for this

Table 2: Nonpharmacological interventions, with corresponding concepts, administered to adolescents in the perioperative period

Study	Type of intervention	Concept				
		Anxiety	Pain	Distress	Coping strategies	Other
Aytekin <i>et al.</i> , ¹⁵ 2016	Distraction	X				Separation scoring
Charette <i>et al.</i> , ⁴⁵ 2014	DVD with information and guided imagery/relaxation exercises	X	X		X	
Duparc-Alegria <i>et al.</i> , ⁴⁷ 2018	Hypnosis	X	X			Morphine consumption during the first 24 hours after surgery
Karakul <i>et al.</i> , ⁵¹ 2018	Classical music from headphones	X				Vital signs
Lambert <i>et al.</i> , ⁵⁰ 1996	Hypnosis/guided imagery	X	X			
Li <i>et al.</i> , ⁴⁹ 2008	Therapeutic play intervention	X				
Nelson <i>et al.</i> , ⁴⁶ 2016	Relaxation training and postoperative music therapy	X	X			
Nilsson <i>et al.</i> , ⁵² 2009	Music player	X	X	X		
Robb <i>et al.</i> , ⁴⁴ 1995	Music-assisted relaxation	X				
Sabaq <i>et al.</i> , ⁵³ 2012	Preoperative preparation program and mothers' presence during the induction	X				
Staveski <i>et al.</i> , ⁴⁸ 2018	Massage therapy and reading	X	X			Exposure to opioids and benzodiazepines

population. Although systematic reviews and text and opinion papers were eligible for inclusion in this scoping review, none were included. The systematic reviews that were potentially eligible included adolescents in their populations, but none of the reviews presented specific results for this age group. The 11 included studies had an experimental design, and more than half were published in 2014 or after. This reveals that the attention given to perioperative anxiety prevention in the pediatric subgroup over the previous decade is growing.

Despite the specific psychological characteristics of this phase of human development, adolescents are not exclusively studied in the perioperative period. Adolescents are often included with younger children in studies concerning preoperative anxiety, yet their behavior can confound the research findings.³⁷ The use of the same hetero-filling instrument to assess children's and adolescents' anxiety is not the most appropriate choice.^{54,55} Anxiety may manifest as behavioral signs such as activity, vocalizations, emotional expressivity, and state of arousal, or

Table 3: Context of nonpharmacological interventions for preventing anxiety in adolescents in the perioperative period

Study	Nonpharmacological intervention	Context		
		Preoperative	Postoperative	Setting
Aytekin <i>et al.</i> , ¹⁵ 2016	Distraction	x		Pediatric surgery department before going into the operative room
Charette <i>et al.</i> , ⁴⁵ 2014	DVD with information and guided imagery/relaxation exercises	x	x	In hospital. The patients took the DVD home and practiced the relaxation after discharge at their home.
Duparc-Alegria <i>et al.</i> , ⁴⁷ 2018	Hypnosis	x		At the operative room
Karakul <i>et al.</i> , ⁵¹ 2018	Classical music on the headphones	x	x	Post-anesthesia care unit
Lambert <i>et al.</i> , ⁵⁰ 1996	Hypnosis/guided imagery	x		During the preadmission visit one week before elective surgery
Li <i>et al.</i> , ⁴⁹ 2008	Therapeutic play intervention (visit and doll demonstration)	X One week before surgery		Visit: along reception area, induction room, and recovery room. Doll demonstration: induction room.
Nelson <i>et al.</i> , ⁴⁶ 2016	Relaxation training and postoperative music therapy	x	x	Before surgery: in the preoperative visit After surgery: hospital room
Nilsson <i>et al.</i> , ⁵² 2009	Music player		x	Post-anesthesia care unit
Robb <i>et al.</i> , ⁴⁴ 1995	Music-assisted relaxation	x	x	Patient room; transport to the surgical suite; induction; recovery room
Sabaq <i>et al.</i> , ⁵³ 2012	Preoperative preparation program and mothers' presence during the induction	x		Pediatric surgery department and included a preoperative tour visit to the operation room
Staveski <i>et al.</i> , ⁴⁸ 2018	Massage therapy and reading		x	Cardiac intensive care unit Cardiology ward

the desired involvement of parents; these all differ between children and adolescents. Preschool and school-aged children show anxiety through crying, keeping professionals away from them, presenting a sad or terrified face, moving the surgical mask away from the face, or not cooperating with their care.⁵⁶ Adolescents may experience and exhibit anxiety

differently than younger children and may not display observable signs.²⁷ During the perioperative period, adolescents are likely to show anxiety through more discreet signs, such as sweating hands, cold feet and hands, muscular tension, increased heart rate, trembling in the lower and upper limbs, remaining silent, and looking away.²⁷

Table 4: Frequency and duration of nonpharmacological interventions for anxiety in adolescents in the perioperative period

Study	Non-pharmacological intervention	Frequency of intervention	Duration of intervention
Aytekin <i>et al.</i> , ¹⁵ 2016	Distraction	One session	20 minutes
Charette <i>et al.</i> , ⁴⁵ 2014	DVD with information and guided imagery/relaxation exercises	One session on the day before surgery, another at discharge, and three times per week at home	30 minutes
Duparc-Alegria <i>et al.</i> , ⁴⁷ 2018	Hypnosis	One session	5-10 minutes
Karakul <i>et al.</i> , ⁵¹ 2018	Classical music on the headphones	One session	About 20 minutes
Lambert <i>et al.</i> , ⁵⁰ 1996	Hypnosis/guided imagery	One session One week before surgery	No longer than 30 minutes
Li <i>et al.</i> , ⁴⁹ 2008	Therapeutic play intervention	One session One week before the surgery	1 hour
Nelson <i>et al.</i> , ⁴⁶ 2016	Relaxation training and post-operative music therapy	One session	20-30 minutes
Nilsson <i>et al.</i> , ⁵² 2009	Music player	One session Starting at admission in post-operative care unit	45 minutes
Robb <i>et al.</i> , ⁴⁴ 1995	Music-assisted relaxation	Three music sessions: in the evening prior to surgery, in patient's room, and in the recovery room	30-50 minutes
Sabaq <i>et al.</i> , ⁵³ 2012	Preoperative preparation program and mothers' presence during the induction	One session On the day before surgery	2 hours
Staveski <i>et al.</i> , ⁴⁸ 2018	Massage therapy and reading	Two to three sessions per week starting within 24 hours after surgery and continued throughout the hospital stay	Massage: 15-30 minutes Reading: 20 minutes

Research demonstrates that anxiety in children and adolescents increases with age.³¹ Of the 11 included studies, six analyzed the relationship between anxiety and pain intensity, and a positive association was found in the perioperative period, which is in line with other studies.³⁰⁻³² Other concepts such as analgesia consumption, coping strategies, and distress were also evaluated. Although no methodological assessment or formal data analysis was done, as these are not required in a scoping

review, some of the studies measured outcomes and the interventions seemed to be of benefit.

Nonpharmacological interventions

The use of nonpharmacological interventions for treating anxiety in the perioperative period has increased over the past several years because of fewer negative side effects compared with pharmacological sedatives.³⁶ Interventions involving children and adolescents have evolved from the use of distraction

techniques⁵⁷ and information leaflets²⁵ to iPad technology,⁵⁸ video games,^{59,60} and virtual reality.^{61,62} In this scoping review, it was found that music/music therapy and hypnosis/guided imagery were the interventions most often used with adolescents in the perioperative period. All the interventions implemented and evaluated in the studies included in this scoping review showed positive results in the reduction of anxiety levels. However, in one study,⁴⁷ anxiety levels and pain scores decreased in both experimental and control groups. The authors attributed these results to the fact that professionals have changed the way they communicate with adolescents during anesthetic induction.⁴⁷ Communication is a powerful tool in patient care. Good communication provides proper interaction with the patient as well as with the perioperative team, resulting in improved professional standards and patient outcomes.⁶³

Population

The adolescent populations in the studies were heterogeneous in total number of participants and sex of participants. The included studies were conducted with adolescents who had specific medical conditions, and when a sex disparity was found in the study samples, it was due to the sex-specific nature of that specific surgical problem (eg, scoliosis is more common in girls than in boys).⁶⁴ Only three of the 11 studies were implemented and evaluated exclusively in adolescents. During adolescence, abstract thinking begins, which enables adolescents to understand how the body functions, the nature of the problem they are facing, and the reason for surgery.⁹ As a result, adolescents often express a desire to be involved in their surgical care.⁶⁵ With this in mind, it is important that researchers develop studies with adolescent populations only, or its subgroups, to achieve specific results about the effectiveness of nonpharmacological interventions in the prevention of perioperative anxiety for these patients.

Concept

The concept of perioperative anxiety is often associated with other concepts such as pain^{66,67} or distress.⁶⁸ Studies conducted with children, that also included adolescents, evaluated perioperative pain and found an association between pain and the levels of anxiety presented. Anxiety is a significant problem in adolescents in the perioperative period, and if not properly assessed, prevented, or

alleviated, anxiety can intensify the pain described by adolescents.⁶⁷

Context

This review found that nonpharmacological interventions to prevent perioperative anxiety were implemented in the preoperative period. However, some of the interventions (music, hypnosis/guided imagery) were intended to continue to the postoperative period. The implementation of the interventions at the time of anesthetic induction may only have minimal effect. The adolescent is likely to already feel anxious because this is the most critical moment before the surgery.^{1,27}

The literature states that adolescents should be involved in decision-making about their surgery from the beginning.⁹ However, authors describe that it is often difficult to get in touch with teenagers a week before the surgery to start implementing a preventive anxiety intervention.¹

Duration and frequency of nonpharmacological interventions

The nonpharmacological interventions performed in groups of adolescents are generally longer than the ones developed on an individual basis.¹⁴ The time chosen to deliver the intervention depends on the adolescent's age and the intervention characteristics.⁶⁹ For example, a preoperative educational program may be implemented one week before surgery or on the day before surgery. Guided imagery, on the other hand, can be initiated on the day before the surgery and continued until just prior to the induction of anesthesia, or it could be implemented only in the induction of anesthesia, which shows that even identical interventions may have different frequencies and duration.

Professionals involved in the interventions

Although the interventions could be implemented and evaluated by any professional from the interdisciplinary team, nurses were the most prominent group in the included studies.^{15,47,49,52,53} It is possible that nurses have a special interest in developing nonpharmacological interventions to prevent anxiety in the perioperative period.⁷⁰⁻⁷² This may be because nonpharmacological interventions do not require a prescription. Nurses identify anxiety as a nursing diagnosis and recognize it as a condition that can affect adolescents' perioperative recovery.

Another reason for nurses' involvement in many of these nonpharmacological interventions may be because they are the professional group who are with the adolescent before, during, and after surgery.

Limitations of the review

This scoping review only included studies published in English, Portuguese, or Spanish. Articles published in other languages could bring other contributions to this review.

Because the objective of this scoping review was to examine and map nonpharmacological interventions implemented and evaluated in the perioperative period to prevent anxiety in adolescents, no assessment of methodological quality was conducted and, therefore, recommendations for practice cannot be made or graded.

Conclusions

This scoping review identified eight nonpharmacological interventions used in the perioperative period to prevent anxiety in adolescents. Interventions were mainly led by nurses. The music/music therapy and hypnosis/guided imagery were the most common nonpharmacological interventions used in this population. The adolescents in the medium (15 to 16 years) and late (17 to 19 years) stage of adolescence were the least studied. The literature revealed a relationship between the use of nonpharmacological interventions to prevent anxiety and pain in the perioperative period.

Considering that developmental characteristics and behavior of children and adolescents are different, studies with nonpharmacological interventions should be conducted separately for each group and studies delivered to different subgroups of the pediatric population (eg, pre-school/school-aged children mixed with adolescents) should be discouraged.

Recommendations for research

The authors of this review recommend that in future studies, the results of the different pediatric age groups are presented according to their developmental stage. This would assist with understanding which nonpharmacological interventions present the best results for a specific pediatric group, such as adolescents. Studies to assess the effect of nonpharmacological interventions on anxiety that include children from zero, three, or five years of

age to 18 years of age should be discouraged. Children and adolescents express themselves differently and experience the perioperative period differently. Thus, they must be evaluated based on their developmental characteristics. Moreover, when the sample of participants includes children of various stages of development, the results obtained may not coincide with what is actually expressed by each group when evaluated separately.

The results of this scoping review suggest that a systematic review should be conducted to evaluate the effectiveness of nonpharmacological interventions for anxiety management in adolescents in the perioperative period.⁷³

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References

1. Monahan JC. Using an age-specific nursing model to tailor care to the adolescent surgical patient. *AORN J* 2014;99(6): 733–749.
2. Goldschmidt K, Woolley A. Using technology to reduce childrens' anxiety throughout the perioperative period. *J Pediatr Nurs* 2017;36(0):256–8.
3. Wright JG, Menaker RJ. Canadian Paediatric Surgical Wait Times Study Group. Waiting for children's surgery in Canada: the Canadian Paediatric Surgical Wait Times project. *CMAJ* 2011;183(9):E559–64.
4. Statistics Portugal. Health statistics 2018 [internet]. 2020 [cited 2020 Nov 7]. Available from: https://www.ine.pt/xportal/xmain?xpid=INE&xpgid=ine_publicacoes&PUBLICACOESpub_boui=257793024&PUBLICACOESmodo=2.
5. Tillig B, Ehrich J, Rolle U. Diversity of service systems in pediatric surgery for fetuses, neonates, infants, children, and adolescents in Europe. *J Pediatr* 2018;192:270–1.
6. World Health Organization. Mental health status of adolescents in South-East Asia: evidence for action [internet]. April 2017 [cited 2018 Jun 17]. Available from: <http://apps.who.int/iris/bitstream/10665/254982/1/9789290225737-eng.pdf>.
7. Sivagurunathan C, Umadevi R, Rama R, Gopalakrishnan S. Adolescent health: present status and its related programmes in India. Are we in the right direction? *J Clin Diagn Res* 2015;9(3). LE01–6.

8. Barrett DE. The three stages of adolescence. *High Sch J* 1996;79(4):333–9.
9. Bayne A, Kirkland P. Prepare children for surgery one stage at a time. *OR Nurse* 2008;2(8):36–9.
10. Fortier MA, Chorney JM, Rony RY, Perret-Karimi D, Rinehart JB, Camilon FS, et al. Children's desire for perioperative information. *Anesth Analg* 2009;109(4):1085–90.
11. Berger J, Wilson D, Potts L, Polivka B. Wacky Wednesday: use of distraction through humor to reduce preoperative anxiety in children and their parents. *J Perianesth Nurs* 2014;29(4):285–91.
12. Özalp Gerçeker G, Karayağız Muslu G, Yardimci F. Children's postoperative symptoms at home through nurse-led telephone counseling and its effects on parents' anxiety: a randomized controlled trial. *J Spec Pediatr Nurs* 2016;21(4):189–99.
13. Rabbitts JA, Groenewald CB, Tai GG, Palermo TM. Presurgical psychosocial predictors of acute postsurgical pain and quality of life in children undergoing major surgery. *J Pain* 2015;16(3):226–34.
14. LaMontagne LL, Hepworth JT, Cohen F, Salisbury MH. Cognitive-behavioral intervention effects on adolescents' anxiety and pain following spinal fusion surgery. *Nurs Res* 2003;52(3):183–90.
15. Aytekin A, Doru O, Kucukoglu S. The effects of distraction on preoperative anxiety level in children. *J Perianesth Nurs* 2016;31(1):56–62.
16. Lee KC, Chao YH, Yiin JJ, Chiang PY, Chao YF. Effectiveness of different music-playing devices for reducing preoperative anxiety: a clinical control study. *Int J Nurs Stud* 2011;48(10):1180–7.
17. Brewer S, Gleditsch SL, Syblik D, Tietjens ME, Vacic HW. Pediatric anxiety: child life intervention in day surgery. *J Pediatr Nurs* 2006;21(1):13–22.
18. Alpert O, Iqbal I, Andrade G, Marwaha R, Ebben J, Zappia k. Perioperative psychiatric conditions and their treatment in children and adolescents. In: Zimbrea PC, Oldham M, Lee HB, editors. *Perioperative psychiatry - a guide to behavioral healthcare for the surgical patient*. Cham, Switzerland: Springer, 2019;p. 297.
19. Rullander AC, Isberg S, Karling M, Jonsson H, Lindh V. Adolescents' experience with scoliosis surgery: a qualitative study. *Pain Manag Nurs* 2013;14(1):50–9.
20. Treas LS, Wilkinson JM. *Basic nursing: concepts, skills & reasoning*. 1st ed. Philadelphia, PA: F.A. Davis Company; 2014; p. 1708.
21. Wicker P. *Perioperative practice at a glance*. 1st ed. Chichester, UK: John Wiley and Sons; 2015; p. 161.
22. Hockenberry MJ, Wilson D, Rodgers CC. *Wong's nursing care of infants and children*. 11th ed. Missouri: Elsevier; 2019 p. 1392.
23. Jackson J. Preoperative assessment. In: Woodhead K, Fudge LK, editors. *Manual of perioperative care: an essential guide*. 1st ed. Chichester: Wiley-Blackwell, 2012; p. 344.
24. Busen NH. Perioperative preparation of the adolescent surgical patient. *AORN J* 2001;73(2):337–41.
25. Kassai B, Rabilloud M, Dantony E, Grousson S, Revol O, Malik S, et al. Introduction of a paediatric anaesthesia comic information leaflet reduced preoperative anxiety in children. *Br J Anaesth* 2016;117(1):95–102.
26. American Psychiatric Association. *Diagnostic and statistical manual of mental disorders*. 5th ed. Portuguese: Climepsi Editores; 2014; p. 1122.
27. Fortier MA, Martin SR, MacLaren Chorney J, Mayes LC, Kain ZN. Preoperative anxiety in adolescents undergoing surgery: a pilot study. *Paediatr Anaesth* 2011;21(9):969–73.
28. Borsook D, George E, Kussman B, Becerra L. Anesthesia and perioperative stress: consequences on neural networks and postoperative behaviors. *Prog Neurobiol* 2010;92(4):601–12.
29. Rullander A-C, Jonsson H, Lundström M, Lindh V. Young people's experiences with scoliosis surgery. A survey of pain, nausea, and global satisfaction. *J Orthop Nurs* 2013;32(6):327–35.
30. Beringer RM, Greenwood R, Kilpatrick N. Development and validation of the Pediatric Anesthesia Behavior score—an objective measure of behavior during induction of anesthesia. *Paediatr Anaesth* 2014;24(2):196–200.
31. Kain ZN, Mayes LC, Caldwell-Andrews AA, Karas DE, McClain BC. Preoperative anxiety, postoperative pain, and behavioral recovery in young children undergoing surgery. *Pediatrics* 2006;118(2):651–8.
32. Connelly M, Fulmer RD, Prohaska J, Anson L, Dryer L, Thomas V, et al. Predictors of postoperative pain trajectories in adolescent idiopathic scoliosis. *Spine* 2014;39(3):E174–81.
33. Tsao JC, Myers CD, Craske MG, Bursch B, Kim SC, Zeltzer LK. Role of anticipatory anxiety and anxiety sensitivity in children's and adolescents' laboratory pain responses. *J Pediatr Psychol* 2004;29(5):379–88.
34. Pereira FCE, Shinde V. Impact of psychological interventions in reducing anxiety among adolescents. *Indian J Health Wellbeing* 2018;9(5):745–7.
35. Flowers SR, Birnie KA. Procedural preparation and support as a standard of care in pediatric oncology. *Pediatr Blood Cancer* 2015;62(Suppl 5):S694–723.
36. Manyande A, Cyna AM, Yip P, Chooi C, Middleton P. Non-pharmacological interventions for assisting the induction of anaesthesia in children. *Cochrane Database Syst Rev* 2015;(7):CD006447.
37. Carlsson RNE, Henningsson RN. Visiting the operating theatre before surgery did not reduce the anxiety in children and their attendant parent. *J Pediatr Nurs* 2018;38:e24–9.
38. Peters MD, Marnie C, Tricco AC, Pollock D, Munn Z, Alexander L, et al. Updated methodological guidance for the conduct of scoping reviews. *JB Evid Synth* 2020;18(10):2119–26.
39. Peters MDJ, Godfrey C, McInerney P, Munn Z, Tricco AC, Khalil H. Chapter 11: Scoping reviews. In: Aromataris E, Munn Z, editors. *JB Manual for Evidence Synthesis*

- [internet]. Adelaide: JBI; 2020 [cited 2020 Nov 5]. Available from: <https://synthesismanual.jbi.global>.
40. Peters MDJ, Godfrey CM, Khalil H, McInerney P, Parker D, Soares CB. Guidance for conducting systematic Scoping Reviews. *Int J Evid Based Healthc* 2015;13(3):141–6.
 41. Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D, et al. PRISMA extension for scoping reviews (PRISMA-ScR): checklist and explanation. *Ann Intern Med* 2018;169(7):467–473.
 42. Pestana-Santos M, Santos MR, Cardoso D, Lomba L. Non-pharmacological interventions used during the perioperative period to prevent anxiety in adolescents: a scoping review protocol. *JBI Database System Rev Implement Rep* 2019;17(9):1883–93.
 43. Moher D, Liberati A, Tetzlaff J, Altman DG; The PRISMA Group. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *PLoS Med* 2009;6(7):e1000097.
 44. Robb SL, Nichols RJ, Rutan RL, Bishop BL, Parker JC. The effects of music assisted relaxation on preoperative anxiety. *J Music Ther* 1995;32(1):2–21.
 45. Charette S, Fiola JL, Charest M-C, Villeneuve E, Théroux J, Joncas J, et al. Guided imagery for adolescent post-spinal fusion pain management: a pilot study. *Pain Manag Nurs* 2015;16(3):211–20.
 46. Nelson K, Adamek M, Kleiber C. Relaxation training and postoperative music therapy for adolescents undergoing spinal fusion surgery. *Pain Manag Nurs* 2017;18(1):16–23.
 47. Duparc-Alegria N, Tiberghien K, Abdoul H, Dahmani S, Alberti C, Thiollier AF. Assessment of a short hypnosis in a paediatric operating room in reducing postoperative pain and anxiety: a randomised study. *J Clin Nurs* 2018;27(1–2):86–91.
 48. Staveski SL, Boulanger K, Erman L, Lin L, Almgren C, Journal C, et al. The impact of massage and reading on children's pain and anxiety after cardiovascular surgery: a pilot study. *Pediatr Crit Care Med* 2018;19(8):725–32.
 49. Li HC, Lopez V. Effectiveness and appropriateness of therapeutic play intervention in preparing children for surgery: a randomized controlled trial study. *J Spec Pediatr Nurs* 2008;13(2):63–73.
 50. Lambert SA. The effects of hypnosis/guided imagery on the postoperative course of children. *J Dev Behav Pediatr* 1996;17(5):307–10.
 51. Karakul A, Bolşık ZB. The effect of music listened to during the recovery period after day surgery on the anxiety state and vital signs of children and adolescents. *J Pediatr Res* 2018;5(2):82–7.
 52. Nilsson S, Kokinsky E, Nilsson U, Sidenvall B, Enskar K. School-aged children's experiences of postoperative music medicine on pain, distress, and anxiety. *Paediatr Anaesth* 2009;19(12):1184–90.
 53. Sabaq AG, El-Awady S. The effect of pre-operative preparation program and mothers presence during induction on anxiety level and behavior change in young children undergoing elective surgery. *Life Sci J* 2012;9(4):3798–807.
 54. Lim E, Fabila T, Sze Ying T, Tan J. HEADPLAY personal cinema system facilitates intravenous cannulation in children: a randomized controlled trial. *Int J Pediatr* 2013;13:849469.
 55. MacLaren JE, Thompson C, Weinberg M, Fortier MA, Morrison DE, Perret D, et al. Prediction of preoperative anxiety in children: who is most accurate? *Anesth Analg* 2009;108(6):1777.
 56. Kain ZN, Mayes LC, Cicchetti DV, Caramico LA, Spieker M, Nygren MM, et al. Measurement tool for preoperative anxiety in young children: the Yale preoperative anxiety scale. *Child Neuropsychol* 1995;1(3):2013–110.
 57. Sola C, Lefauconnier A, Bringuier S, Raux O, Capdevila X, Dadure C. Childhood preoperative anxiety: is sedation and distraction better than either alone? A prospective randomized study. *Paediatr Anaesth* 2017;27(8):827–34.
 58. Caldwell RM, Ray R. Utilization of iPad technology to decrease pediatric preoperative anxiety. *J Pediatr Surg Nurs* 2017;6(4):103–12.
 59. Patel A, Schieble T, Davidson M, Tran MC, Schoenberg C, Delphin E, et al. Distraction with a hand-held video game reduces pediatric preoperative anxiety. *Paediatr Anaesth* 2006;16(10):1019–27.
 60. Messina M, Molinaro F, Meucci D, Angotti R, Giuntini L, Cerchia E, et al. Preoperative distraction in children: hand-held videogames vs clown therapy. *Pediatr Med Chir* 2014;36(5–6):98.
 61. Ryu JH, Oh AY, Yoo HJ, Kim JH, Park JW, Han SH. The effect of an immersive virtual reality tour of the operating theater on emergence delirium in children undergoing general anesthesia: a randomized controlled trial. *Paediatr Anaesth* 2019;29(1):98–105.
 62. Park JW, Nahm FS, Kim JH, Jeon YT, Ryu JH, Han SH. The effect of mirroring display of virtual reality tour of the operating theatre on preoperative anxiety: a randomized controlled trial. *IEEE J Biomed Health Inform* 2019;23(6):2655–2660.
 63. Subramani S, Garg S, Singhal A, Sinha A. Perioperative communication: challenges and opportunities for anesthesiologists. *J Anaesthesiol Clin Pharmacol* 2018;34(1):5–6.
 64. Choudhry MN, Ahmad Z, Verma R. Adolescent idiopathic scoliosis. *Open Orthop J* 2016;10(0):143–54.
 65. Pestana-Santos M, Santos MR, Pestana-Santos A, Pinto C, Lomba L. Perioperative anxiety in adolescents: manifestations and control needs. An integrative review. *Rev Rol Enferm* 2020;43(1,supl):312–21.
 66. Vagnoli L, Bettini A, Amore E, De Masi S, Messeri A. Relaxation-guided imagery reduces perioperative anxiety and pain in children: a randomized study. *Eur J Pediatr* 2019;178(6):913–21.
 67. Chieng YJ, Chan WC, Klainin-Yobas P, He HG. Perioperative anxiety and postoperative pain in children and adolescents undergoing elective surgical procedures: a quantitative systematic review. *J Adv Nurs* 2014;70(2):243–55.

68. Broering CV, Souza CDd, Kaszubowski E, Crepaldi MA. Effects of pre-surgical psychological preparations on stress and anxiety in boys and girls. *Acta Colomb Psicol* 2018;21(1):217–48.
69. Adler AC, Leung S, Lee BH, Dubow SR. Preparing your pediatric patients and their families for the operating room: reducing fear of the unknown. *Pediatr Rev* 2018;39(1):13–26.
70. Stewart B, Cazzell MA, Percy T. Single-blinded randomized controlled study on use of interactive distraction versus oral midazolam to reduce pediatric preoperative anxiety, emergence delirium, and postanesthesia length of stay. *J Perianesth Nurs* 2019;34(3):567–75.
71. Li WH, Chan SS, Wong EM, Kwok MC, Lee IT. Effect of therapeutic play on pre- and post-operative anxiety and emotional responses in Hong Kong Chinese children: a randomised controlled trial. *Hong Kong Med J* 2014;20(suppl 7):36–9.
72. Li HC, Lopez V, Lee TL. Psychoeducational preparation of children for surgery: the importance of parental involvement. *Patient Educ Couns* 2007;65(1):34–41.
73. Pestana-Santos M, Pereira MJ, Santos E, Lomba L, Santos MR. Effectiveness of non-pharmacological interventions to manage anxiety in adolescents in the perioperative period: a systematic review protocol. *JBIEvid Synth* 2021. Epub ahead of print.

Appendix I: Search strategy

MEDLINE via PubMed

Search conducted on September 1, 2019

Search	Query	Records retrieved
#14	Limiters: English; Portuguese; Spanish	452
#13	Search (((((((adolescen*[Title/Abstract] OR teen*[Title/Abstract] OR youth*[Title/Abstract] OR paediatric*[Title/Abstract] OR pediatric*[Title/Abstract] OR child*[Title/Abstract]))) OR ((“Adolescent”[Mesh]) OR “Child”[Mesh]))) AND (((nonpharmacologic*[Title/Abstract] OR Non-pharmacologic*[Title/Abstract] OR “Non pharmacologic”[Title/Abstract] OR “Non pharmacological”[Title/Abstract] OR Cognitive-behaviour[Title/Abstract] OR “Cognitive behaviour”[Title/Abstract] OR “cognitive behavior”[Title/Abstract] OR cognitive-behavior[Title/Abstract] OR “psychological therapy”[Title/Abstract] OR “psychological intervention”[Title/Abstract] OR “Alternative therapy”[Title/Abstract] OR “Alternative therapies” [Title/Abstract] OR “complementary therapy”[Title/Abstract] OR “complementary therapies”[Title/Abstract] OR “Environmental intervention”[Title/Abstract] OR “Environmental interventions”[Title/Abstract] OR Communication*[Title/Abstract] OR “guided imagery”[Title/Abstract] OR distraction[Title/Abstract] OR music[Title/Abstract] OR “virtual reality”[Title/Abstract] OR hypnosis[Title/Abstract] OR reiki[Title/Abstract]))) OR (((“Complementary Therapies”[-Mesh]) OR “Socioenvironmental Therapy”[Mesh:NoExp] OR “Massage”[Mesh:NoExp] OR “Communication”[Mesh:NoExp]))) AND (((perioperative[Title/Abstract] OR postoperative[Title/Abstract] OR preoperative[Title/Abstract] OR operati*[Title/Abstract] OR surgery[Title/Abstract]))) OR (((“Perioperative Period”[Mesh]) OR “Preoperative Care”[Mesh]) OR “Operating Rooms”[Mesh]) OR “Hospitals, Pediatric”[Mesh]) OR “Hospital Departments”[-Mesh]))) AND ((anxiety) OR “Anxiety”[Mesh:NoExp]))	
#12	Search (anxiety) OR “Anxiety”[Mesh:NoExp]	
#11	Search (((perioperative[Title/Abstract] OR postoperative[Title/Abstract] OR preoperative[Title/Abstract] OR operati*[Title/Abstract] OR surgery[Title/Abstract]))) OR (((“Perioperative Period”[Mesh]) OR “Preoperative Care”[Mesh]) OR “Operating Rooms”[Mesh]) OR “Hospitals, Pediatric”[Mesh]) OR “Hospital Departments”[Mesh])	
#10	Search (((nonpharmacologic*[Title/Abstract] OR Non-pharmacologic*[Title/Abstract] OR “Non pharmacologic”[Title/Abstract] OR “Non pharmacological”[Title/Abstract] OR Cognitive-behaviour[Title/Abstract] OR “Cognitive behaviour”[Title/Abstract] OR “cognitive behavior”[Title/Abstract] OR cognitive-behavior[Title/Abstract] OR “psychological therapy”[Title/Abstract] OR “psychological intervention”[Title/Abstract] OR “Alternative therapy”[Title/Abstract] OR “Alternative therapies” [Title/Abstract] OR “complementary therapy”[Title/Abstract] OR “complementary therapies”[Title/Abstract] OR “Environmental intervention”[-Title/Abstract] OR “Environmental interventions”[Title/Abstract] OR Communication*[Title/Abstract] OR “guided imagery”[Title/Abstract] OR distraction[Title/Abstract] OR music[Title/Abstract] OR “virtual reality”[Title/Abstract] OR hypnosis[Title/Abstract] OR reiki[Title/Abstract]))) OR (((“Complementary Therapies”[Mesh]) OR “Socioenvironmental Therapy”[-Mesh:NoExp] OR “Massage”[Mesh:NoExp] OR “Communication”[Mesh:NoExp]))	
#9	Search (((adolescen*[Title/Abstract] OR teen*[Title/Abstract] OR youth*[Title/Abstract] OR paediatric*[Title/Abstract] OR pediatric*[Title/Abstract] OR child*[Title/Abstract]))) OR ((“Adolescent”[Mesh]) OR “Child”[Mesh])	

<i>(Continued)</i>		
Search	Query	Records retrieved
#8	Search "Anxiety"[Mesh:NoExp]	
#7	Search (((("Perioperative Period"[Mesh]) OR "Preoperative Care"[Mesh]) OR "Operating Rooms"[Mesh]) OR "Hospitals, Pediatric"[Mesh]) OR "Hospital Departments"[Mesh]	
#6	Search (((("Complementary Therapies"[Mesh]) OR "Socioenvironmental Therapy"[Mesh:NoExp]) OR "Massage"[Mesh:NoExp]) OR "Communication"[Mesh:NoExp]	
#5	Search ("Adolescent"[Mesh]) OR "Child"[Mesh]	
#4	Search anxiety	
#3	Search (perioperative[Title/Abstract] OR postoperative[Title/Abstract] OR preoperative[Title/Abstract] OR operati*[Title/Abstract] OR surgery[Title/Abstract])	
#2	Search (nonpharmacologic*[Title/Abstract] OR Non-pharmacologic*[Title/Abstract] OR "Non pharmacologic"[Title/Abstract] OR "Non pharmacological"[Title/Abstract] OR Cognitive-behaviour[Title/Abstract] OR "Cognitive behaviour"[Title/Abstract] OR "cognitive behavior"[Title/Abstract] OR cognitive-behavior[Title/Abstract] OR "psychological therapy"[Title/Abstract] OR "psychological intervention"[Title/Abstract] OR "Alternative therapy"[Title/Abstract] OR "Alternative therapies" [Title/Abstract] OR "complementary therapy"[Title/Abstract] OR "complementary therapies"[Title/Abstract] OR "Environmental intervention"[Title/Abstract] OR "Environmental interventions"[Title/Abstract] OR Communication*[Title/Abstract] OR "guided imagery"[Title/Abstract] OR distraction[Title/Abstract] OR music[Title/Abstract] OR "virtual reality"[Title/Abstract] OR hypnosis[Title/Abstract] OR reiki[Title/Abstract])	
#1	Search (adolescen*[Title/Abstract] OR teen*[Title/Abstract] OR youth*[Title/Abstract] OR paediatric*[Title/Abstract] OR pediatric*[Title/Abstract] OR child*[Title/Abstract])	

CINAHL Plus with Full Text via EBSCO

Search conducted on September 1, 2019

Search ID	Query	Records retrieved
	Limiters: English; Portuguese; Spanish EXCLUDE MEDLINE	
S13	S9 AND S10 AND S11 AND S12	74
S12	S4 OR S7	
S11	S3 OR S8	
S10	S2 OR S6	
S9	S1 OR S5	
S8	MH Preoperative Period OR Operating Rooms OR Hospitals, Pediatric	
S7	MH Anxiety	
S6	MH Alternative Therapies OR Socioenvironmental Therapy OR Massage OR Communication	
S5	MH Adolescence OR Child	
S4	TI (anxiety OR AB anxiety)	

<i>(Continued)</i>		
Search ID	Query	Records retrieved
S3	TI (perioperative OR Postoperative OR Preoperative OR operati* OR surgery) OR AB (perioperative OR Postoperative OR Preoperative OR operati* OR surgery)	
S2	TI (nonpharmacologic* OR Non-pharmacologic* OR "Non pharmacologic" OR "Nonpharmacological" OR Cognitive-behaviour OR "Cognitive behaviour" OR "cognitive-behavior" OR cognitive-behavior OR "psychological therapy" OR "psychological intervention" OR "Alternative therapy" OR "Alternative therapies" OR "complementary therapy" OR "complementary therapies" OR "Environmental intervention" OR "Environmental interventions" OR Communication* OR "guided imagery" OR Distraction OR music OR "virtual reality" OR hypnosis OR reiki) OR AB (nonpharmacologic* OR Non-pharmacologic* OR "Non pharmacologic" OR "Non pharmacological" OR Cognitive-behaviour OR "Cognitive behaviour" OR "cognitive behavior" OR cognitive-behavior OR "psychological therapy" OR "psychological intervention" OR "Alternative therapy" OR "Alternative therapies" OR "complementary therapy" OR "complementary therapies" OR "Environmental intervention" OR "Environmental interventions" OR Communication* OR "guided imagery" OR distraction OR music OR "virtual reality" OR hypnosis OR reiki)	
S1	TI (adolescen* OR teen* OR youth* OR paediatric* OR pediatric* OR child*) OR AB (adolescen* OR teen* OR youth* OR paediatric* OR pediatric* OR child*)	

Cochrane Central Register of Controlled Trials via EBSCO

Search conducted on September 1, 2019

Search ID	Query	Records retrieved
S5	S1 AND S2 AND S3 AND S4	75
S4	TI anxiety OR AB anxiety	
S3	TI (perioperative OR postoperative OR preoperative OR operati* OR surgery) OR AB (perioperative OR postoperative OR preoperative OR Operati* OR surgery)	
S2	TI (nonpharmacologic* OR Non-pharmacologic* OR "Non-pharmacologic" OR "Non pharmacological" OR Cognitive-behaviour OR "Cognitive behaviour" OR "cognitive-behavior" OR cognitive-behavior OR "psychological therapy" OR "psychological intervention" OR "Alternative therapy" OR "Alternative therapies" OR "complementary therapy" OR "complementary therapies" OR "Environmental intervention" OR "Environmental interventions" OR Communication* OR "guided imagery" OR Distraction OR music OR "virtual reality" OR hypnosis OR reiki OR AB (nonpharmacologic* OR Non-pharmacologic* OR "Non pharmacologic" OR "Nonpharmacological" OR Cognitive-behavior OR "Cognitive behaviour" OR "cognitive behavior" OR cognitive-behavior OR "psychological therapy" OR "psychological intervention" OR "Alternative therapy" OR "Alternative therapies" OR "complementary therapy" OR "complementary therapies" OR "Environmental intervention" OR "Environmental interventions" OR Communication* OR "guided imagery" OR distraction OR music OR "virtual reality" OR hypnosis OR reiki)	
S1	TI (adolescen* OR teen* OR youth* OR paediatric* OR pediatric* OR child*) OR AB (adolescen* OR teen* OR youth* OR paediatric* OR pediatric* OR child*)	

LILACS

Search conducted on September 1, 2019

Search ID	Search terms	Records retrieved
	Limiters: la: ("pt" OR "es" OR "en")	
	tw:((tw:((adolescen* OR teen* OR youth* OR paediatric* OR pediatric* OR child*))) AND (tw:((nonpharmacologic* OR non-pharmacologic* OR "non pharmacologic" OR "non pharmacological" OR cognitive-behaviour OR "cognitive behaviour" OR "cognitive behavior" OR cognitive-behavior OR "psychological therapy" OR "psychological intervention" OR "alternative therapy" OR "alternative therapies" OR "complementary therapy" OR "complementary therapies" OR "environmental intervention" OR "environmental interventions" OR communication* OR "guided imagery" OR distraction OR music OR "virtual reality" OR hypnosis OR reiki))) AND (tw:((perioperative OR postoperative OR preoperative OR operati* OR surgery))) AND (tw:((anxiety))))	96

Library, Information Science and Technology Abstracts

Search conducted on September 1, 2019

Search ID	Search terms	Records retrieved
S5	S1 AND S2 AND S3 AND S4	1
S4	TI anxiety OR AB anxiety	
S3	TI (perioperative OR postoperative OR preoperative OR operati* OR surgery) OR AB (perioperative OR postoperative OR preoperative OR Operati* OR surgery)	
S2	TI (nonpharmacologic* OR Non-pharmacologic* OR "Non-pharmacologic" OR "Non pharmacological" OR Cognitive-behaviour OR "Cognitive behaviour" OR "cognitive behavior" OR cognitive-behavior OR "psychological therapy" OR "psychological intervention" OR "Alternative therapy" OR "Alternative therapies" OR "complementary therapy" OR "complementary therapies" OR "Environmental intervention" OR "Environmental interventions" OR Communication* OR "guided imagery" OR Distraction OR music OR "virtual reality" OR hypnosis OR reiki OR AB (nonpharmacologic* OR Non-pharmacologic* OR "Non pharmacologic" OR "Nonpharmacological" OR Cognitive-behavior OR "Cognitive behaviour" OR "cognitive behavior" OR cognitive-behavior OR "psychological therapy" OR "psychological intervention" OR "Alternative therapy" OR "Alternative therapies" OR "complementary therapy" OR "complementary therapies" OR "Environmental intervention" OR "Environmental interventions" OR Communication* OR "guided imagery" OR distraction OR music OR "virtual reality" OR hypnosis OR reiki)	
S1	TI (adolescen* OR teen* OR youth* OR paediatric* OR pediatric* OR child*) OR AB (adolescen* OR teen* OR youth* OR paediatric* OR pediatric* OR child*)	

Scopus

Search conducted on September 1, 2019

Search ID	Search terms	Records retrieved
#6	Limiters: (LIMIT-TO (LANGUAGE, "English") OR LIMIT-TO (LANGUAGE, "Portuguese") OR LIMIT-TO (LANGUAGE, "Spanish"))	
#5	#1 AND #2 AND #3 AND #4	422
#4	(TITLE-ABS-KEY (nonpharmacological) OR TITLE-ABS-KEY ("Non-pharmacological") OR TITLE-ABS-KEY ("Non pharmacological") OR TITLE-ABS-KEY ("Cognitive-behaviour") OR TITLE-ABS-KEY ("Cognitive behavior") OR TITLE-ABS-KEY ("cognitive-behavior") OR TITLE-ABS-KEY ("cognitive behavior") OR TITLE-ABS-KEY ("psychological therapy") OR TITLE-ABS-KEY ("psychological intervention") OR TITLE-ABS-KEY ("Alternative therapy") OR TITLE-ABS-KEY ("Alternative therapies") OR TITLE-ABS-KEY ("complementary therapy") OR TITLE-ABS-KEY ("complementary therapies") OR TITLE-ABS-KEY ("Environmental intervention") OR TITLE-ABS-KEY ("Environmental interventions") OR TITLE-ABS-KEY (communication) OR TITLE-ABS-KEY ("guided imagery") OR TITLE-ABS-KEY (distraction) OR TITLE-ABS-KEY (music) OR TITLE-ABS-KEY ("virtual reality") OR TITLE-ABS-KEY (hypnosis) OR TITLE-ABS-KEY (reiki))	
#3	TITLE-ABS-KEY (anxiety)	
#2	(TITLE-ABS-KEY (perioperative) OR TITLE-ABS-KEY (postoperative) OR TITLE-ABS-KEY (preoperative) OR TITLE-ABS-KEY (surgery))	
#1	(TITLE-ABS-KEY (adolescent) OR TITLE-ABS-KEY (teenanger) OR TITLE-ABS-KEY (paediatric) OR TITLE-ABS-KEY (pediatric) OR TITLE-ABS-KEY (child))	

PsycINFO via EBSCO

Search conducted on September 1, 2019

Search ID	Search terms	Records retrieved
S6	Language: - Portuguese, Spanish, English	56
S5	S1 AND S2 AND S3 AND S4	
S4	TI anxiety OR AB anxiety	
S3	TI (perioperative OR postoperative OR preoperative OR operati* OR surgery) OR AB (perioperative OR postoperative OR preoperative OR operati* OR surgery)	

<i>(Continued)</i>		
Search ID	Search terms	Records retrieved
S2	TI (nonpharmacologic* OR Non-pharmacologic* OR "Non pharmacologic" OR "Non pharmacological" OR Cognitive-behaviour OR "Cognitive behaviour" OR "cognitive behavior" OR cognitive-behavior OR "psychological therapy" OR "psychological intervention" OR "Alternative therapy" OR "Alternative therapies" OR "complementary therapy" OR "complementary therapies" OR "Environmental intervention" OR "Environmental interventions" OR Communication* OR "guided imagery" OR distraction OR music OR "virtual reality" OR hypnosis OR reiki) OR AB (nonpharmacologic* OR Non-pharmacologic* OR "Non pharmacologic" OR "Non pharmacological" OR Cognitive-behaviour OR "Cognitive behaviour" OR "cognitive behavior" OR cognitive-behavior OR "psychological therapy" OR "psychological intervention" OR "Alternative therapy" OR "Alternative therapies" OR "complementary therapy" OR "complementary therapies" OR "Environmental intervention" OR "Environmental interventions" OR Communication* OR "guided imagery" OR distraction OR music OR "virtual reality" OR hypnosis OR reiki)	
S1	TI (adolescen* OR teen* OR youth* OR paediatric* OR pediatric* OR child*) OR AB (adolescen* OR teen* OR youth* OR paediatric* OR pediatric* OR child*)	

JB1 Connect+

Search conducted on September 1, 2019

Search ID	Search terms	Records retrieved
#1	Adolescente AND anxiety AND perioperative	1

TDX – Tesis Doctorals en Xarxa (Spain)

Search conducted on September 1, 2019

Search ID	Search terms	Records retrieved
#1	adolescent AND anxiety AND perioperative AND nonpharmacological	3

RCAAP – Repositório Científico de Acesso Aberto de Portugal

Search conducted on September 1, 2019

Search ID	Search terms	Records retrieved
#2	(Issue) Adolescent AND anxiety	28
#1	(Ti) Adolescent AND anxiety	

OpenGrey

Search conducted on September 1, 2019

Search ID	Search terms	Records retrieved
#1	(adolescen* OR teen* OR youth* OR paediatric* OR pediatric* OR child*) AND (nonpharmacologic* OR Non-pharmacologic* OR "Non pharmacologic" OR "Non pharmacological" OR Cognitive-behaviour OR "Cognitive behaviour" OR "cognitive behavior" OR cognitive-behavior OR "psychological therapy" OR "psychological intervention" OR "Alternative therapy" OR "Alternative therapies" OR "complementary therapy" OR "complementary therapies" OR "Environmental intervention" OR "Environmental interventions" OR Communication* OR "guided imagery" OR distraction OR music OR "virtual reality" OR hypnosis OR reiki) AND (perioperative OR postoperative OR preoperative OR operati* OR surgery) AND (anxiety)	3

MedNar

Search conducted on September 1, 2019

Search ID	Search terms	Records retrieved
#1	adolescent AND anxiety AND perioperative AND nonpharmacological	226

Appendix II: Studies ineligible following full-text review

1. Akca SO, Gozen D, Akpınar YY. The effects of pre-op training on the anxiety levels of children in Corum/Turkey. *Rev Assoc Med Bras* (1992). 2015;61(2):121-5.

Reason for exclusion: Ineligible participants.

2. Al-Yateem N, Brenner M, Shorrab AA, Docherty C. Play distraction versus pharmacological treatment to reduce anxiety levels in children undergoing day surgery: a randomized controlled non-inferiority trial. *Child Care Health Dev.* 2016;42(4):572-81.

Reason for exclusion: Ineligible participants.

3. Amedro P, Gavotto A, Gelibert D, Fraysse V, De La Villeon G, Vandenberghe D, et al. Feasibility of clinical hypnosis for transesophageal echocardiography in children and adolescents. *Eur J Cardiovasc Nurs.* 2019;18(2):163-70.

Reason for exclusion: Ineligible context.

4. Arnou Z, Hanan H, Mogilner J. The effect of a hypnotic-based animated video on stress and pain reduction in pediatric surgery. *Int J Clin Exp Hypn.* 2018;66(2):123-33.

Reason for exclusion: Ineligible participants.

5. Bartik K, Toruner EK. Effectiveness of a preoperative preparation program on children's emotional states and parental anxiety. *J Perianesth Nurs.* 2018;33(6):972-80.

Reason for exclusion: Ineligible participants.

6. Borimnejad L, Arbabi N, Seydfatemi N, Inanloo M, Haghani H. The effects of acupressure on preoperative anxiety reduction in school aged children. *Healthmed.* 2012;6(7):2359-61.

Reason for exclusion: Ineligible participants.

7. Borji M, Pouy S, Yaghobi Y, Nabi BN. Effectiveness of acupressure on anxiety of children undergoing anesthesia. *Int J Adolesc Med Health.* 2019.

Reason for exclusion: Ineligible participants.

8. Binguier S, Dadure C, Raux O, Dubois A, Picot MC, Capdevila X. The perioperative validity of the visual analog anxiety scale in children: a discriminant and useful instrument in routine clinical practice to optimize postoperative pain management. *Anesth Analg.* 2009;109(3):737-44.

Reason for exclusion: Ineligible concept.

9. Broering CV, Souza CD, Kaszubowski E, Crepaldi MA. [Effects of psychological preparations for surgery on stress and anxiety in boys and girls]. *Acta Colomb Psicol.* 2018;21(1):217-48.

Reason for exclusion: Ineligible participants. Portuguese.

10. Buehler PK, Spielmann N, Buehrer S, Schmidt AR, Weiss M, Schmitz A. Intraoperative music application in children and adolescents – a pilot study. *Acta Anaesthesiologica Scandinavica.* 2017;61(8):895-903.

Reason for exclusion: Ineligible participants.

11. Carlsson RNE, Henningson RN. Visiting the Operating theatre before surgery did not reduce the anxiety in children and their attendant parent. *J Pediatr Nurs.* 2018;38:e24-e9.

Reason for exclusion: Ineligible participants.

12. Chieng YJ, Chan WC, Klainin-Yobas P, He HG. Perioperative anxiety and postoperative pain in children and adolescents undergoing elective surgical procedures: a quantitative systematic review. *J Adv Nurs.* 2014;70(2):243-55.

Reason for exclusion: Ineligible concept.

13. Chow CH, Van Lieshout RJ, Schmidt LA, Dobson KG, Buckley N. Systematic Review: Audiovisual interventions for reducing preoperative anxiety in children undergoing elective surgery. *J Pediatr Psychol*. 2016;41(2):182-203.

Reason for exclusion: Ineligible participants.

14. Cuzzocrea F, Gugliandolo MC, Larcan R, Romeo C, Turiaco N, Dominici T. A psychological preoperative program: effects on anxiety and cooperative behaviors. *Paediatr Anaesth*. 2013;23(2):139-43.

Reason for exclusion: Ineligible participants.

15. Dehghan F, Jalali R, Bashiri H. The effect of virtual reality technology on preoperative anxiety in children: a Solomon four-group randomized clinical trial. *Perioper Med (Lond)*. 2019;8:5.

Reason for exclusion: Ineligible participants.

16. Dehghan Z, Reyhani T, Mohammadpour V, Aemmi SZ, Shojaeian R, Nekah SMA. The effectiveness of dramatic puppet and therapeutic play in anxiety reduction in children undergoing surgery: a randomized clinical trial. *Iranian red crescent medical journal*. 2017;19(3).

Reason for exclusion: Ineligible participants.

17. Eijlers R, Dierckx B, Staals LM, Berghmans JM, van der Schroeff MP, Strabbing EM, *et al*. Virtual reality exposure before elective day care surgery to reduce anxiety and pain in children: a randomised controlled trial. *Eur J Anaesthesiol*. 2019;36(10):728-37.

Reason for exclusion: Ineligible participants.

18. Fernandes SC, Arriaga P. The effects of clown intervention on worries and emotional responses in children undergoing surgery. *J Health Psychol*. 2010;15(3):405-15.

Reason for exclusion: Ineligible participants.

19. Franzoi MA, Goulart CB, Lara EO, Martins G. Music listening for anxiety relief in children in the preoperative period: a randomized clinical trial. *Rev Lat Am Enfermagem*. 2016;24:e2841.

Reason for exclusion: Ineligible participants.

20. Gursky B, Kestler LP, Lewis M. Psychosocial intervention on procedure-related distress in children being treated for laceration repair. *J Dev Behav Pediatr*. 2010;31(3):217-22.

Reason for exclusion: Ineligible participants.

21. He HG, Zhu L, Chan SW, Klainin-Yobas P, Wang W. The effectiveness of therapeutic play intervention in reducing perioperative anxiety, negative behaviors, and postoperative pain in children undergoing elective surgery: a systematic review. *Pain Manag Nurs*. 2015;16(3):425-39.

Reason for exclusion: Ineligible participants.

22. Huth MM, Broome ME, Good M. Imagery reduces children's post-operative pain. *Pain*. 2004;110(1-2):439-48.

Reason for exclusion: Ineligible participants.

23. Kain ZN, Fortier MA, Chorney JM, Mayes L. Web-based tailored intervention for preparation of parents and children for outpatient surgery (WebTIPS): Development. *Anes Analg*. 2015;120(4):905-14.

Reason for exclusion: Ineligible participants.

24. Kain ZN, Wang SM, Mayes LC, Krivutza DM, Teague BA. Sensory stimuli and anxiety in children undergoing surgery: a randomized, controlled trial. *Anesth Analg*. 2001;92(4):897-903.

Reason for exclusion: Ineligible participants.

25. Kocherov S, Hen Y, Jaworowski S, Ostrovsky I, Eidelman AI, Gozal Y, *et al*. Medical clowns reduce pre-operative anxiety, post-operative pain and medical costs in children undergoing outpatient penile surgery: a randomised controlled trial. *J Paediatr Child Health*. 2016;52(9):877-81.

Reason for exclusion: Ineligible participants.

26. Li WH, Chan SS, Wong EM, Kwok MC, Lee IT. Effect of therapeutic play on pre- and post-operative anxiety and emotional responses in Hong Kong Chinese children: a randomised controlled trial. *Hong Kong Med J*. 2014;20 Suppl 7:36-9.

Reason for exclusion: Ineligible participants.

27. Li HC, Lopez V, Lee TL. Psychoeducational preparation of children for surgery: the importance of parental involvement. *Patient Educ Couns*. 2007;65(1):34-41.

Reason for exclusion: Ineligible participants.

28. Manyande A, Cyna AM, Yip P, Chooi C, Middleton P. Non-pharmacological interventions for assisting the induction of anaesthesia in children. *Cochrane Database Syst Rev*. 2015(7):Cd006447.

Reason for exclusion: Ineligible participants.

29. Messina M, Molinaro F, Meucci D, Angotti R, Giuntini L, Cerchia E, et al. Preoperative distraction in children: hand-held videogames vs clown therapy. *Pediatr Med Chir*. 2014;36(5-6):98.

Reason for exclusion: Ineligible participants.

30. Millett CR, Gooding LF. Comparing active and passive distraction-based music therapy interventions on preoperative anxiety in pediatric patients and their caregivers. *J Music Ther*. 2018;54(4):460-78.

Reason for exclusion: Ineligible participants.

31. Park JW, Nahm FS, Kim JH, Jeon YT, Ryu JH, Han SH. The effect of mirroring display of virtual reality tour of the operating theatre on preoperative anxiety: a randomized controlled trial. *IEEE J Biomed Health Inform*. 2019.

Reason for exclusion: Ineligible participants.

32. Patel A, Schieble T, Davidson M, Tran MC, Schoenberg C, Delphin E, et al. Distraction with a hand-held video game reduces pediatric preoperative anxiety. *Paediatr Anaesth*. 2006;16(10):1019-27.

Reason for exclusion: Ineligible participants.

33. Ryu JH, Park JW, Nahm FS, Jeon YT, Oh AY, Lee HJ, et al. The effect of gamification through a virtual reality on preoperative anxiety in pediatric patients undergoing general anesthesia: a prospective, randomized, and controlled trial. *J Clin Med*. 2018;7(9).

Reason for exclusion: Ineligible participants.

34. Ryu JH, Park SJ, Park JW, Kim JW, Yoo HJ, Kim TW, et al. Randomized clinical trial of immersive virtual reality tour of the operating theatre in children before anaesthesia. *Br J Surg*. 2017;104(12):1628-33.

Reason for exclusion: Ineligible participants.

35. Scheel T, Hoepfner D, Grotevendt A, Barthlen W. Clowns in paediatric surgery: less anxiety and more oxytocin? A pilot study. *Klin Padiatr*. 2017;229(5):274-80.

Reason for exclusion: Ineligible participants.

36. Sola C, Lefauconnier A, Bringuier S, Raux O, Capdevila X, Dadure C. Childhood preoperative anxiety: Is sedation and distraction better than either alone? A prospective randomized study. *Paediatr Anaesth*. 2017;27(8):827-34.

Reason for exclusion: Ineligible participants.

37. Stewart B, Cazzell MA, Percy T. Single-blinded randomized controlled study on use of interactive distraction versus oral midazolam to reduce pediatric preoperative anxiety, emergence delirium, and postanesthesia length of stay. *J Perianesth Nurs*. 2019;34(3):567-75.

Reason for exclusion: Ineligible participants.

38. Strom S. Preoperative evaluation, premedication, and induction of anesthesia in infants and children. *Curr Opin Anaesthesiol*. 2012;25(3):321-5.

Reason for exclusion: Ineligible concept.

39. Vagnoli L, Bettini A, Amore E, De Masi S, Messeri A. Relaxation-guided imagery reduces perioperative anxiety and pain in children: a randomized study. *Eur J Pediatr*. 2019;178(6):913-21.

Reason for exclusion: Ineligible participants.

40. Vagnoli L, Caprilli S, Robiglio A, Messeri A. Clown doctors as a treatment for preoperative anxiety in children: a randomized, prospective study. *Pediatrics*. 2005;116(4):e563-7.

Reason for exclusion: Ineligible participants.

41. Weber FS. [The influence of playful activity on a child's anxiety during the preoperative period in the outpatient surgical center]. *J pediatr (Rio J)*. 2010;86(3):209-14. Portuguese.

Reason for exclusion: Ineligible participants.

42. Yip P, Middleton P, Cyna AM, Carlyle AV. Non-pharmacological interventions for assisting the induction of anaesthesia in children. *Cochrane Database Syst Rev*. 2009(3):CD006447.

Reason for exclusion: Ineligible participants.

43. Zhang Y, Yang Y, Lau WY, Garg S, Lao J. Effectiveness of pre-operative clown intervention on psychological distress: a systematic review and meta-analysis. *J Paediatr Child Health*. 2017;53(3):237-45.

Reason for exclusion: Ineligible participants.

Appendix III: Characteristics of included studies

Author(s), year of publication, country	Study aim	Setting	Study design	Population (age range) M/F per group Surgical condition	Intervention characteristics, including frequency and duration	Outcomes
Robb <i>et al.</i> , ⁴⁴ 1995, USA	To determine if there was a significant decrease in physiological indicators of stress following MAR interventions. To determine whether there was a significant decrease in STAIC anxiety scores (state portion) following MAR interventions. To compile and analyze comments of patients and staff in response to MAR interventions.	Patient room; transport to the surgical suite; induction; recovery room	RCT	N = 20 (8-20 years) Operative procedures on the reconstructive unit	MAR Three music sessions: in the evening prior to surgery, at patient's room, and in the recovery room; 30-50 minutes	Anxiety (STAIC)
Lambert <i>et al.</i> , ⁵⁰ 1996, USA	To examine the effects of hypnosis with guided imagery on the postoperative course for children.	During the pre-admission visit one week before surgery	Experimental design with two groups and pre-post test	N = 52 (7-19 years) 20M/32F Scheduled for elective surgery	Hypnosis/guided imagery One session: one week before the surgery for no longer than 30 minutes	Anxiety (STAIC) Pain (NPS)

<i>(Continued)</i>						
Author(s), year of publication, country	Study aim	Setting	Study design	Population (age range) M/F per group Surgical condition	Intervention characteristics, including frequency and duration	Outcomes
Li <i>et al.</i> , ⁴⁹ 2008, Hong Kong	To determine the effectiveness and assess the appropriateness of using therapeutic play in preparing Hong Kong Chinese children for surgery.	Inside the theater (starting in the reception area, then to the induction room, operating room, and finally to the recovery room)	RCT, two-group, between-subjects design	N = 203 (7-12 years) Experimental group: 67M/30F Control group: 73M/33F Admitted for elective day surgery	Therapeutic play intervention One session: one week before the surgery; one hour	Anxiety (CSAS-C)
Nilsson <i>et al.</i> , ⁵² 2009, Sweden	To test whether listening to music postoperatively reduces morphine consumption and influences pain, distress, and anxiety after day surgery. To describe the experience of listening to music postoperatively in school-aged children who had undergone day surgery.	PACU	Randomized study with an experimental and control group	N = 80 (7-16 years) Experimental group: 20M/20F; Control group: 20M/20F Elective day surgery	Music player One session: starting at the admission in PACU; 45 minutes	Anxiety (STAI short form) Pain (CAS or FLACC) Distress (FAS)

<i>(Continued)</i>						
Author(s), year of publication, country	Study aim	Setting	Study design	Population (age range) M/F per group Surgical condition	Intervention characteristics, including frequency and duration	Outcomes
Sabaq <i>et al.</i> , ⁵³ 2012, Egypt	To evaluate the effect of a preoperative preparation program and mothers' presence during induction on anxiety level and behavior change in young children undergoing elective surgery.	Pediatric surgery department	Quasi-experimental design	N = 120 (9-12 years) Experimental group: 26M/34F Control group: 25M/35F Elective surgery	Preoperative preparation program and mothers' presence during the induction One session: the day before surgery; 2 hours	Anxiety (STAI)
Charette <i>et al.</i> , ⁴⁵ 2014, Canada	To assess an intervention consisting of guided imagery and relaxation, combined with an educational component, in adolescents and young adults undergoing spinal fusion for scoliosis with respect to alleviating pain intensity, reducing anxiety, and enhancing coping.	Presented before surgery to be used at home after discharge	RCT (pilot study)	N = 40 (10-20 years) Experimental group: 2M/18F Control group: 5M/15F Spinal fusion surgery	DVD with information and guided imagery/relaxation exercises One session on the day before surgery, another at discharge, and three times per week at home; 30 minutes	Anxiety (STAI) Pain (BPI) Coping strategies (PPCI)

<i>(Continued)</i>						
Author(s), year of publication, country	Study aim	Setting	Study design	Population (age range) M/F per group Surgical condition	Intervention characteristics, including frequency and duration	Outcomes
Aytekin <i>et al.</i> , ¹⁵ 2016, Turkey	To investigate the effects of distraction on the preoperative anxiety levels of pediatric patients.	Before going into the operating room	Prospective, two-group experimental design	N = 83 (9-18 years) Experimental group: 21M/19F Control group: 23M/20F Elective surgery: abdominal, urinary, perianal, gastrointestinal	Distraction One session; 20 minutes	Anxiety (STAIC) Separation scoring (observational measurement)
Nelson <i>et al.</i> , ⁴⁶ 2016, USA	To evaluate the effectiveness of a preoperative training program on adolescent idiopathic scoliosis patients' pain and anxiety perception after spinal fusion surgery.	Day prior to surgery	RCT	N = 41 (10-19 years) Experimental group: 1M/18F Control group: 3M/19F Spinal fusion surgery	Relaxation training and postoperative music therapy One session; 20-30 minutes	Anxiety (NRS) Pain (FLACC)

<i>(Continued)</i>						
Author(s), year of publication, country	Study aim	Setting	Study design	Population (age range) M/F per group Surgical condition	Intervention characteristics, including frequency and duration	Outcomes
Duparc-Alegria <i>et al.</i> , ⁴⁷ 2018, France	To assess the effect of a short hypnosis session carried out just before induction of anesthesia prior to major pediatric surgery. Primary objective: to assess the impact of hypnosis on postoperative anxiety. Secondary objective: to assess the impact of hypnosis on pain and analgesic consumption.	Operating room prior to major surgery	RCT	N = 118 (10-18 years) Experimental group: 19M/40F Control group: 15M/45F (1 dropout and it was not stated if the participant was male or female) Major orthopedic surgery	Hypnosis One session; 5-10 minutes	Anxiety (VAS-A) Pain (FPS-Revised or NRS)
Karakul <i>et al.</i> , ⁵¹ 2018, Turkey	To evaluate the effect of listening to music on the anxiety state and vital signs of children and adolescents during the recovery period, after a day surgery.	PACU	Experimental design: pre-test/post-test control group design	N = 130 (9-17 years) Experimental group: 40M/25F Control group: 40M/25F Day surgery	Classical music on headphones One session; about 20 minutes	Anxiety (STAIC) Vital signs

<i>(Continued)</i>						
Author(s), year of publication, country	Study aim	Setting	Study design	Population (age range) M/F per group Surgical condition	Intervention characteristics, including frequency and duration	Outcomes
Staveski <i>et al.</i> , ⁴⁸ 2018, USA	To evaluate the safety and feasibility of implementing massage therapy in the immediate post-operative period. To examine the preliminary effects of massage therapy versus standard care plus three reading visits on postoperative pain and anxiety. To evaluate preliminary findings related to opioid and benzodiazepine exposure in patients receiving massage therapy and in reading controls.	Cardiac intensive care unit; cardiology ward	RCT	N = 60 (6-18 years) Experimental group: 14M/22F Control group: 15M/9F Congenital heart surgery	Massage therapy and reading Two to three sessions per week starting within 24 hours after surgery and continued throughout the hospital stay Massage: 15-30 minutes Reading: 20 minutes	Anxiety (STAIC) Pain (FLACC and NRS) Exposure to opioids and benzodiazepines (PRN)

BPI, Brief Pain Inventory; CAS, color analog scale; CSAS-C, Chinese version of the State Anxiety Scale for Children; FAS, facial affective scale; FLACC, face, legs, activity, cry, consolability; FPS-R, Faces Pain Scale – Revised; M/F, male/female; MAR, music-assisted relaxation; NPS, numeric pain scale; NRS, numeric rating scale; PACU, postoperative care unit; PPCI, Pediatric Pain Coping Inventory; PRN, pro re nata (as needed); RCT, randomized controlled trial; STAI, State-Trait Anxiety Inventory; STAIC, State-Trait Anxiety Inventory for Children; VAS-A, Visual Analogue Scale for Anxiety.