I. Minty[1], M. Banks[1]

There is a substantial global burden of perioperative anxiety in the paediatric population – a systematic review

[1] Faculty of Medicine, Imperial College London, South Kensington Campus, London SW7 2AZ, UK.

*email: iona_minty@hotmail.co.uk

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Abstract

Objective: Perioperative anxiety is described as an uncomfortable, tense or unpleasant mood at any point in the surgical journey. It can alter the way patients' deal with the surgical experience and think about surgical treatments in the future. This systematic review aims to investigate the methods of diagnosing perioperative anxiety and assess the prevalence of the condition within the global paediatric population undergoing operations.

Materials and methods: The systematic review was conducted in accordance with the PRISMA Checklist (a 27-item checklist to address introduction, methods, results and discussion with a systematic review). Medline and Scopus databases were searched. Two independent reviewers determined which papers were suitable for inclusion. Inclusion was determined by the mention of prevalence of operative-related anxiety, in a population under 18 years old and patients that were undergoing an operation in a hospital setting. Initially, 48 papers were found and, after screening, a total of 12 eligible studies were included. Data was extracted on the method of diagnosis of anxiety, the prevalence of perioperative anxiety, the time of assessment and the age of the cohort. Cochrane bias assessment was used to assess the presence of types of bias in randomised control trials (RCTs) included and the risk of bias in non-randomised studies of interventions tool in each non-RCTs.

Results: 83% (n=10) studies used the modified Yale Preoperative Anxiety Scale (mYPAS) for diagnosis.¬¬ The overall average prevalence of perioperative anxiety in each paediatric cohort undergoing surgery was 42.1% (95% CI 30.5 - 53.7). There was not sufficient evidence to support a relationship between the age of the patient groups, the time of the anxiety assessment and the prevalence of the perioperative anxiety.

Conclusion: Paediatric anxiety remains a significant factor affecting over a third of all children who undergo operations. The vast majority of papers used the mYPAS for diagnosis although there is still some debate about the most appropriate diagnostic tool. Further studies are needed to assess the factors influencing perioperative anxiety and to evaluate the impact of perioperative anxiety on the patient experience and recovery.

Keywords

Global burden, perioperative, paediatric, anxiety, systematic review.

INTRODUCTION

What is perioperative anxiety?

Perioperative anxiety is described as an uncomfortable, tense, unpleasant mood at any point in the surgical journey, and it can alter the way the patients deal with the experience and think about surgical treatments in the future (Clinical Trials 2021). The anxiety is an emotional response to a potential challenge or threat to reality that can be triggered at several stages in the patients' surgical journey (Clinical Trials 2021). The patient experience of undergoing surgery may be influenced by several factors which are ranked differently in importance by clinicians and patients (Mazurenko et al., 2015). Patients and their relatives are calling for a higher integration of care and a more holistic approach to surgical management, and a better understanding of factors affecting the patient experience that could improve the quality of care.

Anxiety can manifest in several ways and overall can hinder recovery and reduce quality of life. It can influence several factors that alter a patient's experience. It has been recognised as a potential and preventable risk factor for many post-operative complications including increased post-operative pain and an increased anaesthetic and analgesic requirement (Stamenkovic et al., 2018). Perioperative anxiety is associated with an increase in perceived operative pain and can influence patients' recovery and engagement with physiotherapy or

rehabilitation (Rabbitts et al., 2017). It is also associated with delayed healing and an increased length of hospital stay (Mulugeta et al., 2018). Perioperative anxiety as well as other patient-related factors are risk factors for developing emergence delirium or agitation, and the younger the patient, the higher the risk (Alatassi et al., 2020).

The three main fears facing adults were found to be fear of death, fear of complication and fear of the unexpected result of the operation (Bedaso and Ayalew, 2019). In children, these fears are compounded by excessive parental anxiety, high operative pain, an unfamiliar hospital environment, uncertainty about the outcome from the intervention, redo-surgery, parental detachment, stranger anxiety, or a previous unpleasant experience at the hospital, which are seen in children aged seven years old and older (Das and Kumar, 2017). Understanding cognitive development helps in resolving a child's perception of fear and anxiety. The inability to conceptualise, coping with a new environment, concrete thinking and fear of parental separation can all occur in the preoperational stage of cognitive development, which is all difficult to manage.

What are the effects of perioperative anxiety on paediatric patients?

Perioperative anxiety can be triggered at many stages from the pre-operative assessment to the induction of anaesthesia in the operating room. Previous studies have reported the incidence of and risk factors for preoperative anxiety in children undergoing surgery. In contrast, very few examinations have described the incidence of perioperative anxiety (anxiety throughout the pre- and post-operative continuum) in children (Aslan et al., 2017). This is important because anxiety is changeable along the operative journey in response to different triggers including, getting changed, entering the waiting room and preparing for the anaesthetic induction.

Entering the anaesthetic room, or the induction of anaesthesia is a common cause of distress in children. The distress of patients at the induction of the anaesthesia may have potentially immediate harmful physiological and physical effects. Traumatic induction in children is associated with psychological problems with repeat anaesthesia, increased upset in the recovery period, and post-operative regressive behavioural disturbances. Nightmares, separation anxiety, eating disorders and enuresis are all documented (Rice et al., 2008).

Children are very impressionable, especially at a young age and a negative association with surgery could carry on into adulthood and affect their likelihood of seeking help for surgical treatments in the future. In some NHS trusts, management of perioperative anxiety of children nowadays takes a primary place in paediatric anaesthesia (Kumar et al., 2019). A shift in emphasis on psychological outcomes in children undergoing surgery and a greater empathy to the fact that it is a major stress for children and their family members has been attributed to improved outcomes for children. This is due to the prevalence of negative consequences of perioperative anxiety on post-operative pain in children and adolescents and it is essential to use interventions to reduce perioperative anxiety and optimise post-operative management (Kumar et al., 2019). While previous studies have measured the prevalence of perioperative anxiety in children, no global prevalence has been calculated. The complications that arise from increased anxiety are minimisable and an insight into the prevalence throughout the world will lead to a better recognition of the global burden of disease (Nilsson et al., 2008, Kühlmann et al., 2018). Hospitals have been taking steps to change their practices considering new evidence of effective treatments (Nilsson et al., 2008, Kühlmann et al., 2018).

As our population increases, the strain on our NHS resources is pushed to its limits. And the first component of patient care that is usually lost is the ability to spend quality time getting to understand patients, including their worries or fears. Healthcare professionals are increasingly pushed for time. But this review could show the value of spending additional time asking simple questions in order to improve outcomes in the long run.

Aim hypothesis

This review aims to conduct a literature search to investigate the methods of diagnosing perioperative anxiety, the prevalence of the condition within the paediatric population undergoing operations and potentially attributing factors.
The review follows the hypotheses that there are papers measuring perioperative anxiety and it is measured in different ways. Also, that the prevalence of perioperative anxiety varies and there are factors that influence the prevalence rates. The latter information might offer a starting point to quantify the effects of anxiety on outcomes and, if applicable, offer a benchmark for improvement.

METHODS

This systematic review will follow the Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols (PRISMA-P) 2015 checklist which consists of a list of 17 items that provide a standardised guide for carrying out systematic reviews, including the construction

of a protocol, testing for bias and heterogeneity, and other aspects of the review process (Moher et al., 2009). The protocol is registered with PROSPERO Reference ID: CRD42021235378.

The primary outcome of the review was the prevalence of perioperative anxiety in the paediatric population. The review compiled data from PubMed (using MEDLINE) and SCOPUS databases to determine the prevalence of perioperative anxiety in a paediatric population.

Eligibility criteria

All articles describing the prevalence of clinical anxiety, panic disorder or anxiousness as a direct result of an operation in a population under 18 years are included in this review. Studies from all areas of the world were included. Papers were included for any kind of surgical procedure, defined as a procedure requiring a general anaesthetic. All primary research papers were included including RCTs, cohorts, case series and case reports. Papers in a primary language other than English were included and only published papers were included.

Papers were excluded if the participants were over 18 years. Papers were excluded if there was no data about prevalence in the review. Papers were excluded if they were not in a hospital setting. Papers were excluded where participants underwent dental procedures. Papers published before 2000 were excluded in order to keep the conclusion up to date.

Setting

Only studies that took place in a hospital setting were included in the review. By the nature of the topic, no papers were found describing perioperative anxiety in a non-hospital or community setting.

Information Sources

The review searched both PubMed (using MEDLINE) and SCOPUS to find relevant literature.

Search strategy

To capture as much literature as possible, an initial limited search of PubMed was performed using an initial set of search terms. An advanced search builder was used, which can be seen in Table 1. The initial search was conducted on 19 December 2020. Multiple synonyms were used to search to increase the uptake of papers.

The preferred search terms were 'prevalence', 'paediatrics' and 'perioperative'. Synonyms of these terms were also searched for to ensure no terms were missed. This was followed by the identification of additional search terms from the titles and abstracts.

The second search was conducted on 20 December 2020. The final search terms used were 'prevalence', 'paed*', 'paediatrics', 'pediatrics', 'child', 'children', 'infant', 'teenager', 'anxiety', 'panic', 'panic disorder', 'anxious', 'perioperative', 'pre-operative', 'perioperative', and 'undergoing surgery'.

Using PubMed, this search strategy found 40 papers. The review then searched SCOPUS with the same search terms and found 15 results. Seven papers appeared on both databases, so the total number found was 48. So 48 papers were found in the search and 39 were excluded for reasons shown in Figure 1.
On 21 December 2020, the references of the eligible papers found were searched for additional eligible papers. References were only extracted from eligible papers, not from previously published reviews. Searching through references found an additional three eligible patients. The final total number of eligible papers was 12. The search strategy was conducted by the first author and reviewed by the second. The review had no issue accessing any papers. No papers were excluded due to restricted access. All studies were either free access or available through an institutional login.

Data collection

All data extracted was extracted manually through the databases PubMed and SCOPUS. The review collected data on perioperative anxiety and information about each study population including, age, number of participants, type of surgery, and time at which anxiety was measured. RCTs were assessed using the Cochrane bias assessment (RoB 2) and non-RCTs were assessed using the risk of bias in non-randomised studies of interventions (ROBINS-I). The prevalence was calculated by the mean from all

Table 1: Advanced search strategy.

Search Component number	Theme	Search terms used
1	Perioperative	Perioperative OR Pre-operative OR peri-operative OR undergoingsurgery
2	Anxiety	Anxiety OR panic OR panicdisorder OR anxious
3	Paediatrics	Paed* OR paediatrics OR pediatrics OR child OR children ORinfant OR teenager
4	Prevalence	Prevalence

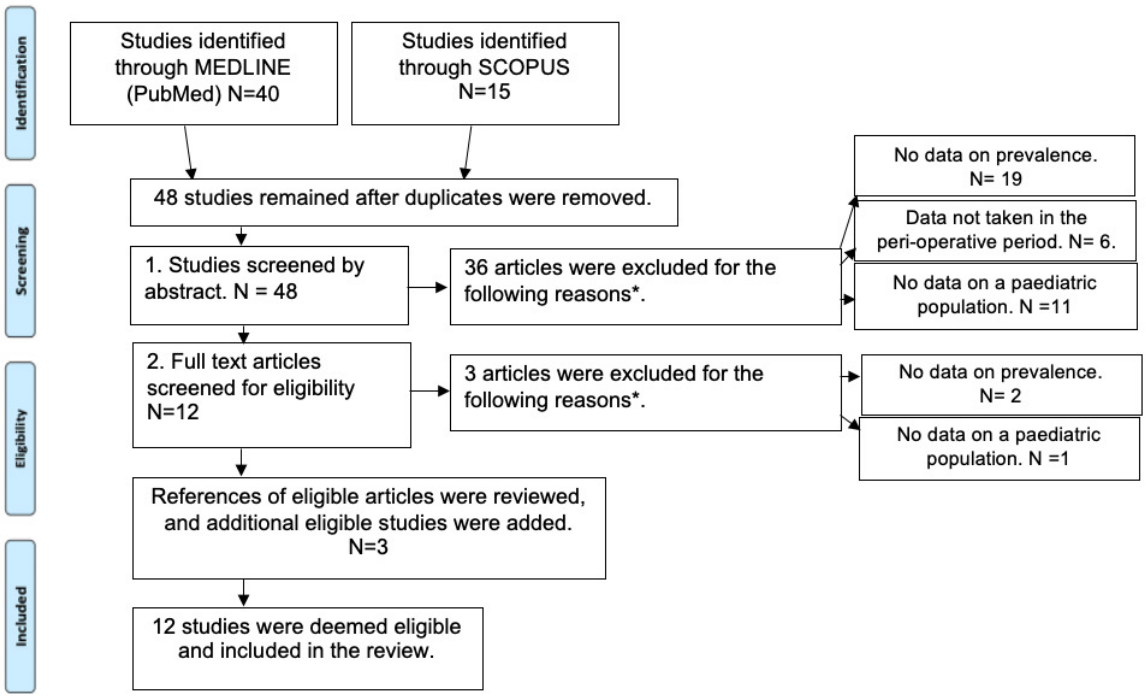

Figure 1: A PRISMA flowchart to show the journey of paper selection.
A PRISMA flow chart to indicate paper selection to identify the prevalence of perioperative anxiety in the global paediatric population.

studies, adjusted for the population size. There was no further statistical analysis, quantitative analysis or meta-analysis performed.

A PRISMA checklist recommends collecting data on the harm and benefit of interventions in patients. Our intervention, a questionnaire, is non-invasive and so this was decided to be inapplicable in this case (Moher et al., 2009).

Risk of bias

The review adhered to predefined objectives and eligibility criteria that were unambiguous in an effort to decrease selection bias. For each study found, all references were searched for additional papers to reduce the chance of missing eligible papers. The review only contains published papers and so there is a risk of publication bias.

Ethical considerations

The review used secondary data from peer-reviewed published articles, and so there is no requirement for ethics approval. The results of this systematic review will be disseminated through publication in a peer-reviewed scientific journal. All data collected in this review is anonymous and no identifiable patient information will be published.

RESULTS

Search results

A total of 48 papers were found using the initial search. A PRISMA flowchart of the numbers of papers excluded can be found in Figure 1, along with reasons for exclusion. (Moher et al., 2009). After review of abstracts and full texts, there were nine eligible papers. The references of all eligible papers were checked which found an additional three papers. A total of 12 papers were included in the final analysis.

Characteristics of included studies

Studies were geographically varied with three from North America, four from South America, two from Europe, two from Asia and one from Australasia.

No data on populations in Africa were found. 83% of studies (n=10) researched either elective, daycare or ambulatory surgeries. With the other two researching laparoscopic only or any surgery requiring a general anaesthetic. Three of the elective studies looked at subgroup surgeries most commonly tonsillectomy, hernia repairs, orthopaedics and otolaryngology. There was a preference for minor surgery and no data

was collected about the anxiety of undergoing a major operation.

A total of 83% of papers (n=10) used the modified Yale Perioperative Anxiety Scale as their preferred diagnostic tool (Moura et al., 2016). The other tools used were the State-Trait Anxiety Inventory and the Visual Analogue Scale (Visoiu et al., 2019). 50% of studies measured anxiety when in the pre-operative stage, and 33% measured it during aesthetic evaluation or induction of anaesthesia. Information about study characteristics, time of diagnosis and all other data collected can be found in Table 2.

Prevalence of perioperative anxiety

Information about age ranges, mean age of participants, the number of participants and the prevalence reported in each study can be found in Table 2. The overall global prevalence of perioperative anxiety in a paediatric population was 42.1% (95% CI 30.5 – 53.7).

Subgroup analysis within age groups

The prevalence in each study varied, along with the age range. A trend of a higher prevalence in younger children was seen although no correlation analysis was performed. One study, whose population was aged 2-7 years old had a prevalence of 81.6%. A second with an age range of 11-17 had a prevalence of 16.1.

Subgroup analysis of the time of diagnosis

A total of 50% of papers measured anxiety in the pre-op waiting room (Alatassi et al., 2020, Barreto et al., 2018), (Cumino et al., 2013, MacLaren et al., 2007, Moura et al., 2016, Visoiu et al., 2019). The weighted average prevalence across all six studies was 31.8%, with an age range of 1-17 years. The remaining papers were divided equally across three different stages, the morning of surgery, time of anaesthetic evaluation and at anaesthetic induction (Kain et al., 2006, Davidson et al., 2006, Berghmans et al., 2015, Batoz et al., 2016, Ben-Amitay et al., 2006, Guaratini et al., 2006). The weighted average prevalence across measured the morning of surgery was 31.2%, with an age range of 5-18 years. The weighted average prevalence measured at the time of anaesthetic evaluation was 47.2%, with an age range of 1.5-16 years. The weighted average prevalence measured at the time of anaesthetic induction was 61.1%, with an age range of 2-18 years.

Risk of bias

The risk of bias in non-randomised studies of interventions (ROBINS-I) tool was used to assess the risk of bias in the 11 observational studies. The one randomised control trial was analysed using the Cochrane bias assessment (RoB 2). A summary of the bias assessment for each paper can be found in Table 3.

There was variation in the chance of confounding bias between studies, there was variation between the quality of statistical analysis that accounted for confounders.
Five studies were based on subgroups of the population, therefore their application to the general population is limited (Kain et al., 2006, Davidson et al., 2006, Berghmans et al., 2015, Alatassi et al., 2020, Barreto et al., 2018, Batoz et al., 2016, Ben-Amitay et al., 2006, Cumino et al., 2013, Guaratini et al., 2006, MacLaren et al., 2007, Moura et al., 2016). One paper was very specific to a handful of laparoscopic procedures and its generalisation is unknown (Visoiu et al., 2019).

All studies measured anxiety and the time of measurement so there was no chance of recall bias. Generally, all studies had a low risk of information bias.
For the RCT, participants were randomly assigned, however, it was impossible to blind participants to the intervention therefore the risk of confirmation bias is high (Cumino et al., 2013).

No papers were seen to have a significant bias that would deem them ineligible from inclusion in the final analysis.

DISCUSSION

Principle finding

A total of 1,361 participants were included in the review. The primary outcome of the review was the prevalence of perioperative anxiety in the paediatric population. This was defined as any anxiety that occurred as a result of the surgery in the pre-operative, operative or post-operative stages. We found that many institutions around the world were researching this phenomenon. The review concludes the global prevalence of perioperative anxiety in the paediatric population to be 42.1%.

Data on tools for diagnosing perioperative anxiety

Scales can be useful to recognise anxiety states and to indicate ways to prevent complications due to elevated levels of anxiety. The modified Yale Preoperative Anxiety Scale (YPAS-m) was developed to evaluate anxiety in preschool children at the time of the anaesthetic induction (Moura et al., 2016). It is an observational scale, being applied and completed in a short period of time (de Castro

Table 2: shows the characteristics of each study including the number of participants, age of population, country, time of surgery, the diagnostic tool used, time of diagnosis, and the prevalence of perioperative anxiety.

Paper	No. of participants	Age of population /years	Meanage/ years	Country	Type of surgery e	Diagnostic tool used***	Time of diagnosis*	Prevalence /%
Alatassi et al., 2020	413	1-14	5.5 (S.D2.1)	Saudi Arabia	Elective surgery (majority otolaryngology)	The modified Yale Preoperative Anxiety Scale	Pre-operative waiting room	37.1
Barreto etal., 2018	100	2-10	-	Brazil	Elective surgery (majority herniarepairs or genitourinary)	The modified Yale Preoperative Anxiety Scale	Pre-operative waiting room	41.0
Batoz et al., 2016	291	6-18	13.05(S.D 2.7)	France	Elective surgery (majority orthopaedic)	Visual AnxietyScale	The dayprior to surgery	41.9
Ben-Amitay et al., 2006	40	6-18	13	Israel	Elective surgery (majority orthopaedics, general surgery, and otolaryngology)	The modified Yale Preoperative Anxiety Scale	Pre-operative waiting room	10.0
Berghmans et al., 2015	401	1.5-16	5.9	Belgium	Elective surgery(not specified)	The modified Yale Preoperative Anxiety Scale	At inductionof anaesthesia	38.0
Cumino etal., 2013	72	4-8	-	Brazil	Elective surgery (majority general or otolaryngology)	The modified Yale Preoperative Anxiety Scale	At inductionof anaesthesia	69.4
Davidson et al., 2006	1250	3-12	-	Australia	Elective surgery (majority general or otolaryngology)	The modified Yale Preoperative Anxiety Scale	At inductionof anaesthesia	50.2
Guaratini et al., 2006	100	2-7	4.25	Brazil	Elective surgery(not specified)	The modified Yale Preoperative Anxiety Scale	Pre-operative waiting room	81.6
Kain et al., 2006	241	5-12	-	US	Elective surgery (tonsillectomies and adenoidectomies only)	The modified Yale Preoperative Anxiety Scale	Post-operative (three days after)	18.3
MacLaren et al., 2007	55	6-12	8.05 (*S.D.*1.78)	US	Elective surgery (tonsillectomies and adenoidectomies only)	The modified Yale Preoperative Anxiety Scale	Pre-operative holding area	16.2
Moura et al., 2016†	87	5-6	-	Brazil	Elective surgery (Inguinal or umbilical herniarepairs only)	The modified Yale Preoperative Anxiety Scale	Pre-operative holding area	52.3
	123	7-12	-					47.7
Visoiu et al., 2019	202	11-17	13.8 (S.D = 1.9)	US	Elective surgery (majority laparoscopic surgery, including robotic cholecystectomies)	State-TraitAnxiety Inventory (STAI)	Pre-operative holding area	16.1
Overall statistics	**3,375**							**42.1††**

*Time of diagnosis was categorised into one of the following four categories: the day prior to surgery, the pre-operative waiting room, at induction on anaesthesia and post-operative (at least a day after surgery).
** The type of surgery was defined as either elective or emergency with the speciality that made up the majority of cases in brackets.
***The modified Yale Preoperative Anxiety Scale with four domains, activity (scale 1–4), vocalisations (scale 1–6), emotional expressivity (scale 1–4), and state of apparent arousal (scale 1–4). The score was adjusted to give a percentage, with the cut off for inclusion being 30 per cent (Kain et al 1997). Stait-Trait Anxiety Inventory scale consists of 20 statements, participants get a score between 20-60, the visual analogue scale is adjusted to give a score out of 100, both scales defined anxiety as a score above 30 (Visoiu et al 2019), (Batoz et al 2018).
† Moura et al., 2016 had data on prevalence within two separate age groups, therefore the data is displayed separately.
† † Overall prevalence was calculated by finding the average of the prevalences in each paper, weighted for the number of participants in each study.

Table 3a: Cochrane Bias assessment for all randomised control trials (RCTs) included in the study. The domains of bias included and the definition of each category of risk are in accordance with the criteria set out by originaldesigners of the tool (Higgins et al., 2011).

Paper	Random sequence generation	Allocation concealment	Selective reporting	Blinding of personnel andoutcome	Incomplete outcome data
Cumino etal., 2013	Low risk	Low risk	Low risk	High risk	Low risk

Table 3b: Risk of Bias In Non-randomized Studies of Interventions (ROBINS-I) tool to assess bias in each nonrandomised control study (non-RCTs). The domains of bias included and the definition of each category ofrisk are in accordance with the criteria set out by original designers of the tool (Sterne et al., 2016).

Paper	Bias: confounding	Bias: selection	Bias: information	Bias: reporting
Alatassi et al., 2020	Low risk	Low risk	Low risk	Low risk
Barreto et al., 2018	Low risk	Moderate risk	Low risk	Low risk
Batoz et al., 2016	Moderate risk	Moderate risk	Low risk	Low risk
Ben-Amitay et al., 2006	Moderate risk	Moderate risk	Low risk	Low risk
Berghmans et al., 2015	Moderate risk	Moderate risk	Low risk	Low risk
Davidson et al., 2006	Low risk	Low risk	Low risk	Low risk
Guaratini et al., 2006	Low risk	Moderate risk	Low risk	Low risk
Kain et al., 2006	Moderate risk	Low risk	Low risk	Low risk
MacLaren et al., 2007	Low risk	Low risk	Low risk	Low risk
Moura et al., 2016	Moderate risk	Low risk	Low risk	Low risk
Visoiu et al., 2019	Low risk	Serious risk	Low risk	Low risk

Morais Machado et al., 2018). 83% (n=10) studies used the modified Yale Preoperative Anxiety Scale (YPAS-m) to diagnose perioperative anxiety. 17% (n=2) of studies used other diagnostic criteria namely State-Trait Anxiety Inventory and Visual analogue scale (Visoiu et al., 201, Batoz et al., 2016). One paper used the STAI, which is less able to quantify anxiety, however, it may have been applicable in this case as it is quicker to do and anxiety was not their primary outcome
(Visoiu et al., 2019).

There is a strong consistency in the review using YPAS-m, showing it to be the preferred method of diagnosis amongst clinicians conducting research. It offers low heterogeneity and comparisons are a more valuable comparison between the studies as there are fewer confounders. The modified Yale Preoperative Anxiety Scale offers a quick, reliable and comparable way to measure anxiety at a point in time. However, it recognises the difficulty in explicitly eliciting anxiety in very young children therefore it is limited to children older than two years.

Relationship between time of diagnosis and perioperative anxiety

The patient journey consists of several potential anxiety triggers including getting changed, entering the waiting room and preparing for anaesthetic induction. Therefore, it is important to consider the variance in time of measurement. Papers were subdivided into four categories depending on the stage at which they measured the patients' anxiety. The four stages were, the day prior to surgery, the pre-operative waiting room, at induction on anaesthesia and post-operative (at least a day after surgery). The sample size is too small to make a definitive statement, and it is difficult to isolate the diagnostic stage especially when there are other confounding factors including age and diagnostic scale used. However, prevalence appears to be highest in the anaesthetic room and at the point of anaesthetic induction out of all of the four stages.

Relationship between age and perioperative anxiety

Each study looked at a specific age range within the paediatric population. The papers showed a general trend of higher anxiety in the lower age groups. No correlation analysis was done, and this is not strong enough to suggest causation, but the relationship has been echoed by previous studies. The effect of age may be explained by factors such as decreased parental anxiety, decreased stranger anxiety, or decreased parental separation anxiety (Das and Kumar, 2017). As children get older the influence of these factors decreases and we see the prevalence of perioperative anxiety generally decline with age. Due to the large age

ranges of the majority of the studies, we were unable to stratify perioperative anxiety based on age.

This review found variation between studies in similar age groups. Variability could be due to a number of factors. Studies were in different countries and cultural roles could have played a role. Countries may also vary in clinical practice or hospital organisation. Moura et al., accounted for some of the anxiety to hospital design (Moura et al., 2016). After the surgery, patients were returned to the pre-operative holding area. Those patients waiting for their operation noted anxiety triggered by seeing distressed or crying post-operative patients. Cumino et al found a higher level of anxiety in children when undergoing the anaesthetic evaluation as opposed to the clinical examination (Cumino et al., 2013). They suggest that perioperative anxiety is triggered more by the thought of the anaesthetic and the unknowns surrounding that, rather than the surgery itself. It could also be that children have undergone clinical examinations previously and so are more comfortable with them whereas the anaesthetic is more unfamiliar. Patients go through an emotional journey and anxiety peaks by triggers such as entering the pre-operative room and induction on anaesthesia, therefore data was collected on the time of diagnosis in order to explain the variation between prevalence statistics.

Limitations of the study

The review used PubMed and SCOPUS as its main search engines, EMBASE was not included in the search strategy which could cause selection bias. This review did not collect data on the severity of anxiety. Increasing severity compounds the negative effects caused by anxiety and its relationship would have been interesting to evaluate. No study included gathered data on an emergency or life-threatening surgery. It is suspected that anxiety in these groups would be much higher, but our data cannot evaluate this.

The review only looks at the operative anxiety the paediatric patients only. Several studies included information on the emotional state of the parents. Parental anxiety can influence, paediatric anxiety. It was not included in the review as it was felt to be well documented in the literature (de Castro Morais Machado et al., 2018). The review did not include a meta-analysis and therefore there can be no assumptions made about the relationship between perioperative anxiety and influencing factors including age or type of surgery. Any links are speculatory and a causal relationship cannot be assumed.

Anxiety affects 15-20% of children and adolescents (Wilding et al., 2018). There is a marked increase in the prevalence of anxiety triggered by surgery, however, a large proportion of positive cases of perioperative anxiety could be triggered by a pre-morbid condition. The questionnaire identifying perioperative anxiety (Yale Preoperative Anxiety Scale in 83% of cases) may also identify children with anxiety who have never been screened before or haven't been able to verbalise their feelings previously.

The review subgrouped papers based on the point in the patients' journey where anxiety was measured. The perioperative period covers many parts of the process and anxiety can fluctuate depending on what stage the patient is in. The review could not find data that measured the same cohort across the whole perioperative time to gain an insight into the variance across time.

Due to the small number of papers a subgroup analysis of smaller age ranges could not be performed. Furthermore, there were studies with similar age ranges but, overlapping age ranges cannot be combined for analysis due to the unknown numbers of participants at each age. The review identified a negative association between age and anxiety prevalence but is unable to conclude causality or quantify the strength of the association.

Systematic reviews are susceptible to compounded bias from all papers included. Due to the inclusion of only published papers, publication bias could have affected the results. A large volume of search terms and searching eligible papers for references limited the number of eligible papers missed in the search process.

Several studies showed a subset of operations only so their prevalence statistics may not be applicable to the prevalence of anxiety in all outpatient procedures (Kain et al., 2006, Moura et al., 2016, Visoiu et al., 2019). One was deemed to have significant selection bias as it excluded patients undergoing several laparoscopic procedures and several were excluded as no staff member was available to interview them (Visoiu et al., 2019). Overall, all primary outcomes were met, the prevalence is generalisable to the subset of the population described in the review. Reporting and Information bias was low risk in all studies. In MacLaren et al., patients were added to the study consecutively from being admitted and no effort was made to ensure the cohort was generalisable to the general study population (MacLaren et al., 2007). Due to the sample size of 55 patients, there is a moderate risk that selection bias influenced the results (MacLaren et al., 2007). One retrospective study that collected a large cohort of 413 patients, had limited selection bias (Alatassi et al., 2020). A study performed multivariate Poisson's logistic regression to diminish the effects of any confounding variables (Barreto et al., 2018). One study used the Modified

Yale Score but blinded research assistants to the study hypothesis reducing confirmation bias (Kain et al., 2006). Overall, all primary outcomes were met, the prevalence is generalisable to the subset of population described in the study. Reporting and Information bias was low risk in all studies. The main limitation is generalising it to all elective surgeries. The RCT did not blind participants (due to the nature of the questionnaire intervention) which could have led to variation in outcomes due to the placebo effect (Cumino et al., 2013).

Areas for future research

Our findings show that perioperative anxiety affects over a third of all children undergoing operations. Pre-anaesthetic anxiety is not routinely evaluated in children, which is amiss as several available post-operative management plans can improve it, including good comprehensive analgesia. Studies to identify which patients could benefit from additional anaesthetic support would be a further step to improving patient outcomes.

Studies are lacking in paediatric patients undergoing major surgery. Major surgeries are even more anxiety-inducing and so the consequences of the anxiety are compounded. Furthermore, a review looking further into the patient journey and triggers of patient anxiety and the consequences on recovery could offer insight into changing clinical practice.

CONCLUSION

Prevalence in paediatric anxiety remains a significant factor affecting over a third of all children who undergo operations. A vast majority of papers used the mYPAS for diagnosis although there is still some debate about the most appropriate diagnostic tool.
A general negative trend was found between age and proximity to the operating room and prevalence of anxiety, although no statistical analysis was performed, and a larger sample size would be needed to quantify the relationship. Further studies are needed to formally evaluate the impact of perioperative anxiety on the patient experience and recovery.

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Study registration: The review was registered to PROSPERO, ID CRD42021235378

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