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Journal of Perioperative Nursing: Fulfilling its mission and achieving its vision

The *Journal of Perioperative Nursing* (JPN) continues to fulfil its mission to be the trusted source of evidence for perioperative nurses and is within reach of achieving its vision to be the world's leading perioperative nursing journal. In this editorial, I take the opportunity to celebrate the journal's achievements over the past two years.

The last two years have seen JPN climb the international journal rankings. JPN is ranked 11th among all medical–surgical nursing journals in the most recent list, placing us above the *AORN Journal* (ranked 13th), the Journal of *Perioperative Practice* (ranked 18th) and just below the *Journal of Perianaesthesia Nursing* (ranked 8th). JPN is well on track to achieving its vision of being the world's leading perioperative nursing journal.

JPN's governance and publishing practices were reviewed and modified to meet the internationally recognised *Principles of Transparency and Best Practice in Scholarly Publishing*[1]. Unfortunately, many online journals exist purely for profit and do not abide by scholarly principles. We have worked hard to set ourselves apart from these unscrupulous operators by developing robust and transparent policies and processes.

An Editorial Advisory Board (EAB) was established in 2020 as part of the governance review. The EAB comprises highly regarded perioperative nurses from Australia and abroad with expertise in clinical practice, management, governance and academia (see Table 1).

Three Associate Editors were also appointed: Dr Paula Foran, Dr Lois Hamlin and Dr Oya Gumuskaya. The EAB and editorial team have set the journal's strategic direction and monitored our progress towards our goals.

The editorial team has worked hard to actively disseminate our articles to the perioperative community in an easily accessible format. You have probably received the monthly email update from me, including a summary and link to the latest published articles. Our Associate Editor, Dr Oya Gumuskaya, is also working with our authors to produce social media content that can be shared widely to help highlight publications.

The emerging scholars section remains one of the most popular sections of our journal. Our Associate Editor, Dr Paula Foran, works with students and first-time authors to support them through writing and publishing a manuscript. This initiative is part of the journal's commitment to building the capacity of perioperative nurses in research and scholarship.

This year we continued the tradition of awarding a paper of the year. The paper of the year for 2020 was awarded to Noriko Ogo and Dr Paula Foran for their paper, 'The effectiveness and compliance of surgical face mask wearing in the operating suite environment: An integrated review'. The article had the highest downloads (over 1600 to date) of all papers published in JPN during 2020.

Table 1: Editorial Advisory Board members

Name	Role
Juliet Asbery	Chair, Perioperative Nurses College New Zealand
Prof. **Karen Clark-Burg**	Dean, University of Notre Dame School of Nursing
Rebecca East	Chief Executive Officer, ACORN
Dr **Paula Foran**	University of Tasmania
Prof. **Brigid Gillespie**	Professor of Patient Safety, Griffith University
Jenny Green	Nursing Lecturer, Massey University
Dr **Oya Gumuskaya**	Lecturer, University of Newcastle
Dr **Toni Hains**	Nurse Practitioner / PNSA
Dr **Lois Hamlin**	ACORN Journal Editor Emerita
Claire Kennedy	Australian Day Surgery Nurses Association (ADSNA), past president
Dr **Judy Mundy**	Lecturer, Queensland University of Technology
Fiona Newman	Australian College of PeriAnaesthesia Nurses (ACPAN), President
A/Prof. **Pat Nicholson**	Perioperative Coordinator, Deakin University
A/Prof. **Sonya Osborne**	Associate Head (Research), University of Southern Queensland
Jo Perry	Perioperative Coordinator
A/Prof. **Nicholas Ralph**	University of Southern Queensland
Judy Smith	Perioperative Coordinator, University of Technology
Sharron Smyth-Demmon	Perioperative Coordinator, Australian College of Nursing
A/Prof. Victoria Steelman	University of Iowa, Associate Professor Emerita

The EAB is committed to open access publishing, which means that any perioperative nurse in the world can access our journal anywhere and at any time. We believe that perioperative nursing knowledge should not be locked behind paywalls but should be readily and freely available to support evidence-based care.

Open access is also beneficial to our authors. Open access can make the difference between being cited and not cited. The easier it is to access a paper, the more likely it is to be downloaded, read and cited. JPN has been listed in the Directory of Open Access Journals (DOAJ) in recognition of this commitment. Listing in the directory signifies we are a quality, open access journal that follows best practice scholarly publishing principles.

In the past two years, JPN has had 75 000 downloads – evidence that we are achieving our mission. And the annual number of downloads per year grows exponentially, with almost 50 000 in the past twelve months. The top ten countries for downloads in this period were Australia, United States of America, United Kingdom, Canada, New Zealand, India, Philippines, Ireland, China and Singapore.

Multidisciplinary and international submissions that address the journal's aim and are relevant to the global perioperative nursing community are welcomed. As the journal's ranking and reputation has grown, we have seen more international perioperative nurses and other perioperative health care professionals submit papers.

I want to thank the EAB, our Managing Editor, Eleanor Tan, the ACORN staff and the dedicated peer reviewers for all their hard work. These past two years have been an exciting and successful period for the journal. I am confident that we can achieve even greater heights in the coming two years.

Reference

1. Committee on Publication Ethics (COPE). Principles of Transparency and Best Practice in Scholarly Publishing [Internet]. Eastleigh, Hampshire: COPE; 2014 [updated 2018 January 15; cited 2021 August 23]. Available from: https://doi.org/10.24318/cope.2019.1.12.

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Undertaking the surgical count: An observational study

Abstract

Objective

To systematically measure and describe perioperative nurses' surgical count practices using the Surgical Count Observational Tool, to measure conformity with standardised processes and identify barriers and enablers influencing nurses' practices.

Sample and setting

A large public tertiary hospital in Western Australia.

Methods

The Surgical Count Observational Tool (SCOT) was developed using the Content Validity Index over two Delphi panel rounds and then pilot tested. Individual observations were analysed according to 14 criteria based on the 2016 Australian College of Perioperative Nurses (ACORN) standard 'Management of accountable items used during surgery and procedures'[1]. Count processes were observed over two consecutive weeks across six specialist perioperative teams including nurses, surgeons, anaesthetists and technicians to measure compliance with the ACORN standard. The SCOT and a field diary were then used in an observational study of 83 nursing staff, including 54 circulating nurses and 29 instrument nurses, over a period of 57 hours. Interrater reliability was calculated using Cohen's kappa. Descriptive statistics were used to analyse observational data.

Results

Of the 1268 count practices observed, 759 were compliant with the ACORN standard, representing a 60 per cent compliance rate.

Conclusion

Consistency and compliance rates were lower than expected. Patient, case, environmental factors and expectations of surgeons and co-workers were observed to act as barriers to best practice in perioperative nurses undertaking a surgical count, while nurse's knowledge was observed to act as an enabler.

Keywords: surgical count, perioperative, structured observations, best practice, patient safety, standard

Table 1: Components of observational tool (based on the 2016 ACORN accountable items standard[1])

Component number	Component	Descriptor	Number of behavioural indicators
1	Count process	The recommended steps or actions required to undertake a count.	25
2	No count required	No accountable items used during procedure as the procedure does not involve opening a body cavity or making an incision.	2
3	Accountable items removed from OR	Items that are part of the count process remain in the OR for the duration of the procedure.	5
4	Absorbable gauze swabs, wool balls, pharyngeal packs utilised	Accountable items that may not have an x-ray identifiable strip but are used intra-operatively. These items are sometimes divided and must be recorded on the count sheet.	13
5	Incorrect number of items in package	Accountable items come in a standardised number (for example, 1, 5 and 10). When opening a package the right number of items should be as stated on the package.	7
6	Count relief	A relieving nurse that undertakes a component of the count when the original staff member is not available, for example, during a tea break.	9
7	Simultaneous procedures	Two different procedures on the same patient that occur at the same time. May be the same surgical team or two different surgical teams.	5
8	Sequential procedure. OR cleared/not cleared between procedures	Different procedures that occur on the same patient but at different times. Same original sterile set up may or may not be used.	14
9	Intentionally retained items	Accountable items are left in or on the patient at the end of a procedure, for example, packing of a cavity to be removed later.	7
10	Removal of intentionally retained items	When a patient returns to OR to have accountable items removed that were left in situ by necessity and were documented on the original count sheet as being retained.	2
11	Tray lists	Paper lists of instruments that accompany individual surgical trays.	15
12	Progressive counting away technique	The process followed to account for all accountable items, for example, handing off packs from the sterile field and placing in a container in groups of five.	9
13	Emergency situation	The patient enters the OR and there is no time to undertake a surgical count due to a medical or surgical emergency.	3
14	Incorrect count	The original count tally for the procedure is not congruent with the final count tally on completion of the procedure.	8
		Total number of items	**124**

Background

In 2006, the Australian Commission on Safety and Quality in Health Care (ACSQHC) was established as part of an Australian initiative to improve safety and quality in health care. The ACSQHC is jointly funded by each Australian state and territory and one of its roles is to advise on best practice and provide recommendations for nationally agreed safety and quality standards. In 2002, health ministers endorsed a table of eight descriptors of sentinel events that became reportable to the ACSQHC. These were related to harm, serious harm or death that a patient sustained while under the care of a health care facility (HCF)[2]. One of these sentinel events was retained items in surgery.

In Western Australia during 2015 and 2016, there were 434 reportable events within HCFs, three of which were related to retained items in surgery[3]. The surveillance unit identified contributing factors as communication, the environment and practitioner knowledge, skill and competence. Failure to follow latest policy, procedure or guidelines was seen as an important contributing factor, an issue that has also been identified in the USA. The American Joint Commission Sentinel Event Alert[4] published a 10–15 per cent error rate in surgical count practices, which was attributed to failure to follow policy and procedure. This is a significant issue, as it can increase the likelihood of an unintentionally retained item (URI).

Rowlands and Steeves[5] review of studies on incorrect surgical processes found a significant risk of URIs in surgery due to failure to follow current surgical count process and procedure. Their review included studies of possible causes of URIs in surgery but failed to identify current barriers to and enablers of perioperative nurses following best practice when undertaking a surgical count.

The surgical count is a structured, standardised process developed by the Australian College of Perioperative Nurses (ACORN) to assist nurses in maintaining best practice standards and ensuring patients receive safe, high quality nursing care[6]. Despite endorsement by peak national and international perioperative bodies, variations in clinical practice continue to occur. This study aimed to systematically examine perioperative nurses' surgical count practices in one major Australian hospital.

Objective

The aim of this prospective observational study was to describe current surgical count practices of perioperative teams and calculate overall compliance with the relevant ACORN practice standard using a specially developed observational tool – the Surgical Count Observational Tool (SCOT). This tool was developed using behavioural performance markers that reflected the count process as recommended in the 2016 version of the ACORN standard 'Management of accountable items used during surgery and procedures' (the ACORN accountable items standard). Subsumed under the overarching aim were the following two objectives:

1. to develop a tool based on the ACORN accountable items standard

Table 2: Feedback from Delphi participants

Round 1 feedback	Round 2 feedback	Descriptors
Lack of clarity	Add a word to increase clarity	Unclear sentence structure
Items listed may vary across sites		Particular item may not be the same at any given site, for example, surgeon signing the count sheet
Irrelevant item		The relevance of the item listed was unclear
Definition of some words unclear		Lack of understanding about what was being asked
Repetition of items	Ambiguous because the item is very similar to another item	Repetition of items
	Somewhat unclear about what is being asked	Unsure of what the category is for
	Did not respond to item	Giving a mark of 1 or 2 but provided no feedback as to reason why

2. to systematically observe perioperative nurses' compliance with surgical count practices recommended in the ACORN accountable items standard using the tool.

The study also aimed to identify barriers and enablers influencing nurses' practices.

Literature review

The literature reviewed for this study provided information about the surgical count process and concluded that the perioperative nurse's ability to undertake a surgical count was influenced by patient factors, case factors, environmental factors including distraction and noise within the operating room, and individual factors including knowledge of policy development. No empirical studies on the barriers and enablers in undertaking a surgical count were found.

Ethics

Ethics approval was granted through the university and participating hospital's ethics approval processes. Information about the study was given to participants who provided their informed consent. Research integrity was maintained through joint planning and discussions by the research team. Feedback about the data analysis was provided to participants during in-service sessions at the participating hospital prior to writing the final report and this provided opportunities to clarify or modify findings prior to the final report being written.

Methods

Observational tool development

The observational tool contained 14 components of the count process (see Table 1), each consisting of behavioural indicators. These were based on the standard 'Management of accountable items used during surgery procedures'[1] which outlines the recommended actions that should be taken by the circulating and instrument nurses while undertaking a surgical count.

Each behavioural indicator was formatted with 'Yes', 'No' and 'N/A' (not applicable) tick boxes for ease of recording observed behaviours. In instances where the behaviour was required as part of the count process 'yes' was ticked if the behaviour had been observed and 'no' if it was not observed or undertaken as part of the process. The 'N/A' tick box was used for any of the behaviours that were not required during the count process. For example, if there were no intentionally retained items for the case observed 'N/A' was ticked for all the behaviours within that component.

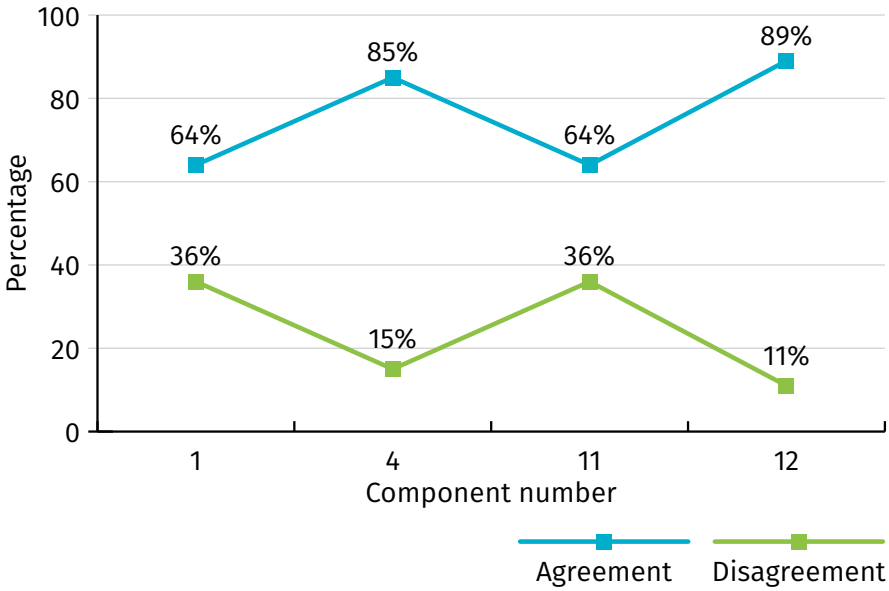


Figure 1: Disagreement between raters following pilot study

Content validation

A Delphi study was undertaken to test content validity using the content validity index (CVI)[7]. Two rounds of the Delphi panel occurred with four out of the ten perioperative nurses who were invited to review the observational tool responding to the request and then providing further feedback on the revised observational tool. All responders had at least 20 years perioperative experience, were aged 36 years or over and held a hospital certificate, diploma or a bachelor's degree in health science

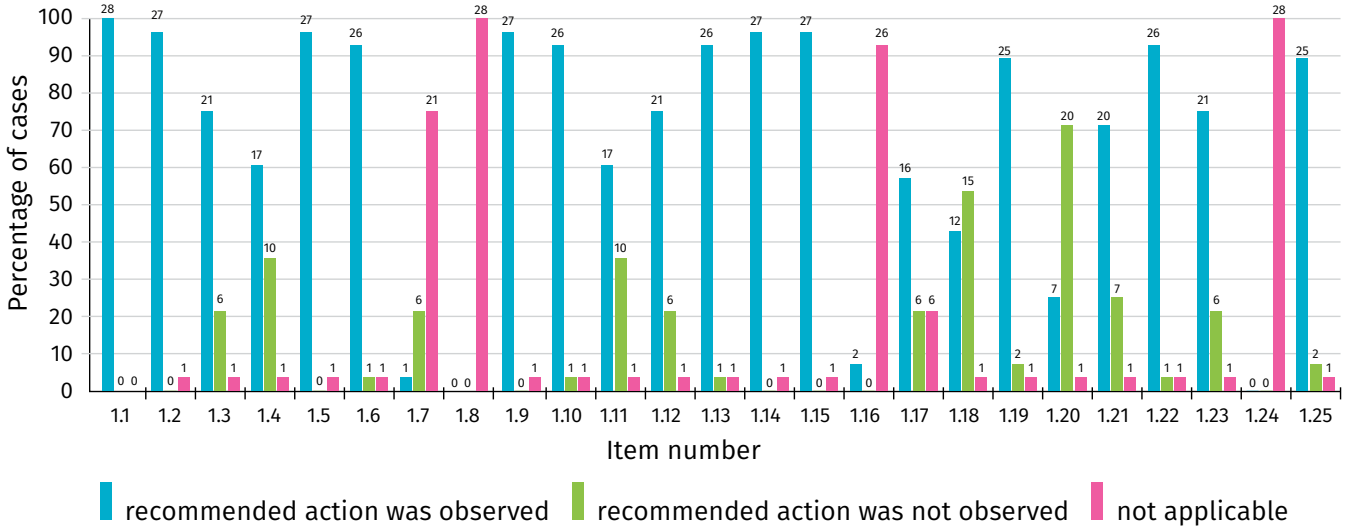
In the first round, responders were requested to review the observational tool by rating each item according to its relevance, with '1' being not at all relevant through to '4' being very relevant. Feedback was also encouraged about clarity of wording and flow of items as well as the structure and layout of the document. The level of agreement for the total CVI was 0.75 and 0.66 in rounds one and two respectively, both considered acceptable levels[7].

Minor edits were made to the observational tool in response to responders' comments (Table 2). To maintain the alignment with the ACORN accountable items standard, individual items that may have varied across hospital sites were maintained

Table 3: Surgical case demographics

Case number	Patient ASA	Surgical specialty	Operative procedure	Total procedure time (minutes)	Total number of nurses	Total number of team members
1	2	Orthopaedics	Fractured clavicle	75	3	9
2	3	Orthopaedics	Total hemiarthroplasty	65	3	9
3	2	Orthopaedics	Total knee replacement	180	3	6
4	1	General surgery	Chest abscess	95	3	7
5	2	Neurosurgery	Excision tumour	210	3	7
6	LA	Neurosurgery	Ganglionectomy by radiofrequency	50	2	8
7	3	Neurosurgery	Burr holes and insertion of shunt	155	3	7
8	1	Trauma	Removal of glass from foot	60	3	7
9	4	Trauma	Proximal femoral nail	110	3	8
10	2	Orthopaedics	Bilateral knee replacement	120	3	8
11	2	Plastics	Mastectomy and axillary clearance	165	3	8
12	3	Plastics	Mastectomy and axillary clearance	115	3	8
13	3	Plastics	Excision of multiple lesions	125	4	8
14	LA	Plastics	Excision mucosal biopsy	30	2	5
15	3	General surgery	Staging laparoscopy	45	4	8
16	3	General surgery	Ivor Lewis and thoracotomy	410	2	11
17	1	Plastics	Mastectomy and DIEP (deep inferior epigastric perforator artery) flap	410	5	12
18	2	General surgery	Laparoscopic cholecystectomy	75	3	6
19	3	General surgery	Vasectomy	40	2	10
20	2	Emergency	Laparoscopy	90	3	6
21	1	Emergency	Laparoscopic appendicectomy	60	3	8
22	2	Emergency	Laparoscopic appendicectomy	80	3	9
23	4	Plastics	Excision of multiple lesions	50	3	6
24	LA	Plastics	Excision of cheek lesion	35	3	4
25	LA	Plastics	Excision of multiple lesions	105	2	6
26	2	Orthopaedics	Revision hip replacement	80	3	9
27	3	Trauma	Open reduction and internal fixation fractured femur	190	3	9
28	3	General surgery	Gastrojejunostomy	225	3	14

Note: LA = local anaesthetic.



1.1 = An approved perioperative document (APD) was utilised
1.2 = Two nurses perform the initial count
1.3 = Both nurses count together
1.4 = Both nurses count aloud
1.5 = Both nurses count items individually
1.6 = Both nurses visualise all items
1.7 = Count recommenced if interrupted
1.8 = What type of interruption occurred?
1.9 = Only items required are opened
1.10 = Items opened and counted as per original packaging
1.11 = Items remain in inner packaging for initial count
1.12 = Items remain as originally secured
1.13 = Each accountable item is separated as it is being counted
1.14 = Items checked for integrity
1.15 = Items checked for x-ray detectable marker
1.16 = Dropped/contaminated items removed with packaging if prior to commencement of initial count
1.17 = Items added to the count intraoperatively are recorded on APD
1.18 = Additional counts undertaken
1.19 = Surgeon notified of outcome of each count
1.20 = Instrument nurse notified surgeon
1.21 = Circulating nurse notified surgeon
1.22 = Same two nurses finalise the count
1.23 = APD signed appropriately by both nurses
1.24 = APD signed appropriately by surgeon
1.25 = OR cleared of all accountable items at conclusion of surgery

Figure 2: Compliance with recommended actions as observed for count process (component 1, behavioural indicators 1.1 to 1.25)

and no items were deleted except for those that were repetitive. Following the second Delphi review, the tool was deemed ready for piloting.

Pilot study

Setting and sample

At the time of the study, the pilot site had 300 beds and eight commissioned operating rooms (ORs), performing over 460 elective surgical cases per month across all specialties. Over 65 staff were employed in the OR facility including registered nurses, clinical nurses and anaesthetic technicians.

Interrater reliability

The pilot study was conducted over three days and observational data collected by two perioperative nurses – one was a researcher for this study and the other a doctoral student. Twelve nurses were observed undertaking surgical counts for six procedures over 7.7 hours (463 minutes) of surgical time. Surgical time was recorded from when the patient was brought into the OR, asleep or awake, to when they left the OR for the Post Anaesthesia Care Unit (PACU). Each procedure lasted 25 to 150 minutes.

Six procedures were required to achieve the minimum sample size for interrater reliability[8]. Case information relative to specialty, operative time, patient ASA (American Society of Anaesthesiologists risk grading for anaesthesia) and procedure was collected to contextualise observations to better explain the results.

Consistency of observers

Observations included 744 individual behavioural indicator items observed in relation to the count process for the six surgical procedures. The two raters used the observational tool specifically designed for this study.

Results

The two raters agreed on the count behaviours that were observed and those not observed for 726 of the 744 observations. Cohen's Kappa reflected a high level of interrater agreement (K=0.85, p<.0001). Figure 1 illustrates the interrater disagreement across components 1, 4, 11 and 12. All other items reflected a 100% agreement and are not illustrated in the table.

Main observational study

Sample and setting

The main study site was a large metropolitan public tertiary hospital which at the time of the study had 13 commissioned operating theatres with over 800 surgical procedures being performed per month across elective, urgent and emergent cases. All specialties except obstetrics, neonates and paediatrics were covered. The unit employed all categories of perioperative staff including registered nurses, clinical nurses and staff development nurses.

Observations occurred over two consecutive weeks between 7.00 am and 7.00 pm Monday to Friday. Count processes of nursing staff were observed across six different specialties. Surgical time included from when the patient arrived in the OR, awake or asleep, until they left the OR for the PACU.

Method

The observational tool was used to collect relevant data in relation to the count process. At the beginning of the tool there was an area to document case information relative to specialty, operative time, patient ASA and procedure. This information was aimed at contextualising the observations to better explain the observations and determine other factors that may have influenced the count process undertaken by the nurse. Information on the number of staff members involved in the case was also collated as this could have an impact on the count process. A field diary recorded notes, including mannerisms, conversations and processes, to explain why items were not observed and what may have hindered nurses' ability to undertake the count process. Structured observations allowed description of count behaviours.

Data analysis

Absolute (n) and relative (%) values were used to describe frequencies of behavioural indicators observed using the SCOT. Compliance rates for individual behavioural indicators were calculated as a percentage using the formula 100n/d where n is the number of cases in which the recommended behaviour was observed and d is the total number of cases in which the recommended behaviour was required. Compliance rates for each of the 14 components of the SCOT were calculated by using the formula 100N/D where N is the total number of 'Yes's recorded for each component and D is the number of applicable behavioural indicators that had been observed (i.e. the total number of behavioural indicators observed for a component minus the number of 'N/A's recorded for that component). The overall compliance rate for undertaking a surgical count as recommended by the ACORN accountable items standard was calculated in the same way by dividing the total number of 'Yes's recorded on the SCOT by the number of applicable behavioural indicators that had been observed (i.e. the total number of behavioural indicators observed minus the number of 'N/A's recorded on the SCOT).

Results

The SCOT was used in 28 procedures over six different specialties. In all, 83 nursing staff including 54 circulating room nurses and 29 instrument nurses were observed by the first author over 57 hours (3450 minutes) surgical time. Table 3 shows the case demographics that provided relevant data to be considered when a count process was not clearly followed. Of the 14 components in the SCOT, eight were seen to occur by the researcher and six were not seen to occur (see Table 4).

Count process

The first component of the SCOT is count process. Figure 2 shows the 25 behavioural indicators of the count process and the compliance observed for each of them. The following observations are of note:

- the instrument and circulating nurse were observed counting aloud (behavioural indicator 1.3, n=21/d=27, 78% compliance) and together during 17 cases (behavioural indicator 1.4, n=17/d=27, 63% compliance) in the initial count process but in subsequent and final counts only the instrument nurse counted aloud, indicating a lack of consistency in this process
- the count process was interrupted on many occasions. These interruptions occurred because the surgeon requested assistance or additional items from the instrument nurse. Behavioural indicator 1.7 is 'Count recommenced if interrupted'. Field notes indicated that the count process often resumed from the point it had been interrupted, instead of starting again from the items that were being counted at the time.
- the ACORN accountable items standard recommends that all accountable items should remain in their original packaging until they have been accounted for (behavioural indicator 1.11); however, the researcher observed the instrument nurses removing items from their original packaging, e.g. loading scalpel blades onto their respective handles or sutures onto needle holders prior to counting. The recommended behaviour was observed in 17 of the 28 cases (n=17/d=27, 63% compliance).

- the field notes described instances where instrument nurses were not opening suture packets to show the circulating nurse the number of needles in the pack. The practice of removing the paper strip or plastic bag from around swabs that secured them in their original numbers was common (behavioural indicator 1.12, n=21/d=27, 78% compliance). This practice was performed so the swabs could be folded and placed in a corner on the instrument trolley in preparation for the first count.
- the process to determine how many counts were needed for a given procedure was not clear. Additional counts were undertaken in 12 cases (behavioural indicator 1.18, n=12/d=27, 44% compliance). Field notes illustrated instances where the most senior nurse in the room would make the final decision on how many counts would be undertaken, which was rarely challenged by the scrub team.
- there was inconsistency in terms of who should inform the surgeon of the count outcome. Field notes indicated that most often the circulating nurse would notify the surgeon of the outcome of the count (behavioural indicator 1.21, n=20/d=27, 74% compliance) but did not always wait for a response before carrying on with their duties. Notably, the surgeon rarely acknowledged the count outcome; however, this was not the case when the instrument nurse notified the surgeon of the count outcome (behavioural indicator 1.20, n=7/d=27, 26% compliance).

Due to the nature of the procedures observed and limited knowledge of surgeons' preferences for particular cases it was difficult for the researcher observing the procedure to determine whether only required accountable items and instruments were opened (behavioural indicator 1.9, n=27/d=27, 100% compliance) and that all appropriate packs and instruments had been checked for integrity (behavioural indicator 1.14, n=27/d=27, 100% compliance) and x-ray detectable markers (behavioural indicator 1.15, n=27/d=27, 100% compliance).

Another anomaly in the count process was the discarding of accountable items by the circulating nurse into the waste bin immediately following the second count, rather than after the final count. This was explained to the researcher as a 'time saver', and these items were just re-recorded as 'correct' for the third count.

No count required

'No count required' should only occur when no accountable items are used for the case or there is no surgical incision that would allow accountable items to be retained. Of the 28 cases observed (see Table 3), only one was classed as 'no count required' – a ganglionectomy by radiofrequency (case #6). The patient received a local anaesthetic and no instrument nurse was allocated to the procedure.

Count relief

The ACORN accountable items standard recommends that relief time be included in the APD (behavioural indicator 6.4, n=2/d=11, 18% compliance); this ideally occurs whenever the instrument or circulating nurse is relieved for a break during a procedure (behavioural indicator 6.1, n=2/d=14, 14% compliance) and also applies when a nurse is being relieved permanently (behavioural indicator 6.5, n=3/d=14, 21% compliance). This is undertaken so that if there is an issue with the final count staff involved with the procedure may be followed up appropriately.

Sequential and simultaneous procedures

During this study the researcher observed three sequential or simultaneous procedures. These cases were described in field notes as being somewhat disorganised, with up to three circulating nurses handing up accountable items simultaneously to the scrub nurse.

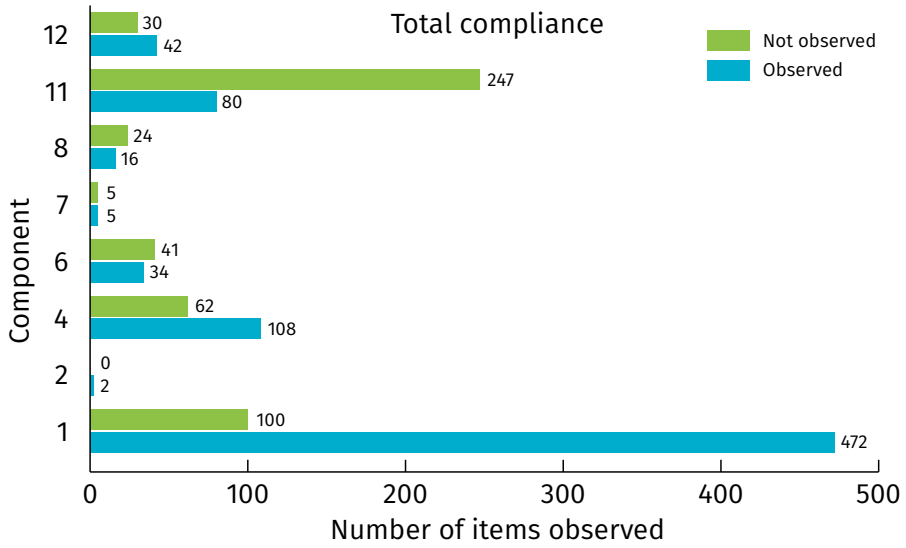


Figure 3: Compliance for components of the observational tool that were observed by the researcher

An example of the risk of such disorganisation was during one procedure the final count was incorrect and the circulating nurse just added the extra number of items to the count sheet.

Tray lists

Tray lists were attached to nearly every instrument tray opened by the circulating nurse (behavioural indicator 11.2, n=25/d=28, 89% compliance). The researcher was not always able to see whether the list had been signed by the sterilisation technician as the document was often discarded into the waste before signatures could be confirmed. Field observations also confirmed that because tray lists were discarded, the columns that had been provided on the tray list to count and check off instrumentation were not being used by the nurses. The instrument and circulating nurses' details, which would assist the sterilisation department in the event of any discrepancies in the trays returned, were also omitted from the tray list documentation. The patient's medical record number and the date of the procedure were also omitted as the tray list was not used in the way recommended by the ACORN accountable items standard.

Occasionally the circulating nurses would place the tray list on the bottom of the instrument trolley, so it could be returned with the tray for reprocessing (behavioural indicator 11.14, (n=21/d=28, 75% compliance). The process for counting instrumentation was somewhat inconsistent, as some nurses counted all instruments while others counted just a few.

Progressive counting away technique

The researcher observed counting and handing off of swabs from the worktable that did not follow best practice. When items were 'counted off', they were not always opened out fully by either the instrument or circulating nurse (behavioural indicator 12.1, n=3/d=28, 11% compliance). Once placed in the count receptacle, they were not recounted and the process of labelling the bagging receptacle with the patient's name or number was not seen to occur. No count discrepancies were observed that involved the reopening of the bagging receptacle.

Observed compliance

As described, eight of the 14 components of the observational tool were seen by the researcher during the 28 procedures observed. Figure 3 displays the compliance for each of these eight components based on documentation of individual behavioural indicator items observed.

Table 4 provides a list of the six components that were not seen to occur by the researcher during the observational period.

The overall compliance rate for undertaking a surgical count as recommended by the ACORN Standards was 60 per cent. Overall there were 1268 behavioural indicator items observed: 759 complied with the ACORN Standard's recommendations for undertaking a surgical count and 509 did not comply. The overall compliance rate was calculated by dividing the total number of compliant behavioural indicator items (759) by the total number of items that had been observed minus the not applicable items (1268), then multiplying by 100 to get a percentage.

Overall compliance rate:

$$\frac{759}{1268} \times 100 = (59.85)\ 60\%$$

Table 4: Components that did not occur

Component number	Component	Notes
3	Accountable items removed from the OR	May occur depending on the procedure but this was not observed to occur by the researcher
5	Incorrect number of items in a package	Considered a rare occurrence in the OR and was not observed to occur by the researcher
9	Intentionally retained items	Considered a rare occurrence in the OR and was not observed to occur by the researcher
10	Removal of intentionally retained items	Considered a rare occurrence in the OR and was not observed to occur by the researcher
13	Emergency situation	Although the researcher observed cases considered emergencies, there was always enough time to undertake a count
14	Incorrect count	Considered a rare occurrence in the OR and was not observed to occur by the researcher

The overall non-compliance rate was 40 per cent, calculated in the same way.

Overall non-compliance rate:

$$\frac{509}{1268} \times 100 = (40.14)\ 40\%$$

Discussion

Structured observations of perioperative nurses' practices while undertaking a surgical count provided a snapshot of the challenges that perioperative nurses encountered during the count process. Observations indicated a lower-than-expected rate of compliance and conformity. The main barriers were found to be time pressures, the pace of the surgical environment and expectations of surgeons and co-workers; enablers were personal factors including the nurse's knowledge, experience and familiarity with standardised expectations.

Our observations suggest that perioperative nurses were often placed under pressure to complete a surgical count either by the surgery finishing more quickly than anticipated, surgeon behaviour or the anaesthetic team pushing drapes away to wake the patient up before a final count had been completed, which was also found in a study by Butler et al.[9]. These pressures lead to the count process not always being undertaken correctly and therefore are a hindrance to undertaking best practice. Time pressure and the ability to turn procedures around quickly, which relates to productivity, was also described in the literature as contributing to more than half of incorrect counts[10].

The importance of perioperative nurses' knowledge about the count process was another key finding in this research. Knowledge enabled perioperative nurses and provided the confidence they required to question and challenge practices. However, colleagues' behaviour and hierarchy within the operating room sometimes prevented nurses from challenging others' practices, especially for the more junior nurses who may have found it easier to do as somebody else wanted rather than follow the correct process. This finding was consistent with studies by Cima et al.[11], Freitas et al.[12] and Norton et al.[13].

The process of undertaking a surgical count differed between perioperative nurse and surgical specialty. This study found inconsistencies in the count process as not all perioperative nurses followed best practice as recommended by the ACORN accountable items standard, with 40 per cent of those observed deviating from best practice principles. Much of the literature related to surgical counting describes standardised processes and the ability to follow those processes to improve the chances of a correct count at the conclusion of a procedure[12,13,14,15].

The development of an observational tool that aligned with the process recommended by the ACORN accountable items standard and was expertly reviewed and refined by perioperative peers added strength to the study. The tool produced a definitive document that provided a clear delineation of the steps that the perioperative nurse needs to follow when undertaking a surgical count. Use of this tool should enable nurses to ensure positive outcomes for the surgical patient by ensuring no items were left unintentionally within the surgical cavity.

The opportunity to observe these practices in real time assisted in providing an objective and measurable process around challenges in undertaking the surgical count process. The field diary relating to each observed case provided reflections on the actions occurring in the OR. These diary entries, together with the data recorded on the observational tool, provided an in-depth understanding of the contextual barriers and enablers teams faced while trying to undertake a surgical count process according to the ACORN accountable items standard[1] For example, the surgeon interrupting the count process to request an instrument or the circulating nurse leaving the OR to gather further equipment or items.

Implications for perioperative nursing

Perioperative nurses face many challenges in the OR that may affect their ability to follow best practice in relation to the surgical count. This research provides empirical data relative to these daily challenges. Ongoing research is needed into policy development, with a focus on implementation strategies that enable perioperative nurses to undertake the surgical count process.

Policy development

The possibility of retained items by not having an established process for counting was found in a study by Cima et al.[16]. Perioperative staff involved in surgical counts require consistency and structure to ensure the count process is followed as recommended in the ACORN accountable items standard. HCFs need to co-develop implementation resources, with specialty nurses, surgeons and anaesthetists, that provide guidance around the count process in relation to specific surgical procedures[12].

Research by Kieft et al.[17] found that nurses who were involved in local policy review gained a deeper understanding of the process and

were better able to follow the guidelines. Norton et al.[13] undertook a quality-improvement activity that included reviewing and revising their current count policy, and this reduced the number of count discrepancies that they were having. The findings of this study align with the literature, demonstrating the importance of policy development in relation to the surgical count process.

Clinical practice development

Perioperative nurses need to count aloud and together for all surgical counts so that the surgical team is alerted to what is occurring and know that they should not interrupt. They need to find a clear avenue that ensures minimal disruption from the surgical or nursing team when they are undertaking any components of the count process. Distraction while counting can lead to error or incorrect documentation of items counted. Much of the literature discussing URIs cites many types of distractions in a complex environment as a cause of incorrect counts[9,10,18]. This demonstrates the importance of the count process and the concentration required.

Maintaining items in their original packaging needs to be recommended in the HCF count process. It was observed that instrument nurses would like to remove items to neatly fold them and have sutures loaded ready for the case to start. According to the ACORN accountable items standard it is important that swabs and sutures remain in their original packaging until counted in case there are any discrepancies with the item being counted. Throughout the literature there was no evidence of how this process affects the accuracy of the surgical count; however, the recommendation in the ACORN accountable items standard[1] provides a systematic method of managing a discrepancy in the original count.

Having multiple nurses handing up items to the instrument nurse may appear to save time but can lead to error in documentation and incorrect counts. Removing possible causative factors that can lead to a count error may, in fact, speed up the count process. Once again, the literature does not provide any evidence to support this principle; however, if the process ensures that documentation is completed correctly then there is a possibility of reducing a potential risk.

Surgical tray lists are an ongoing grey area in the ACORN accountable items standard. A lack of standard processes for the tray list can put pressure on the HCF to develop a process that is efficient and reduces the possible impact of an incorrect count. HCFs need to find a way to include tray lists into the count process and provide a safer environment to prevent retained items in surgery. The process of using tray lists and their impact on the surgical count is not described within the literature. As documented by Edel[14], reducing variation in practices can reduce the risk of count errors. Some specialties use a large number of surgical trays which may impact the nurse's ability to count each piece of paper included in the set, moving away from the process recommended in the ACORN accountable items standard.

Limitations

A limitation to this observational study was the use of a single hospital locale. Perioperative nurses working in this hospital may undertake practices differently to the general perioperative nursing population. The researcher recruited nurses from different specialties and with different levels of experience.

As with all observational studies, we were mindful of the possibility of a Hawthorne effect – that subjects being observed will change their practice or behaviour while being watched[19]. The first author (VW) spent a prolonged period at the research site so potential participants were able to engage and ask questions. During field observations, participants were aware of the researcher being present but as soon as procedures began participants tended to revert to normal daily activities[20].

Conclusion

This observational study has described the count behaviours of perioperative nurses using a rigorously developed observation tool. The study has made a major contribution to the literature on quality and safety in perioperative nursing by developing a validated tool that can be used in other locations to conduct surgical audits of count procedures.

The analysis provides evidence of the challenges faced by perioperative nurses while undertaking the surgical count but further discussion is required to gain an understanding of the challenges and why perioperative nurses did not question or speak up when there was a breach in the recommended count process.

This study demonstrates the need for HCFs to develop a policy and procedure for undertaking surgical counts, taking into consideration the complexity and clinical requirements of certain procedures and specialties. Perioperative nurses may be more inclined to follow policy and procedure around the surgical count if they feel it is relevant and required for the surgical procedure they are undertaking.

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Effectiveness of non-pharmacological interventions to manage anxiety in adolescents in the perioperative period: A systematic review and meta-analysis

Abstract

Aims

To evaluate the effectiveness of non-pharmacological interventions to manage anxiety in adolescents in the perioperative period.

Design

Systematic review of effectiveness and meta-analysis.

Data sources

MEDLINE, CINAHL, PsycInfo, Cochrane Central Register of Controlled Trials, SciELO, sources of unpublished studies and grey literature, including Open Grey and RCAAP – Portugal, were systematically searched without time limits (up to December 2020).

Review methods

This review followed the Joanna Briggs Institute (JBI) methodology for systematic reviews of evidence effectiveness. The selection process, critical analysis and extraction of data were performed by two independent reviewers. Studies were critically appraised using JBI Critical Appraisal Checklist for Randomised Controlled Trials. Data was synthesised through meta-analysis (using a fixed-effect model in the RevMan 5.2.8) and narrative synthesis.

Results

This analysis included five studies with a total of 420 adolescents. The effectiveness of non-pharmacological interventions, including cognitive–behavioural techniques, hypnosis, guided imagery and relaxation, were examined in the perioperative context. A meta-analysis (n=136 adolescents) of three studies suggests no differences in adolescents' anxiety when non-pharmacological interventions are applied compared to standard care (SMD -0.14, 95% CI -0.48 to 0.20, p=0.42). Individually, all the studies showed that non-pharmacological interventions were beneficial on the reduction of the adolescents' anxiety, although no statistical significance was found.

Conclusion

Despite insufficient evidence on the effectiveness of non-pharmacological interventions, they should be considered as a resource in the management of adolescent anxiety in the perioperative period.

Key words: adolescent, anxiety, perioperative care, nursing, systematic review, non-pharmacological, guided imagery, education

Introduction

Anxiety is a common symptom in adolescents undergoing surgery[1]. Up to 65 per cent of adolescents that undergo surgery experience considerable anxiety symptoms before the procedure[1]. The highest scores are generally reported just before the start of anaesthesia, in the induction room, where about 80 per cent of individuals present very high levels of anxiety[1]. It is estimated that about five million adolescents in the United States of America and 65 000 in Canada experience a surgical procedure each year[2,3]. In Portugal, of the 970 200 surgeries performed in 2018, 17 482 were at paediatric age – up to 14 years old[4]. Although efforts were made to find data from a global number or even from other countries, it was not possible to find discriminated surgical statistics for the adolescent or paediatric groups.

The World Health Organization (WHO) defines adolescence as the phase between childhood and adulthood ranging from 10 to 19 years old[5]. Given the developmental characteristics, adolescence can be divided into three stages: early adolescence (10–14 years), medium adolescence (15–16 years) and late adolescence (17–19 years)[6]. This specific population experiences rapid physical, cognitive and psychosocial development[5]. However, physical growth precedes cognitive maturation[7] and both emotional and judgmental maturation are important cofactors for perioperative care[8].

Non-pharmacological interventions (NPIs) implemented in the preoperative period help to reduce anticipatory anxiety and preoperative anxiety by offering a peaceful and pleasant state[9]. The NPIs can also complement pharmacological interventions offering a feeling of well-being[9].

The behaviour of the paediatric population in a perioperative situation has been widely studied, and many reviews have been conducted on the topic[10–13]. Despite adolescents being included in these studies, the specific subject of NPIs – how these could be used and which effects to expect on adolescent's perioperative anxiety – was not reported. This is particularly relevant if we attend to developmental characteristics and want to know which NPI could be better suited for the adolescent population.

Background

Adolescents' anxiety in the perioperative period frequently results from fear of the unknown, fear of the inability to wake up, fear of death after anaesthesia, loss of control and pain[14,15]. But anxiety can last past the surgical experience. Some adolescents revealed trouble sleeping, nightmares and waking up with an intense sense of fear and anxiety, that lasted longer than the recovery period[16]. Even for those individuals who have been provided with information about the surgical procedure, the perioperative experience may still be distressing and overwhelming[10]. In general, the child/adolescent anticipates the surgical experience according to their maturity, previous information and involvement in the treatment process[17].

Anxiety can be defined as an emotional state that involves feelings of apprehension, tension, nervousness and worry accompanied by physiological or motor arousal[18]. It is a normal reaction to any threat, and it can be protective under some circumstances. Anxiety can also be associated with the anticipation of a future concern and is more correlated with muscle tension and avoidance behaviour[19,20]. A fearful temperament, somatisation tendencies, trait anxiety and depression are significant predictors for pre-operative anxiety in the adolescent[1]. The triggering factors for anxiety in the perioperative period are related to how the patient fears the unknown; perceives physical injuries, pain and loss of control, and the uncertainty of what is expected in the immediate experience[21]. Perioperative anxiety can consequently require a longer time for induction of anesthesia and post-operative recovery, increase the risk of post-operative delirium and increase pain scores and the consumption of analgesia[22].

In the last decade, a substantial investment has been made in studies focusing on the neurocognitive development processes of adolescents, to clarify why they react and behave differently from not only children but also from adults[23]. A decade ago, Fortier and colleagues highlighted the need to develop primary studies in the perioperative context, involving adolescents only in their samples[1]. Some studies conducted in the perioperative period demonstrated contradictory results for the relationship between anxiety and age, gender and previous medical experiences[24–26]. Nevertheless, the higher the scores of anxiety, the greater are adolescents' negative emotions and difficulties with pain management and dealing with health care professionals[27].

The State-Trait Anxiety Inventory form Y (STAI-Y) is an instrument for assessing state of anxiety (20-items) and trait of anxiety (20-items), with each one scoring between 20 and 80[18]. The STAI for children (STAIC) has scores ranging from 20 to 60, with higher scores indicating greater anxiety[18]. Both instruments are considered 'gold standard' in the evaluation of adolescents' anxiety in the perioperative period[18]. The Visual Analogue Scale for Anxiety (VAS-A)

and the Numeric Rating Scale (NRS) are also often used and easy to apply. The scores range from 0 to 10 and higher scores indicate greater anxiety.

The interventions used to prevent anxiety in the preoperative period include both non-pharmacological and pharmacological strategies[28,29]. The former allow changes to the meaning attributed to the anxiety-causing agent. That is, NPIs achieve cognitive restructuring which is oriented to the cognitions, expectations, assessments and constructions that complement the experience of anxiety[30]. Furthermore, NPIs have no side effects, no need for a prescription, are recommended as a resource in the control of adolescent anxiety and fear related to surgical procedures, and the adolescent can use them as tools to manage other anxiety situations throughout life[30].

The NPIs are differentiated into five categories: psychological, physical, nutritional, digital and elemental health interventions[31]. Psychological interventions include relaxation therapies, health education programs, psychotherapies and body-mind programs[31,32]. The use of these NPIs is safe and has no adverse reactions[32].

A preliminary search throughout MEDLINE, PROSPERO, Joanna Briggs Institute (JBI) Database of Systematic Reviews and Implementation Reports and the Cochrane Database of Systematic Reviews was conducted and found some systematic reviews on this topic[10–13,33–35]. In all the cited studies, the authors do not present results for the adolescent population. Additionally, a previous scoping review identified which NPIs are used with the adolescent population in the perioperative period but the effects, alone or grouped, have not yet been evaluated[36]. Therefore, there is a need to systematise the findings, focusing on the NPIs and the management of anxiety in adolescents in the perioperative period, and produce the best evidence for the health care professionals who work with this population in this context.

The review

Aim

This review aimed to evaluate the effectiveness of non-pharmacological interventions to manage anxiety in adolescents in the perioperative period.

The following review question was addressed in this study: What is the effectiveness of non-pharmacological interventions to manage anxiety in adolescents in the perioperative period?

Design

This systematic review was conducted according to the JBI methodology for systematic reviews of effectiveness[37] and this report was organised using the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA 2020) statement. The review protocol was registered in PROSPERO (CRD42020184386) and previously published[38] to increase transparency and reduce the risk of bias.

Search methods

The search followed a three-step strategy to identify both published and unpublished studies that met the inclusion criteria (Table 1). Initially a limited search of MEDLINE (Pubmed) and CINAHL (EBSCO) was undertaken and followed by an analysis of the relevant text words included in the title and abstract and the index terms of the selected articles. All the identified keywords and index terms were adapted for each database and a second search was undertaken in December 2020.

The searched databases included MEDLINE (PubMed), CINAHL (EBSCO), PsycInfo (EBSCO), Cochrane Central Register of Controlled Trials (EBSCO) and SciELO. Sources of unpublished studies and grey literature searched included Open Grey and RCAAP – Portugal Open Access Scientific Repository. The full search strategies are provided in Supplement 1. Finally, all references of the studies selected for critical appraisal were screened to find additional studies. Studies published in English, Spanish and Portuguese were considered for inclusion. No date or geographical limits were applied to this review.

Search outcomes

A total of 985 potentially relevant studies were identified from the database searches. All identified citations were collated and uploaded into the citation manager EndNote X8 (Clarivate Analytics, PA, USA) and duplicates were removed. After the full text of the selected studies was examined, the titles and abstracts of the remaining studies were screened to check whether they met the inclusion criteria. These steps were undertaken by two independent reviewers (MPS, MJP) and any disagreements between both were discussed jointly or with a third reviewer (APS).

Quality appraisal

Eligible studies were critically appraised by two independent reviewers using the JBI Critical Appraisal Checklist for Randomised Controlled Trials[37]. All items have three potential responses 'yes', 'unclear' and 'no', with 'yes' scoring 1, and the others 0. The quality of the RCT studies were classified into good (score 11–13), moderate (score 7–10) and poor (score <6). Once again, any disagreements between reviewers were discussed jointly or with a third reviewer (APS). Considering

Table 1: Inclusion criteria based on population, intervention, control, outcomes and study (PICOS) format

Review question	Inclusion criteria
Population	Adolescents (10–19 years) in the perioperative context
Intervention	NPIs such as education, massage, hypnosis, guided imagery, music therapy, music or virtual reality. There were no limitations in frequency, intensity or who delivers the intervention.
Comparator	Usual/standard care
Outcome	Anxiety (STAI-Y or STAIC or VAS-A or NRS)
Studies	Experimental and quasi-experimental study designs including randomised controlled trials (RCTs), non-randomised controlled trials, before and after studies, and interrupted time-series studies. Analytical observational studies including prospective and retrospective cohort studies, case control studies and analytical cross-sectional studies.

there were few studies concerning the use of NPIs to manage anxiety in adolescents in the perioperative period, researchers decided to include all the selected studies and discuss their methodological weaknesses[38].

Data abstraction

Data from the included studies was extracted by the same two independent reviewers (MPS, MJP) using the standardised JBI data extraction tool (JBI SUMARI)[37]. Data extracted included: study design, participant's details, setting and location, intervention (frequency, duration, dose), comparator, outcome measures, measurements points and outcomes of significance to the review objective.

Synthesis

Studies were pooled with statistical meta-analysis using Review Manager 5.2.8. (Copenhagen: The Nordic Cochrane Centre, The Cochrane Collaboration, 2011). Effect sizes expressed as standardised final post-intervention mean differences (for continuous data) and their 95 per cent confidence intervals were calculated for analysis. Heterogeneity was assessed statistically using the standard $\chi^2$and I^2 tests. Statistical analyses were performed using fixed-effect models due to the absence of heterogeneity (I^2=0%)[39]. Subgroup analyses were not conducted due to insufficient data. As there were fewer than ten studies included in the meta-analysis, it was not possible to assess publication bias and generate the funnel plot. Where statistical pooling was not possible, the findings are presented and synthesised in narrative format, without meta-analysis.

Results

A total of 58 papers were retrieved for full-text review. Of these, 53 articles were excluded and reasons are noted in Supplement 2. Five studies were critically assessed and included in this review. The study identification is described in detail in Figure 1.

Methodological quality

Although different study designs were considered for inclusion, only RCTs met the criteria and all of them were of moderate quality[40–44].

In the standardised critical appraisal instrument for RCTs, seven out of 13 questions about the studies were rated as 'yes' (Table 2). None of the RCTs provided sufficient information about whether those delivering the treatment were blinded to treatment assignment. With the exception of one[42], the studies used clear randomisation for assignment to the treatment or control group and allocation to treatment group was concealed. Another study[44] clearly describes that the participants were blind to the treatment assignment, and only two studies[42,43] outline in a clear way that those delivering the treatment were blind to treatment assignment. At last, only one study[41] presents a complete follow-up.

Characteristics of included studies

All the studies included in this review were published between 2003 and 2019 and are written in English. Specific information and characteristics of these studies are summarised in Table 3.

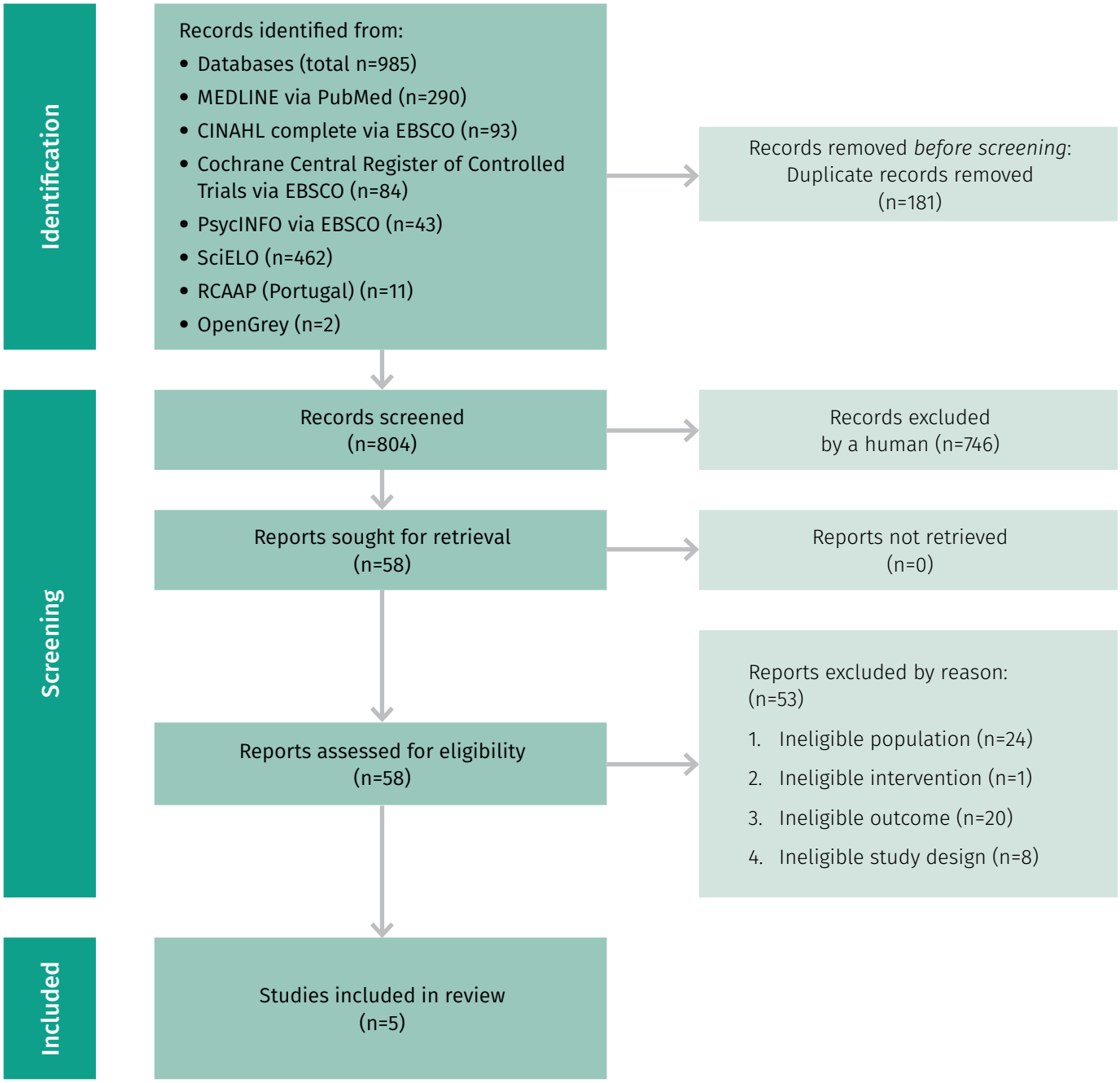

Figure 1: PRISMA 2020 flow diagram including searches of databases

From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71.

Settings

Two studies were conducted in the United States of America (USA)[40,42], one in France[43], one in Canada[41] and one in Poland[44]. All the studies were developed in a hospital context though in different clinical settings: orthopaedics[40–42], thoracic paediatric surgery[44] and the operating room just before anaesthesia induction[43].

Sample size

The number of participants varied from 40[41] to 118[43] per study. At pre-intervention the included studies had a total sample of 437 participants. However, at post-intervention the total sample had 420 participants. Of these, 279 were females and 141 were males.

Participants

The participants' ages ranged from 9 to 19 years old. Only one study[44] included participants aged nine years. Authors of this study were contacted to ascertain exactly how many nine-year-olds were included in the sample. As there were only two, after a thorough discussion, the

Table 2: Quality appraisal of eligible studies

	LaMontagne et al., 2003	Charette et al., 2014	Nelson et al., 2016	Duparc-Alegria et al., 2018	Tomaszek et al., 2019	%
1. Was true randomisation used for assignment of participants to treatment groups?	Y	Y	U	Y	Y	80
2. Was allocation to treatment groups concealed?	Y	Y	U	Y	Y	80
3. Were treatment groups similar at baseline?	Y	Y	Y	Y	Y	100
4. Were participants blind to treatment assignment?	U	N	N	N	Y	20
5. Were those delivering treatment blind to treatment assignment?	N	N	N	N	U	0
6. Were outcome assessors blind to treatment assignment?	N	N	Y	Y	U	40
7. Were treatment groups treated identically other than the intervention of interest?	Y	Y	Y	Y	Y	100
8. Was follow-up complete, and if not, were strategies to address incomplete follow-up utilised?	N	Y	N	N	N	20
9. Were participants analysed in the groups to which they were randomised?	Y	Y	Y	Y	Y	100
10. Were outcomes measured in the same way for treatment groups?	Y	Y	Y	Y	Y	100
11. Were outcomes measured in a reliable way?	Y	Y	Y	Y	Y	100
12. Was appropriate statistical analysis used?	Y	Y	Y	Y	Y	100
13. Was the trial design appropriate, and any deviations from the standard RCT design (individual randomisation, parallel groups) accounted for in the conduct and analysis of the trial?	Y	Y	Y	Y	Y	100
Score	9	10	8	10	10	

Y = Yes, N = No, U = Unclear

Table 3: Characteristics of included studies

Study details	Study design	Participants details (EG/CG)	Setting and location	Intervention (frequency, duration)	Comparator	Outcome measures	Measurements points	Outcomes (EG/CG)
LaMontagne et al., 2003[40] (USA)	RCT with four groups	n = 109 Information only n=27 Coping only n=27 Information plus coping n=30 Control group n=25. Ages:11 to 18 years	During preoperative orthopaedic clinic visit	Cognitive–behavioural Intervention delivered by video (one session, 8–10 minutes)	Usual care	STAIC	Preoperative (day before surgery) Post-operative (day two after surgery)	Information only: 38,93 (7,10) Coping only: 37,07 (6,38) Control group: 39,88 (8,28)
Charette et al., 2014[41] (Canada)	RCT (pilot study)	n = 40 (20/20) Ages: 11 to 20 years	At hospital on the day before surgery	A DVD providing information and demonstration of guided imagery, relaxation and education (one session, 30 minutes)	Usual care	STAI-Y	Preoperative (day before) Post-operative (day of discharge) and follow-up (one month follow-up visit)	EG: 47,25 (3,37) CG: 47,85 (5,93)
Nelson et al., 2016[42] (USA)	RCT	n = 41 (19/22) Ages: 10 to 19 years	During preoperative visit	Relaxation training program video (one session, 20–30 minutes)	Usual care	NRS	Preoperative and post-operative (day two after surgery)	EG: 3,5 (2,7) CG: 3,7 (2,9)
Duparc-Alegria et al., 2018[43] (France)	RCT	n = 118 (59/59) Ages: 10 to 18 years. [EG: 14,8 (13–15,9) CG: 14,6 (13,5–15,7)]	In the operating room just before anaesthesia	Short session of hypnosis (one session, 5–10 minutes)	Usual care	VAS-A	Preoperative (day before surgery) Post-operative (day one after surgery)	EG: 1 [min 0; max 8] CG: 0 [min 0; max 7]
Tomaszek et al., 2019[44] (Poland)	RCT	n = 112 (56/56) Ages: 9 to 18 years. [EG: 14,3 (2,2) CG: 14,2 (2,2)]	Day before surgery	Additional information support from a psychologist (one session, 45 minutes)	Usual care	STAIC and STAIY Expressed as sten scores from 1–10; sten score of 5 or 6 –moderate level of anxiety; 7 and more – high level of anxiety	Preoperative (day before surgery) and post-operative (48 hours after surgery)	EG: 5,5 (4–7) CG: 5,5 (5–7)

EG = Experimental group, CG = Control group, NRS = Numeric Rating Scale, RCT = Randomised Control Trial, STAIC = State–Trait Anxiety Inventory for Children, STAI-Y = State–Trait Anxiety Inventory form Y, USA = United States of America, VAS-A = Visual Analogue Scale – Anxiety

review authors decided to keep the study for inclusion in this review.

There were no substantial differences in age, sex, ethnic background or socioeconomic status among the study groups. Surgery for scoliosis[40–43] and thoracic surgery[44] were the most common. Patients with mental disorders, cognitive deficits[40,41,43,44], chronic illness or problems with verbal communication were not eligible[44].

Characteristics of the intervention

All the interventions were delivered during the preoperative period and involved different methods such as, cognitive–behavioural techniques using information and coping strategies[40], hypnosis[43], guided imagery and education[41], and training and relaxation[42]. One study used 'additional information' delivered by a psychologist[44]. In addition to the main intervention, four studies included an education/information component[40–42,44]. In one study, the intervention was delivered by the music therapists[42], in two studies the interventions were facilitated by nurses[41,43].

Outcome measures

Regarding the outcome and assessment tools, anxiety was measured using self-administered instruments[40,41,44] or instruments filled out by the researcher[42,43]. The most commonly used instrument was STAI-C[40,44] or STAI[41,44]. One study used the VAS-A[43] and another used the NRS[42]. With regard to timing of the assessment, the studies assessed anxiety before delivering the intervention in the preoperative period, and in the post-operative

period, either the day after surgery[43] or on day two[40,42,44]. In one study the post-intervention evaluation was done on the day of discharge[41]. Only the study by Charette et al.[41] assessed anxiety at three stages: pre-intervention, the day of discharge and in the follow-up consultation, one-month after surgery.

Effectiveness of non-pharmacological interventions

In the Charette et al. study, the follow-up comparison between the experimental group and the control group (44,75 +- 3,46 vs 47,68 +- 4,42) showed that the former tended to have lower anxiety levels (p=0.03), with moderate effect size. However, the evaluations made on the day of the surgery and the discharge day were not statistically significant[41].

In the Nelson et al. study, the use of relaxation training had significant effects on anxiety reduction in both groups. Despite the treatment group presenting a slightly greater anxiety reduction there were no statistically significant differences between the two groups[42].

In the Duparc-Alegria study, when using a short session of hypnosis there were no differences between groups but a significant decrease in anxiety levels was shown in both groups (p<0.0001)[43].

In the Tomaszek et al. study that delivered additional information, the patients in the experimental group showed significantly lower levels of state anxiety at 48 hours after surgery than prior to the procedure (Z=3.357, p<0.001)[44]. Conversely, when comparing anxiety levels in the preoperative and post-operative periods, they were significantly increased in the control group (Z=2.146, p=0.031)[44]. Regardless of the group, participant's correlation established statistically significant associations between preoperative and post-operative state anxiety (R=0.6, t=8.26, p<0.001), preoperative state anxiety and trait anxiety (R=0.4, t=4.92, p<0.001), post-operative state anxiety and trait anxiety (R=0.5, t=6.96, p<0.001) and perioperative state anxiety and patient age (R=-0.4, p<0.001)[44].

LaMontagne et al. analysed cognitive–behavioural interventions for reducing adolescent's perioperative anxiety using information alone, coping strategies alone, and a combination of both information and coping strategies[40]. The ANOVA analysis showed no difference between the groups (F [3.11] .92, p=0.44). When analysing results for the 'combined information and coping' group, the results were shown to be more than twice the size of the other groups (63.50) and with a negative slope (-0.78) indicating that lower levels of post-operative anxiety were associated with higher levels of preoperative anxiety[40]. In the same study, for the younger adolescents (<13.25 years), the interventions that included coping strategies were shown to be more effective in the reduction of anxiety in the post-operative period than the interventions that did not include coping strategies[40].

Meta-analysis

The meta-analysis was conducted including three studies[40–42] which corresponded to a sample of 136 adolescents in the perioperative period. As listed in Figure 2, the findings suggest no differences in anxiety when NPIs are applied compared to standard care (SMD -0.14, 95% CI -0.48 to 0.20, p=0.42).

Discussion

To our knowledge, this is the first systematic review presenting an overview of the effect of NPIs with exclusive focus on the adolescent population in the perioperative period. The identified studies used NPIs such as cognitive–behavioural techniques using 'information' and coping strategies, hypnosis,

	Non-pharmacological intervention (NPI)			Usual care (UC)				Standard mean difference
Study or subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Fixed, 95% CI
Charette el al., (2014)	47.25	3.37	20	47.85	5.93	20	29.6%	-0.12 (-0.74, 0.50)
LaMonlagne el al., (2003)	38.19	7.96	30	39.88	8.28	25	40.2%	-0.21 (-0.74, 0.33)
Nelson el al., (2016)	3.5	2.7	19	3.7	2.9	22	30.2%	-0.07 (-0.68, 0.54)
Total (95% CI)			**69**			**67**	**100.0%**	**-0.14 [-0.48, 0.20]**

Heterogeneity: Chi²= 0.11. df= 2 (P = 0.95); I²= 0%
Test for overall effect Z = 0.81 (P = 0.42)

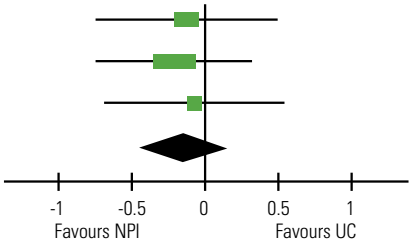

Figure 2: Forest plot of non-pharmacological interventions (NPIs) compared with the usual care (UC) for anxiety in adolescents in the perioperative period

guided imagery, relaxation training and information[40–44]. Although the NPIs could be implemented by any professional, nurses were the professionals who were most often involved in the conception, implementation and evaluation of these interventions[36]. Additionally, the duration of interventions included in this review was diverse. The optimal frequency, 'dosage' and timing for the delivery of NPIs to manage adolescent anxiety in the perioperative period needs improvement as it is recommended in similar applications of NPIs[32,36]. The majority of these NPIs do not require extra time or additional costs for their implementation; however, it is important to evaluate their feasibility in order to develop protocols and establish multidisciplinary routines in perioperative teams[45].

The low number of studies presenting specific results for the adolescent population and the variability of interventions made it impossible to analyse the effect of each intervention independently. However, the review authors overcame this limitation by grouping the interventions to perform the meta-analysis and analyse their overall effect.

Mixed findings about the value of 'additional' information suggest that the adolescent population should previously be carefully evaluated for developmental characteristics and the trait and state of their anxiety[40,44]. LaMontagne et al. found that in adolescents with high trait anxiety, the intervention was revealed to be more effective when used with information. However, when anxiety was evaluated as low in the preoperative period, the use of a single intervention was more effective in reducing anxiety following surgery than a combination of interventions. A combined approach, that offers more information and advice than the adolescents can assimilate, can make them more anxious[40]. Conversely, Tomaszek et al. concluded that despite the delivery of additional information by a psychologist, adolescents with high levels of trait anxiety did not benefit from it. Only adolescents with lower levels of trait anxiety benefited from the information support prior to the surgical procedure[44]. These results could be related to the 'dose' or amount of information delivered. Beyond the intervention, the information 'dose' should be tailored to the needs of the individual and fit their developmental characteristics, preserving a low state of anxiety during the perioperative period[32,40]. Similarly, a qualitative study found that lack of information and understanding about the procedure were the main reasons for adolescents to become apprehensive[46]. Moreover, an integrative review identified that adolescents want to be involved in their perioperative care, revealing the need for information prior to the surgical procedure which will subsequently have a positive effect on their pain management and post-operative recovery, both in the hospital and at home[17].

The study using guided imagery showed no short-term effect on the adolescents' anxiety level. But in the follow-up evaluation, one month after the surgery, the adolescents' anxiety levels tended to be lower. Guided imagery is effective in the preoperative period and is not known to be associated with adverse effects thus being a safe option to improve recovery[32,47]. A meta-analysis of the effectiveness of guided imagery preoperatively has shown it to be effective in relieving preoperative state anxiety in children (d = -3.71) and preoperative trait anxiety in adults (d = -0.64)[47].

Despite no statistical significance, the use of relaxation and training showed a slight reduction in adolescent anxiety levels[42]. The use of relaxation and guided imagery techniques with children was shown to be effective in anxiety reduction in the perioperative period[45]. A systematic review with meta-analysis of the effects of relaxation therapy on adults with anxiety disorder showed this technique is effective[48].

With the hypnosis intervention, there were no differences and a significant decrease in anxiety levels was seen in both groups[43]. A possible explanation for this result is the fact that the anaesthetic nurses were trained with hypnotic techniques for the purposes of the study and that impacted the way the trained person cared for both the intervention and control group. This training induces changes in language, such as the use of positive suggestions[43] and the use of these desirable and reassuring words can improve patient perception and subjective experience[49]. Additionally, hypnosis in adolescents uses natural hypnotic abilities that teens bring to the clinical encounter. Adolescents are also highly responsive to hypnotic therapeutic suggestions when compared to adult patients[50].

The results of the current review show that the effect of using NPIs to reduce adolescent anxiety in the perioperative period is not statistically significant. The evidence gathered is not strong enough to make effective recommendations in favour of or against the use of NPIs with adolescents in the perioperative period. However, individually each study showed beneficial effects from the application of each intervention and highlighted some concerns to be accounted for when delivering NPIs to adolescents, such as age, maturity, previous trait and state of anxiety, and the characteristics of the intervention.

Strengths and limitations

This review filled an existing gap in the literature by assessing the effectiveness of NPIs in managing anxiety in adolescents during the perioperative period. However, this review has some limitations. Only five studies met the inclusion criteria, and these had small sample sizes of less than 60 participants in each study group. The type of surgical procedure and anxiety measurement instrument also differed among the studies. Although it was not possible to draw conclusions, it was highlighted that it is of utmost importance to consider their age, when evaluating the effect of the interventions on the adolescent population, and separate early adolescents from late adolescents.

Another limitation was the absence of the long-term effect (follow-up) evaluation in four of the five studies. Furthermore, there is language bias as only English, Spanish or Portuguese language studies were considered for inclusion.

Conclusion

This review examined the best available evidence on the effectiveness of NPIs in managing anxiety in adolescents during the perioperative period. Although anxiety represents a common problem in the perioperative period, limited studies were found regarding the effect of NPIs implemented and evaluated exclusively in the adolescent population. The topic of information/education was present in four studies revealing it as an important resource, especially when delivered alongside the NPIs at their implementation stage. Nevertheless, this review also showed that the trait and state of adolescent anxiety should be evaluated before intervention and information delivery. Although the studies do not report a statistically significant difference in anxiety, a slight improvement in score was found after NPI delivery compared to before NPI delivery and this was considered clinically relevant.

The recommendations from this review can be used as a tool to guide the design of future studies, refining, exploring and utilising non-pharmacological interventions to their full potential, with the aim of successful management of anxiety in adolescents during the perioperative period.

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Effectiveness of non-pharmacological interventions to manage anxiety in adolescents in the perioperative period: A systematic review and meta-analysis

Supplemental material 1: Search strategies

MEDLINE (Pubmed)

Search conducted 26 December 2020

Search	Query	Records retrieved
#1	("Young Adult"[Mesh]) OR "Adolescent"[Mesh]	2 405 294
#2	(((((("Complementary Therapies"[Mesh]) OR "Imagery, Psychotherapy"[Mesh]) OR "Hypnosis"[Mesh:NoExp]) OR "Music Therapy"[Mesh]) OR "Virtual Reality Exposure Therapy"[Mesh]) OR "Massage"[Mesh:NoExp]	227 063
#3	(("Perioperative Care"[Mesh]) OR "Preoperative Care"[Mesh]) OR "Operating Rooms"[Mesh]	162 277
#4	"Anxiety"[Mesh:NoExp]	80 390
#5	(adolescen*[Title/Abstract] OR teen*[Title/Abstract] OR youth*[Title/Abstract] OR paediatric*[Title/Abstract] OR pediatric*[Title/Abstract] OR child*[Title/Abstract])	1 768 344
#6	(nonpharmacologic*[Title/Abstract] OR Non-pharmacologic*[Title/Abstract] OR "Non pharmacologic"[Title/Abstract] OR "Non pharmacological"[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 "guided imagery"[Title/Abstract] OR imagery[Title/Abstract] OR music[Title/Abstract] OR "music therapy"[Title/Abstract] OR "virtual reality"[Title/Abstract] OR hypnosis[Title/Abstract])	81 232
#7	(perioperative[Title/Abstract] OR postoperative[Title/Abstract] OR preoperative[Title/Abstract] OR operati*[Title/Abstract] OR surgery[Title/Abstract] OR "preoperative period"[Title/Abstract])	2 141 446
#8	(anxiety[Title/Abstract] OR "STAIC"[Title/Abstract] OR "STAI"[Title/Abstract] OR "VAS-A"[Title/Abstract] OR "STAI-Y"[Title/Abstract])	190 956
#9	#1 OR #5	3 543 818
#10	#2 OR #6	289 863
#11	#3 OR #7	2 194 676
#12	#4 OR #8	212 892
#13	#9 AND #10 AND #11 AND #12	307
Limited to English, Portuguese, Spanish		290

PsycInfo (EBSCOhost)

Search conducted 26 December 2020

Search	Query	Records retrieved
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*)	875 489
S2	TI (nonpharmacologic* OR Nonpharmacologic* OR "Non pharmacologic" OR "Non pharmacological" OR "psychological therapy" OR "psychological intervention" OR "Alternative therapy" OR "Alternative therapies" OR "complementary therapy" OR "complementary therapies" OR "guided imagery" OR imagery OR music OR "music therapy" OR "virtual reality" OR hypnosis) OR AB (nonpharmacologic* OR Nonpharmacologic* OR "Non pharmacologic" OR "Non pharmacological" OR "psychological therapy" OR "psychological intervention" OR "Alternative therapy" OR "Alternative therapies" OR "complementary therapy" OR "complementary therapies" OR "guided imagery" OR imagery OR music OR "music therapy" OR "virtual reality" OR hypnosis)	73 717
S3	TI (perioperative OR postoperative OR preoperative OR operati* OR surgery OR "preoperative period") OR AB (perioperative OR postoperative OR preoperative OR operati* OR surgery OR "preoperative period")	136 217
S4	TI (anxiety OR "STAIC" OR "STAI" OR "VAS-A" OR "STAI-Y") OR AB (anxiety OR "STAIC" OR "STAI" OR "VAS-A" OR "STAI-Y")	197 134
S5	MA adolescents OR teenagers OR teen OR youth	258 490
S6	MA complementary therapy	258 490
S7	MA perioperative OR peri-operative OR preoperative OR preoperative OR post-operative OR postoperative OR surgical	7 335
S8	MA anxiety	52 853
S9	S1 OR S5	1 023 122
S10	S2 OR S6	74 902
S11	S3 OR S7	138 397
S12	S4 OR S8	210 553
S13	S9 AND S10 AND S11 AND S12	47
Limited to Spanish, English, Portuguese		43

CINHAL Complete (EBSCOhost)

Search conducted 26 December 2020

Search	Query	Records retrieved
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*)	709 066
S2	TI (nonpharmacologic* OR Nonpharmacologic* OR "Non pharmacologic" OR "Non pharmacological" OR "psychological therapy" OR "psychological intervention" OR "Alternative therapy" OR "Alternative therapies" OR "complementary therapy" OR "complementary therapies" OR "guided imagery" OR imagery OR music OR "music therapy" OR "virtual reality" OR hypnosis) OR AB (nonpharmacologic* OR Nonpharmacologic* OR "Non pharmacologic" OR "Non pharmacological" OR "psychological therapy" OR "psychological intervention" OR "Alternative therapy" OR "Alternative therapies" OR "complementary therapy" OR "complementary therapies" OR "guided imagery" OR imagery OR music OR "music therapy" OR "virtual reality" OR hypnosis)	38 503
S3	TI (perioperative OR postoperative OR preoperative OR operati* OR surgery OR "preoperative period") OR AB (perioperative OR postoperative OR preoperative OR operati* OR surgery OR "preoperative period")	431 958
S4	TI (anxiety OR "STAIC" OR "STAI" OR "VAS-A" OR "STAI-Y") OR AB (anxiety OR "anxiety level" OR "STAIC" OR "STAI" OR "VAS-A" OR "STAI-Y")	99 342
S5	MH adolescence	566 153
S6	MH hypnosis OR massage OR virtual reality	24 093
S7	MH preoperative period	6 123
S8	MH anxiety	46 839
S9	S1 OR S5	1 031 305
S10	S2 OR S6	58 091
S11	S3 OR S7	433 119
S12	S4 OR S8	114 647
S13	S9 AND S10 AND S11 AND S12	97
Limited to Spanish, English, Portuguese		93

Cochrane Central Register of Controlled Trials (EBSCOhost)

Search conducted 26 December 2020

Search	Query	Records retrieved
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*)	161 986
S2	TI (nonpharmacologic* OR Nonpharmacologic* OR "Non pharmacologic" OR "Non pharmacological" OR "psychological therapy" OR "psychological intervention" OR "Alternative therapy" OR "Alternative therapies" OR "complementary therapy" OR "complementary therapies" OR "guided imagery" OR imagery OR music OR "music therapy" OR "virtual reality" OR hypnosis) OR AB (nonpharmacologic* OR Nonpharmacologic* OR "Non pharmacologic" OR "Non pharmacological" OR "psychological therapy" OR "psychological intervention" OR "Alternative therapy" OR "Alternative therapies" OR "complementary therapy" OR "complementary therapies" OR "guided imagery" OR imagery OR music OR "music therapy" OR "virtual reality" OR hypnosis)	18 505
S3	TI (perioperative OR postoperative OR preoperative OR operati* OR surgery OR "preoperative period") OR AB (perioperative OR postoperative OR preoperative OR operati* OR surgery OR "preoperative period")	230 423
S4	TI (anxiety OR "STAIC" OR "STAI" OR "VAS-A" OR "STAI-Y") OR AB (anxiety OR "anxiety level" OR "STAIC" OR "STAI" OR "VAS-A" OR "STAI-Y")	73 218
S5	MH adolescent	102 689
S6	MH hypnosis OR massage OR virtual reality	911
S7	MH preoperative period	263
S8	MH anxiety	867
S9	S1 OR S5	241 939
S10	S2 OR S6	19 111
S11	S3 OR S7	230 447
S12	S4 OR S8	73 512
S13	S9 AND S10 AND S11 AND S12	169
Limited to Spanish, English, Portuguese		84

SciELO

Search conducted 26 December 2020

Search	Query	Records retrieved
#1	(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*))	70 497
#2	(ti:(nonpharmacologic* OR Non-pharmacologic* OR "Non pharmacologic" OR "Non pharmacological" OR "psychological therapy" OR "psychological intervention" OR "Alternative therapy" OR "Alternative therapies" OR "complementary therapy" OR "complementary therapies" OR "guided imagery" OR imagery OR music OR "music therapy" OR "virtual reality" OR hypnosis)) OR (ab:(nonpharmacologic* OR Non-pharmacologic* OR "Non pharmacologic" OR "Non pharmacological" OR "psychological therapy" OR "psychological intervention" OR "Alternative therapy" OR "Alternative therapies" OR "complementary therapy" OR "complementary therapies" OR "guided imagery" OR imagery OR music OR "music therapy" OR "virtual reality" OR hypnosis))	149 694
#3	(ti:(perioperative OR postoperative OR preoperative OR operati* OR surgery OR "preoperative period")) OR (ab:(perioperative OR postoperative OR preoperative OR operati* OR surgery OR "preoperative period"))	49 259
#4	(ti:(anxiety OR "STAIC" OR "STAI" OR "VAS-A" OR "STAI-Y")) OR (ab:(anxiety OR "anxiety level" OR "STAIC" OR "STAI" OR "VAS-A" OR "STAI-Y"))	5 241
#5	#1 AND #2 AND #3 AND #4	3 912
Limited to Spanish, English, Portuguese		462

Open Gray–System for Information on Gray Literature in Europe

Search conducted 26 December 2020

Search	Query	Records retrieved
#1	Adolescen* AND surgery AND anxiety	2

RCAAP – Repositório Científico de Acesso Aberto de Portugal (Portugal)

Search conducted 26 December 2020

Search	Query	Records retrieved
#1	Adolescen* AND surgery AND anxiety	11

Effectiveness of non-pharmacological interventions to manage anxiety in adolescents in the perioperative period: A systematic review and meta-analysis

Supplemental material 2: Studies ineligible following full-text review

Study	Reason for exclusion
1. Arnon 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):123–133.	Ineligible population and outcomes of interest not clearly defined.
2. Augustin P, Hains AA. Effect of music on ambulatory surgery patients' preoperative anxiety. AORN J 1996;63(4):750, 3–8.	Ineligible population.
3. Aytekin A, Doru O, Kucukoglu S. The Effects of Distraction on Preoperative Anxiety Level in Children. J Perianesth Nurs 2016;31(1):56–62.	The authors sent several emails to the article author (AA) asking for how many nine-year-old children they include in the study sample and they never got any answer.
4. Coşkuntürk AE, Gözen D. The effect of interactive therapeutic play education program on anxiety levels of children undergoing cardiac surgery and their mothers. J Perianesth Nurs 2018;33(6):781–789.	Ineligible outcome.
5. Bailey PD, Jr., Bastien JL. Preinduction techniques for pediatric anesthesia. Curr Opin Anaesthesiol.2005;18(3):265–269.	Ineligible study design.
6. Borimnejad L, Arbabi N, Seydfatemi N, Inanloo M, Haghanii H. The effects of acupressure on preoperative anxiety reduction in school aged children. Healthmed 2012;6(7):2359–2361.	Ineligible outcome.
7. Borji M, Pouy S, Yaghobi Y, Nabi BN. Effectiveness of acupressure on anxiety of children undergoing anesthesia. Int J Adolesc Med Health 2019.	Ineligible population.
8. Calipel S, Lucas-Polomeni MM, Wodey E, Ecoffey C. Premedication in children: Hypnosis versus midazolam. Paediatr Anaesth 2005;15(4):275–281.	Ineligible population.
9. 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–e29.	Ineligible outcome.
10. Fernandes SC, Arriaga P. The effects of clown intervention on worries and emotional responses in children undergoing surgery. J Health Psychol 2010;15(3):405–415.	Ineligible population.
11. 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.	Ineligible population.
12. Eijlers R, Legerstee JS, Dierckx B, Staals LM, Berghmans J, van der Schroeff MP et al. development of a virtual reality exposure tool as psychological preparation for elective pediatric day care surgery: Methodological approach for a randomized controlled trial. JMIR Res Protoc 2017;6(9):e174.	Ineligible outcome.

Study	Reason for exclusion
13. 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):728–737.	Ineligible population.
14. Fancourt D, Lee C, Baltzer Nielsen S, Capps S, Brooks P. Relax anaesthetics: The effect of a bespoke distraction app on anxiety levels in children undergoing induction of anaesthesia. Anesth analg 2016;123(3):298–299.	Ineligible outcome.
15. 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.	Ineligible population.
16. Huth MM, Broome ME, Good M. Imagery reduces children's post-operative pain. Pain 2004;110(1–2):439–448.	Ineligible outcome.
17. 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.	Ineligible population.
18. Kain ZN, Caldwell-Andrews AA, Krivutza DM, Weinberg ME, Gaal D, Wang SM et al. Interactive music therapy as a treatment for preoperative anxiety in children: A randomized controlled trial. Anesth Analg 2004;98(5):1260–1266, table of contents.	Ineligible population.
19. Karakul A, Bolışık 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 Ped Res 2018;5(2):82–87.	The authors sent an email to the article author (AK) asking for how many nine-year-old children they include in the study sample. The author answered 28 children. After that, the authors asked if it would be possible to get the output results excluding the nine-year-old children. The article author (AK) answered yes, but never sent it or answered subsequent emails.
20. 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. BJA: Br J Anaesth 2016;117(1):95–102.	Ineligible population. No specific results for adolescent population.
21. Ko JS, Whiting Z, Nguyen C, Liu RW, Gilmore A. A randomized prospective study of the use of ipads in reducing anxiety during cast room procedures. Iowa Orthop J 2016;36:128–132.	Ineligible outcome.
22. 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):877–881.	Ineligible outcome. An email was sent to the author (SK) and he answered that he doesn't have the database anymore.
23. Kumar A, Das S, Chauhan S, Kiran U, Satapathy S. Perioperative anxiety and stress in children undergoing congenital cardiac surgery and their parents: Effect of brief intervention-a randomized control trial. J Cardiothorac Vasc Anesth 2019;33(5):1244–1250.	Ineligible outcome.
24. Lambert SA. The effects of hypnosis/guided imagery on the postoperative course of children. J Dev Behav Pediatr 1996;17(5):307–310.	Ineligible outcome.

Study	Reason for exclusion
25. 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.	Ineligible outcome.
26. Li HC. Evaluating the effectiveness of preoperative interventions: the appropriateness of using the Children's Emotional Manifestation Scale. J Clin Nurs 2007;16(10):1919–1926.	Ineligible outcome.
27. 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.	Ineligible outcome.
28. 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 7:36–39.	Ineligible outcome.
29. Mainer JA. Nonpharmacological interventions for assisting the induction of anesthesia in children. AORN J 2010;92(2):209–210.	Ineligible study design.
30. 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.	Ineligible outcome.
31. 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):460–478.	Ineligible population.
32. Moro ET, Módolo NS. [Children, parents and anxiety.]. Rev Bras Anestesiol. 2004;54(5):728–738.	Ineligible study design.
33. Nilsson S, Kokinsky E, Nilsson U, Sidenvall B, Enskär K. School-aged children's experiences of postoperative music medicine on pain, distress, and anxiety. Paediatr Anaesth. 2009;19(12):1184–90.	No specific results for adolescent population.
34. O'Conner-Von, S. Preparation of adolescents for outpatient surgery: Using an internet program. AORN J 2008, 87(2), 374–398.	Ineligible study design.
35. 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.	Ineligible population.
36. Rhodes R, Nash C, Moisan A, Scott DC, Barkoh K, Warner WC et al. Does preoperative orientation and education alleviate anxiety in posterior spinal fusion patients? A prospective, randomized study. J Pediatr Orthop 2015;35(3):276–279.	Ineligible outcome.
37. Robinson PJ, Kobayashi K. Development and evaluation of a presurgical preparation program. J Pediatr Psychol 1991;16(2):193–212.	Ineligible outcome.
38. Rodriguez S, Caruso T, Tsui B. Bedside entertainment and relaxation theater: Size and novelty does matter when using video distraction for perioperative pediatric anxiety. Paediatr Anaesth 2017;27(6):668–669.	Ineligible study design.
39. 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.	Ineligible population. No specific results for adolescent population.

Study	Reason for exclusion
40. 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).	Ineligible population.
41. 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):1628–1633.	Ineligible population.
42. 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.	Ineligible population.
43. Sagredini R, Mascheroni C, Diotto V, Tranquillini E, Paracchini F, Mercuri P. Treatment of anxiety at induction of anaesthesia in children: a randomized controlled trial of non-pharmacological approach versus midazolam or placebo. Paediatr anaesth 2013;23(3):285.	Ineligible study design.
44. Scheel T, Hoeppner D, Grotevendt A, Barthlen W. clowns in paediatric surgery: Less anxiety and more oxytocin? A pilot study. Klin Padiatr 2017;229(5):274–280.	Ineligible outcome.
45. Sola C, Lefauconnier A, Bringuier S, Raux O, Capdevila X, Dadure C. Childhood preoperative anxiolysis: Is sedation and distraction better than either alone? A prospective randomized study. Paediatr Anaesth 2017;27(8):827–834.	Ineligible outcome.
46. Soliveres J, Sánchez A, Balaguer J, Estruch M, Sánchez J, Solaz C. Parental presence in the operating room: Effect on the quality of anesthetic induction and postoperative agitation in children. Rev Esp Anestesiol Reanim 2011;58(8):472–476.	Ineligible population.
47. Staveski SL, Boulanger K, Erman L, Lin L, Almgren C, Journel 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):725–732.	Ineligible population. No specific results for adolescent population.
48. Strom S. Preoperative evaluation, premedication, and induction of anesthesia in infants and children. Curr Opin Anaesthesiol 2012;25(3):321–325.	Ineligible study design.
49. 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):913–921.	Ineligible population and outcomes of interest not clearly defined.
50. Verschueren S, van Aalst J, Bangels AM, Toelen J, Allegaert K, Buffel C et al. Development of CliniPup, a serious game aimed at reducing perioperative anxiety and pain in children: Mixed methods study. JMIR Serious Games 2019;7(2):e12429.	Ineligible population.
51. Wang ZX, Liu SL, Sun CH, Wang Q. Psychological intervention reduces postembolization pain during hepatic arterial chemoembolization therapy: A complementary approach to drug analgesia. World J Gastroenterol 2008;14(6):931–935.	Ineligible intervention.
52. Whipple J. Surgery Buddies: A music therapy program for pediatric surgical patients. music therapy perspectives. 2003;21(2):77–83.	Ineligible study design.
53. William Li HC, Lopez V, Lee TL. Effects of preoperative therapeutic play on outcomes of school-age children undergoing day surgery. Res Nurs Health 2007;30(3):320–332.	Ineligible outcome.

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'Can you hear me?' Barriers to and facilitators of communication in the presence of noise in the operating room

Abstract

Aim

The aim of this study was to explore health professionals' perceptions of the impact of noise on communication in the operating room.

Sample and setting

Health professionals working in the operating room at a tertiary, affiliated, major referral hospital in northern Australia were recruited using purposive sampling.

Method

Semi-structured interviews were undertaken using an exploratory qualitative design to explore health professionals' perceptions of communication and the impact of noise in the operating room. Interviews were transcribed verbatim and analysed using thematic analysis.

Results

In all, 26 health professionals participated, including anaesthetists, surgeons, nurses and theatre technicians. Two themes were analysed from the data: barriers to communication and facilitators of communication in the operating room. Barriers to communication focused on difficulties that health professionals experienced when attempting to communicate in the presence of noise – difficulty hearing in noisy operating rooms, positioning of health professionals, and inability to filter out sounds. Facilitators of communication consisted of health professionals' adaption to the presence of noise during communication – non-verbal communication, such as gestures, and the ability to filter out unwanted sounds.

Conclusion

Health professionals of all levels of experience encounter communication difficulties. With increased experience, health professionals are able to filter out unwanted sounds provided the OR is not too noisy. Consideration needs to be given to the use of space and positioning of noise emitting equipment to optimise communication in the OR. Furthermore, communication can be facilitated by the judicious use of non-verbal communication.

Keywords: operating room, communication, noise, communication barriers, interdisciplinary communication, health communication

Background

The operating room (OR) is busy, with activities such as opening paper packets and handling instruments and equipment, and noisy with phones ringing, alarms sounding, music being played and devices emitting noise[1–6]. Such noise-emitting devices may include suction, forced air patient warmers, high volume suction units and the anaesthetic machine which may sound alarms. Health professionals in the OR include anaesthetists, surgeons, nurses and theatre technicians. When trying to communicate effectively, these health professionals must compete with the noise generated by devices and activities. When surveyed about noise and communication, health professionals acknowledged that the OR was a noisy environment which impacted negatively on their ability to deliver patient care[7].

There are three main sources of noise in the OR – conversations, equipment and music. These result in average sound pressure levels ranging from 55 to 70 decibels (A weighted) (dB(A))[8,9]. The average sound pressure levels for various types of conversation are 45 to 55 dB(A) for quiet conversations[9], 60 dB(A) for normal conversations[10] and 61 to 70 dB(A) reported for speaking with raised voices[11,12]. Therefore, with the diverse range of average sound levels in the OR, health professionals would be required to raise their voice in order to be heard.

Past research has found that health professionals, whether they were undertaking a task or not, experienced diminished ability to communicate effectively with the sound levels commonly in the OR[13]. In their research, Way et al.[13] assessed the surgeon's ability to understand and repeat words, with and without undertaking a task, with and without music playing, and with typical OR noises including quiet, filtered noise and background OR noise[13]. In another study, that used a cross-sectional design to survey the effects of noise on work practices in the OR, surgeons expressed that they found noise distracting during OR activities such as completing the surgical safety checklist[14]. Two cross-sectional studies surveying anaesthetists found that good communication among health professionals was an important factor in delivering patient care[15], and poor communication resulted in surgical or procedural delay[16]. In another cross-sectional study, OR health professionals were surveyed on teamwork and communication, with nurses explaining that a hierarchy within the health care team led to reluctance to raise concerns about patient safety issues[17]. Past research into communication failure in the OR found the failure rate ranged from nine percent[18] to 57 per cent[19] of all communication events, depending on the type of procedure, surgical specialty and the phases of the surgical procedures observed. Communication between OR health professionals is an essential component of delivering patient care, with communication failure negatively impacting patient safety[20].

Communication failure is a common cause of adverse events that originate in the OR with consequences including surgical count errors leading to retained surgical products, patient harm or death; wrong site or side surgery, and wrong implant inserted[21,22]. A qualitative study identified communication failure, with information not being communicated, to be a result of hesitancy and reservation[23]. In a grounded theory study using semi-structured interviews, communication failure was interpreted as a lack of respect by the surgeons and other team members who participated in the study[24].

Past research into communication in the OR has used surveys focussing on communication between OR health professionals, quality of communication during laparoscopic surgery, communication and teamwork, and the impact of noise on OR health professionals' work practices[14–17,25]. In studies where qualitative designs were used, the focus was on team communication[23], the impact of tension on communication[26], interdisciplinary communication dynamics[24] and communication behaviours for effective workplace practice[27]. There has been little previous work on how noise impacts communication. Health professionals' perceptions and experiences of communicating in the presence of noise needs to be further explored to enable a deeper understanding of communication and the influence of noise in the OR.

Aim

The aim of this study was to explore operating room health professionals' perceptions of the impact of noise on communication in the operating room.

Sample and setting

The research was undertaken at a tertiary university-affiliated hospital, which services a large rural and remote area of Northern Australia. Participants were 205 health professionals employed in the operating suite, including surgeons, surgical trainees, anaesthetists, anaesthetic trainees, perioperative nurses and theatre technicians.

Information about the research was presented to health professionals during weekly meetings and followed up by email and with information notices placed at various sites in the

operating suite. Further information was given to those who expressed an interest in participating, and a mutually agreeable interview time was organised. Interviews were conducted in a quiet room within or adjacent to the operating suite. Purposive sampling was used to recruit participants from each health professional group to ensure representation from each group and a wide range of ages, years of experience and number of years working at the research site[28].

Inclusion criteria for participating health professionals were a minimum of two weeks worked and at least one day per week working in the operating rooms at the research site. Exclusion criteria were working only in the preoperative or post-operative care of patients.

Methods

This research used an exploratory qualitative methodology with semi-structured interviews to investigate how health professionals perceived the impact of noise on communication in the operating room[29]. The research was granted ethical approval from the research site ethics committee ((2017.2801) and the university (1749562).

The interviews were undertaken by the first author using a topic guide (Table 1) derived from past research[7,27] and guided by the first author's clinical experience as a perioperative nurse working at the research site[19,30]. The first author underwent training, and the other authors had experience in undertaking qualitative interviews with content expertise in perioperative nursing, patient safety and interprofessional communication. Semi-structured interviews were audio-recorded, transcribed verbatim and analysed by all authors using thematic analysis[31], enabling themes to be explored and interpreted.

Table 1: Topic guide for interviews

Topic wording
1. How do you think noise impacts communication in the OR?
2. What do you think influences communication in the OR?
3. Tell me about any problems you have had communicating in the OR. Can you describe a situation where this has occurred?

The thematic analysis process consisted of five stages – becoming familiar with the data in the transcripts, conceptualising the themes, applying the themes to the data, rearranging the data into the themes and mapping the themes[31]. NVivo for Mac (version 11.4.3, Melbourne) was used to manage the data during the final two stages of the analysis process.

Rigour during the recruitment and data analysis phase was maintained by the selection of participants, the use of a reflective journal and collaborative discussion during the analysis process. During the data collection, the first author kept a journal to record reflections after each interview. The reflective journal was also used to prepare for the interview to ensure no preconceived ideas were included in the data collected[23]. During the analysis process, the data coded into each theme were regularly reviewed to ensure the definition of each theme was consistent throughout the analysis process[32]. Each theme was discussed collaboratively with all authors to ensure consistency throughout the coding process[26,33].

Results

In all, 26 interviews were undertaken ranging from 17 to 65 minutes with an average length of 29 minutes. Ten participants were women, and 16 were men. The anaesthetists included seven consultants and one trainee. Of the nurses interviewed, two were anaesthetic nurses, four were instrument–circulating nurses and two were anaesthetic–instrument–circulating nurses. The surgeons comprised five consultants and three trainees from a range of surgical specialties – ear, nose and throat (n = 2), general surgery (n = 3), neurosurgery (n = 1), ophthalmic surgery (n = 1), and orthopaedic surgery (n = 1). Four participants spoke a language other than English at home (Table 2).

Two major themes emerged from data analysis – 'barriers to communication in the presence of noise' and 'facilitators of communication in the presence of noise'.

Barriers to communication in the presence of noise

The theme 'barriers to communication in the presence of noise' consisted of three sub-themes – 'hearing difficulties in noisy ORs', 'positioning of health professionals' and 'being unable to filter out sounds'.

Hearing difficulties in noisy operating rooms

Participants expressed that their attitudes to noise changed as they grew older. A surgeon reported that younger health professionals were still able to communicate in the presence of noise. However, he reported becoming less tolerant of noise in the OR as he aged. The surgeon described:

Table 2: Characteristics of participants (N = 26)

Demograhics		n
Occupation	Anaesthetists and trainees	8
	Surgeons and trainees	8
	Nurses	8
	Theatre technicians	2
Number of years working in OR	Less than 1 year	1
	1–5 years	3
	6–10 years	14
	11–15 years	3
	More than 16 years	5
Number of years at research site	Less than 1 year	5
	1–5 years	14
	6–10 years	3
	11–15 years	3
	More than 16 years	1

> I think younger people … in the operating [room] tolerate noise and seem to manage with communication. Certainly, my experience has been that I was more tolerant of noise in the operating [room] when I was younger. (SC4)

An anaesthetist, aged between 26 and 35 years, described that he was becoming more frustrated conversing in a noisy OR as he grew older. Another surgeon also attributed his communication difficulties in noisy ORs to hearing loss caused by aging. This surgeon commented that he was unaware of noisy ORs when he was a trainee; however, as a consultant this situation had changed and he experienced difficulties while trying to communicate.

Positioning of health professionals

The layout of equipment in an OR varied according to the room's size and physical layout and position of items such as gas supply outlets and power points. How the space in the OR was used when positioning the equipment influenced where health professionals were able to stand and move around during surgery, and thus had impact on their ability to communicate.

A surgeon observed that he was required to use the same speciality equipment irrespective of the size of the OR. This resulted in less space for health professionals to navigate and approach a person to converse quietly when operating in a small OR. Instead, a health professional had to speak in a raised voice over the noise emitted by the equipment. The surgeon reported:

> … in [a small operating room], the scrub nurse has to be confined to a corner because of the arrangements of the [equipment] … So, I find perhaps the nurse has to talk more often or speak more loudly to reach the nurse on the other end. But in [a large operating room] … there is more space to move around so you can quietly ask the nurse whatever you need. (SC1)

An instrument–circulating nurse commented that positioning equipment, such as the suction and electrosurgical units, near the foot end of the OR table negatively impacted effective communication. Instrument–circulating nurses positioned near the equipment were required to raise their voice in order to be heard. This was a concern raised by the nurses when required to complete the surgical count.

An anaesthetic nurse recounted a situation affected by the position of the suction and electrosurgical units in the OR. In this situation, a circulating nurse was experiencing difficulties understanding what the instrument nurse was asking. The anaesthetic nurse was situated on the opposite side of the OR and could clearly hear the circulating nurse asking the instrument nurse to repeat the request. The anaesthetic nurse described:

> I have noticed that if I'm over the other side [of the OR] to where the [instrument] trolley tends to be … They may be going back and forth with a 'May I have this?' … 'What are you saying?' … I can hear perfectly well what that [instrument nurse] is saying, … and I will venture over and say this is what they want. (NAIC2)

Being unable to filter out sounds

The ability to clearly comprehend conversations required health professionals to filter out some of the sounds in the OR, allowing them to focus on conversations that were necessary at the time. However, health professionals reported that when the OR was noisy, they were unable to filter out these sounds.

An inexperienced instrument–circulating nurse, with limited working experience in the OR, became overburdened when attempting to listen to all conversations occurring around her. The nurse recalled:

> At the moment I'm trying to listen to everybody. … You have the anaesthetists talking to their students. … You have the surgeon speaking to the other nurse and all the other different noises and bits and pieces. … at the moment I'm just taking it all in …, it becomes a little bit overwhelming. (NIC1)

When the OR was noisy, a theatre technician was unable to concentrate on requests made by other members of the team. The technician forgot the task he was asked to complete due to the volume of noise that was occurring at the time. This forgetfulness resulted in repeated communication and hindered his ability to complete the task in a timely manner. Similarly, a surgical trainee described his experiences of attempting to concentrate during complex surgery. He related that if the OR was noisy, he experienced difficulties filtering out some of the sounds which would allow him to concentrate on the surgical procedure.

Facilitators of communication in the presence of noise

The theme 'facilitators of communication in the presence of noise' consisted of two sub-themes – 'using non-verbal communication in the presence of noise' and 'being able to filter out sounds in the presence of noise'.

Using non-verbal communication in the presence of noise

Non-verbal communication was described as an effective form of communication when the OR was noisy. Participants recalled using non-verbal gestures, either independently or in conjunction with verbal communication, and specifically using their hands, eyes, or facial expressions to communicate.

A surgeon recounted being able to use non-verbal hand gestures to facilitate effective communication when requesting a surgical instrument during a surgical procedure. He stated that during a procedure he tended to mumble; therefore, in a noisy OR he preferred to use non-verbal communication. However, the surgeon qualified the use of non-verbal hand gestures for communication by adding that this style of communication would depend on the level of experience of the instrument nurse, whether the instrument nurse was attentive during the surgical procedure and how often they had worked together. The surgeon reported:

> I think if it is a good [instrument] nurse and I put out my hand, they know what's going on in the operation, they know what I need, so it is really nice not to ask and sometimes when it is loud you rely on that more. I have a tendency to mumble as well. … So that comes with working together for a while, knowing the operation and getting to know each other. (SC7)

The use of non-verbal gestures to communicate was described by an anaesthetic consultant when the OR was noisy. The consultant used gestures such as stern facial expressions or holding his finger up to pursed lips to request for silence in the OR. Moreover, an anaesthetic trainee recalled the response she received when she stood up suddenly in the OR with a stern look on her face and projected her voice to get the attention of the other health professionals in the OR. The use of non-verbal gestures enabled her to gain their attention during the emergency. The trainee recounted:

> I have to admit being six foot … I just tend to have to stand up. … it's your non-verbal stuff. If you actually are a six-foot-tall female, stand up and make eye contact with the theatre and project your voice so that everyone just goes [clicks fingers] boom. … with the I'm not joking tone … and it works quite well …. I'm usually laid back, all of a sudden, you're – you're a presence in the theatre. (AT8)

Being able to filter out sounds in the presence of noise

Another facilitator of effective communication in the presence of noise was being able to filter out sounds in the OR. Participants reported that filtering out sounds such as concurrent conversations and equipment, including suction or electrosurgical units, enabled them to focus their attention on the tasks at hand and essential conversations.

An anaesthetic consultant described filtering out some sounds during the induction of anaesthesia phase while she observed an anaesthetic trainee induce the patient. The consultant explained that she did not listen to sounds unrelated to the anaesthetic

phase of the procedure, such as the call bell, which enabled her to communicate effectively with the trainee. The anaesthetist recalled:

> I will watch the [anaesthetic trainee] do a whole induction … without noticing the [call bell] going off. You are tuned into different things … We all ignore certain noises that don't bother us and are tuned to noises that do. (AC5)

A surgical trainee recalled disregarding some sounds unrelated to his role during the surgical procedure, such as the oxygen saturation alert tone. By not listening to the unrelated sounds, he was able to concentrate on the procedure and communicate effectively with the surgeon and instrument nurse.

Discussion

This research explored how noise affected communication between health professionals in the operating room. Health professionals struggled to communicate effectively when the OR was noisy, revealing barriers to effective communication including positioning of health professionals, hearing difficulties in noisy ORs, and being unable to filter out sounds. Due to the presence of noise, health professionals used facilitators of communication including non-verbal gestures and filtering out some conversations and noise emitted by equipment. However, restrictions existed for when it was possible to use these facilitators. Non-verbal gestures were an effective means of communication when recipients understood the meaning of the gestures and the context in which they were being used. Filtering out irrelevant conversations was also an effective facilitator of communication when the noise levels were not elevated or if filtering occurred in the presence of experienced OR health professionals.

The arrangement of equipment in the OR was dictated by the type of surgery, door position, power and services outlets, and anaesthetist and surgeon's preferences. Surgical specialties need an OR of an appropriate size for the equipment required and number of health professionals involved in the surgery. If the equipment used for the surgery resulted in lack of space in the OR, then the circulating nurse may not be able to stand near the instrument nurse to communicate quietly. Instead, the conversations occur with raised voices across the obstructing equipment. The noise emitted by some equipment has been identified in past research[14] as contributing to communication failure. Past research found failure to meet surgeons' expectations of positioning and choice of equipment resulted in breakdown of communication between the surgeon and other health professionals[24]. However, in a study of how perioperative nurses' practice was governed, nurses became more familiar with the surgeons' requirements for each type of procedure as they gained experience working with them. Through this knowledge, the perioperative nurses were able to try different arrangements of the equipment to overcome the barriers to effective communication posed by the equipment[34].

Health professionals reported experiencing difficulties hearing conversations when the OR was noisy; however, this may not necessarily be due to any hearing deficit. Past research on hearing difficulties among orthopaedic, urological and oral faciomaxillary surgeons[3,35–37] found mixed results. Orthopaedic surgeons were exposed to noise levels over the threshold level and exposure time required for occupational noise-induced hearing loss to occur[3,35]. However, a study undertaking audiometry testing of 22 senior orthopaedic surgeons, found 11 of them had some degree of noise-induced hearing loss but not of a degree to be classified as deafness[38]. Another study undertook audiometry testing of 18 health professionals, from a range of ages and types, who worked in orthopaedic surgery[39]. This study found the exposure was insufficient to pose a danger to hearing, and no noise-induced hearing loss was present in any of the participants. Moreover, the studies investigating hearing loss in oral faciomaxillary and urological surgeons found they were not exposed to noise levels shown to result in hearing loss[36,37].

Rather than experiencing a hearing loss, health professionals may become less tolerant of the noise levels in the OR, especially considering the complex cognitive tasks that they undertake. Past research showed that health professionals experienced diminished ability to communicate with the noise levels present in the OR, regardless of whether they were undertaking an activity or not[13]. Furthermore, communication was more likely to breakdown if a health professional was undertaking complex cognitive tasks, such as those undertaken in the OR, while communicating in the presence of noise[13].

For health professionals to be able to use non-verbal gestures as an effective means of communication in noisy ORs, their colleagues needed to be aware of the meanings of the gestures as well as the context in which they are used. If the instrument nurse can see the surgical field and is familiar with the surgery, then hand gestures used by the surgeon may be an effective means of communication. In an

observational study of the transfer of objects between the instrument nurse and the surgeon during surgical procedures[40], the use of non-verbal gestures by the surgeon was an effective means of communication when they could be observed by the instrument nurse. This finding was confirmed by another study that found the recipient of the gestures needed to be able to see them as they occurred[41]. Despite these restrictions, participants recounted situations where the use of non-verbal gestures were an effective method of communication without contributing to the sound levels in a noisy OR.

The ability of health professionals to filter out some sounds or conversations to facilitate communication depended on their level of experience and the noise level in the OR. Health professionals who were new to the OR environment experienced difficulties adapting to the communication styles used in the OR[42] and had more breakdowns in communication than experienced OR health professionals[43]. The results from this study were consistent with past research that found elevated noise levels degraded the quality of verbal communication, placed stress on health professionals and resulted in breakdown of communication[13]. Accounting for these difficulties, experienced health professionals need to support and foster inexperienced OR health professionals to adopt an effective communication style in the OR[18].

Limitations

This research was undertaken at one research site and may not be representative of the experiences in other operating suites. However, health professionals with a range of work experience in other operating suites were included in the research. Further research in this area could include multiple sites to expand these findings and provide further insight into the barriers to and facilitators of communication in the presence of noise in the OR.

Implications for practice

A number of implications for practice have been derived from this research, relating to positioning of equipment in the OR, the use of non-verbal gestures, and consideration of inexperienced health professionals and their inability to filter the sounds. The positioning of equipment in the OR is influenced by many factors and impacts the team of health professionals. Surgical procedures need to be undertaken in an OR that leaves adequate space for health professionals to manoeuvre around the equipment. Health professionals need to endeavour to reduce the noise levels in the OR. One measure that could be further used is non-verbal gestures, provided that colleagues are aware of their meaning and are able to see the gestures.

Conclusion

Health professionals of all levels of experience encountered difficulties communicating in the noisy environment of the OR. Inexperienced health professionals struggled with communicating effectively and thus need to be supported until they acclimatise to the competing sounds in the OR and learn methods of effective communication. More experienced health professionals were able to filter out unwanted sounds, providing the OR was not too noisy, to enable them to concentrate on vital conversations. Attention to the positioning of equipment and optimal utilisation of space is required to optimise communication in the OR. Furthermore, communication can be facilitated by the judicious use of non-verbal communication.

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Culturally focused pre-surgery screening to reduce Aboriginal and Torres Strait Islander patient surgical cancellations

Abstract

Background

There are health disparities in many countries between First Nations and non–First Nations populations. In Australia, the Aboriginal and Torres Strait Islander population have several risk factors and are more likely to experience higher rates of post-operative morbidity complications and mortality.

Purpose

To develop a culturally appropriate pre-surgery screening tool, administered by phone, to check health and wellness, identify relevant factors and support Aboriginal and Torres Strait Islander patients to ensure they are appropriately prepared to undertake surgery. The screening tool aims to reduce rates of patient-initiated cancellations of surgery and gain a greater understanding of factors contributing to patient-initiated cancellations of Aboriginal and Torres Strait Islander patients.

Methods

This quality improvement project uses the Model for Improvement methodology and integrates 'Plan, Do, Study, Act' (PDSA) cycles to implement, assess and improve the intervention. The rate of Aboriginal and Torres Strait Islander patient-initiated surgical cancellations was measured for an Australian tertiary referral hospital.

Results

The six-month phase after implementation demonstrated a decreased mean rate (0.078 to 0.060) of Aboriginal and Torres Strait Islander patient-initiated cancellations. Responses were thematically analysed to identify contributing factors for surgical cancellations.

Conclusions

Implementing a culturally appropriate pre-surgery screening tool, developed by suitably qualified staff, positively advocated for Aboriginal and Torres Strait Islander patient's health and wellbeing.

Implications

This study is highly generalisable as the setting has similar key performance indicators and operational governance to many other hospitals treating Aboriginal and Torres Strait Islander patients nationwide.

Keywords: Aboriginal and Torres Strait Islander, health and wellness, social wellbeing, cultural sensitivity, cultural awareness

Introduction

Problem

There is significant evidence of health disparities in many countries between First Nations and non–First Nations populations. This is clearly demonstrated by the decreased life expectancy for First Nations populations compared to their non–First Nations counterparts in developed countries including, Canada (6 years for both sexes), Australia (10.6 for males and 9.5 years for females) and New Zealand (7.1 years for both sexes)[1]. In Australia, the Aboriginal and Torres Strait Islander population have several risk factors for chronic diseases and are more likely to experience higher rates of post-operative morbidity complications and mortality[2]. The gap in health, education and employment between Aboriginal and Torres Strait Islander people and other Australian populations is not closing at the rate the government has committed to, despite an increased expenditure on health services for Aboriginal and Torres Strait Islander people[3]. This paper focuses on addressing the health disparity of Aboriginal and Torres Strait Islander people through improving timely access to surgical care. Social and emotional wellbeing is a key factor that contributes to decreased health status, chronic disease and poorer health outcomes in Aboriginal and Torres Strait Islander people, and these increase the risk of developing lowered social and emotional wellbeing, including psychological problems[4].

Background

Social and emotional wellbeing is a multifaceted concept which can comprise mental health and an individual's cultural connection to land, in particular, as well as their culture, ancestry, family, spirituality, economic situation and community. If these elements of wellbeing are not addressed, patients are at risk of negative health outcomes, including anxiety and depression, and behavioural risks including drug use, excessive alcohol consumption and suicide[4]. The available literature demonstrates the benefits of assessing the social and emotional wellbeing of Aboriginal and Torres Strait Islander patients in health care; however, there is no literature available regarding any targeted pre-surgical screening of health, wellness or social wellbeing.

Research indicates that engagement rates with Aboriginal and Torres Strait Islander people are suboptimal because of a lack of culturally appropriate services, difficulty building trusting patient–clinician relationships, discriminative health care behaviour, expense and inability to access services[5]. Conventional, westernised assessment instruments may cover elements of the surgical process; however, they are unfamiliar, may consist of inappropriate language, and do not reflect Aboriginal and Torres Strait Islander cultural beliefs and understandings of health, wellness and sickness, and these things negatively impact assessment validity[6]. Health care focus must shift from purely reporting disparities in surgical outcomes for Aboriginal and Torres Strait Islander people to identifying and developing best practice preventative processes for addressing poor surgical outcomes[2].

Purpose

This quality improvement project endeavoured to develop a culturally appropriate, phone-administered pre-surgery screening tool to check health, wellness and social wellbeing, identify relevant factors and support Aboriginal and Torres Strait Islander patients to ensure they are appropriately prepared to undertake surgery, taking into consideration both clinical and non-clinical surgical journey factors. The rate of patient-initiated cancellations was be measured to evaluate the effectiveness of the screening tool and responses were analysed to gain a greater understanding of the issues contributing to the occurrence of patient-initiated surgical cancellations of Aboriginal and Torres Strait Islander patients. The expert knowledge and experience of Aboriginal and Torres Strait Islander health service members was used during development and implementation of the screening tool to address cultural appropriateness and differences in health literacy. This specialised input was used in an attempt to counteract the underlying health disadvantage confronting Aboriginal and Torres Strait Islander people, a disadvantage that leads to feelings of loss of control, disempowerment and disengagement[3].

Methods

Design

The screening tool was developed using a Model for Improvement (MFI) framework – a two-tiered approach encompassing the 'thinking' stage, forming a cross-functional team, and the 'doing' stage, integrating Plan, Do, Study, Act (PDSA) cycles to repetitively implement, assess and improve interventions until aims are achieved[7]. A concurrent, nested mixed method design was used to review the six-month implementation phase and results, whereby quantitative data interpretation took priority for effectiveness assessment and qualitative data was accessed for understanding content addressed within the screening tool. Measuring the rate of Aboriginal and Torres Strait Islander patient-initiated

surgical cancellations was used for quantitative assessment of the effectiveness of the screening tool in improving the timely access to surgical services for Aboriginal and Torres Strait Islander patients. Responses to the screening tool were used as qualitative data to gain a greater understanding of the issues contributing to the occurrence of Aboriginal and Torres Strait Islander patient-initiated surgical cancellations.

Ethical considerations

This project was deemed a quality improvement project by our institution and exempt from ethical review. The project considered the six core Aboriginal and Torres Strait Islander values – spirit and integrity, cultural continuity, equity, reciprocity, respect and responsibility[8]. These values ensure projects develop best practice ethical standards, respect the values and guarantee the relevant priorities, needs and aspirations of the population[8]. To mitigate ethical concerns, it was vital that this project was guided by Aboriginal and Torres Strait Islander staff members[8].

Setting and sample

The setting for this project was a large, Australian, tertiary, referral hospital that provides comprehensive elective and emergency surgical services to metropolitan and rural regions state-wide. This hospital has a primary catchment population of 338 155 people; however, most patients live outside the primary catchment area throughout Queensland, northern New South Wales and Northern Territory. Surgical and perioperative services provide secondary and comprehensive tertiary elective and emergency surgical services, delivering more than 26 000 operations annually at an average of over 500 procedures each week. The hospital has twenty-two operating rooms and two minor procedure unit operating rooms. Aboriginal and Torres Strait Islander people make up 3.6 per cent of the total number of surgical cases treated at this hospital.

Within this hospital, the Aboriginal and Torres Strait Islander health services have clinical and non-clinical staff who assist the hospital service lines with the cultural needs of Aboriginal and Torres Strait Islander patients. The hospital established this in response to their local Hospital and Health Service (HHS) 'Better together' plan – a commitment to closing the gap in Aboriginal and Torres Strait Islander health outcomes. A review of operating performance data and surgical preparation processes for Aboriginal and Torres Strait Islander patients indicated both high levels of patient-initiated surgical cancellations and the absence of a dedicated pathway for supporting these patients.

The sample for this project included all patients scheduled to undergo elective surgery during the six-month implementation phase who were identified on the hospital patient administrative system as 'Aboriginal', 'Torres Strait Islander' or 'Aboriginal and Torres Strait Islander'.

Procedure

The two major tiers of the project were:

1. the thinking stage that involved forming a cross-functional team with diverse representation of staff involved in the surgical journey
2. the doing stage using PDSA cycles to repetitively assess and improve the intervention.

Tier one: Thinking stage

An affinity diagram was used to deconstruct the preoperative surgical journey into segments and cluster the roles associated with each segment. A vital aspect of the project aim was leveraging the knowledge, skills and expertise of both the appropriate surgical staff and the Aboriginal and Torres Strait Islander staff. An additional member of the project team was a staff member trained in information and technology (IT), for the purpose of exploring the opportunity to improve clinical process and achieve higher levels of operational efficiency by including automated elements in processes.

Following the team's establishment, a fishbone cause and effect diagram was used to diagnose and deconstruct the complex interplay of causes contributing to patient-initiated surgical cancellations of Aboriginal and Torres Strait Islander patients (Figure 1). The root causes and causal relationships identified in the fishbone diagram were used for the foundation of the pre-surgery screening tool. Aboriginal and Torres Strait Islander staff provided cultural expertise when drafting the phone script for the screening tool.

Tier two: Doing stage

Through consultation with the IT-trained staff member, it was identified that using basic level computer scripting/programming could automate many time-consuming tasks, specifically the non-clinical task of searching raw data reports to identify specific subsets of patients. This project used Visual Basic Scripting (VBScript), a computer scripting language developed by Microsoft, allowing Microsoft Windows users to create automation tools for creating, managing, editing, saving and sending documents.

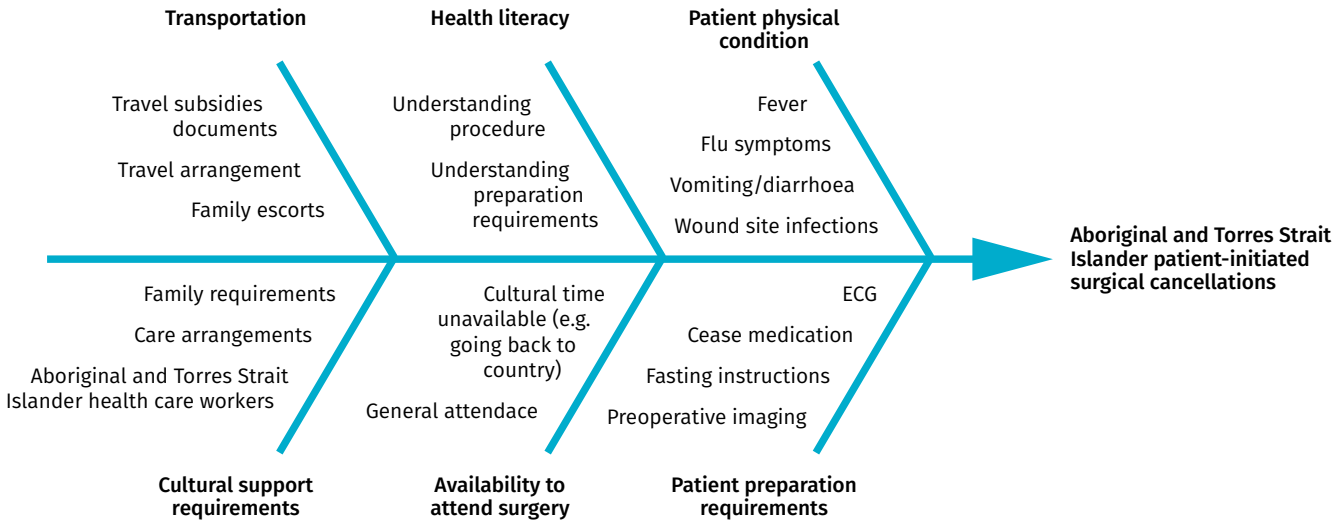

Figure 1: Factors contributing to Aboriginal and Torres Strait Islander patient-initiated surgical cancellations

This software scripting was used to automate the data collection, analysis and display steps, allowing automatic extraction of relevant information (pre-set conditions) from reports to generate individualised, prefilled screening tool templates and email the templates to the staff member conducting the screening.

During the development of the screening tool and the clinical pathway, PDSA cycles were used regularly to review progress; this led to the addition of appropriate staff members and changes to the process for conducting the screening. After the first tool was designed by the project team and implemented in practice, PDSA cycles were again used to adjust the content and phrasing of the tool, based on the feedback from patients and clinicians involved in the process (Figure 2).

When reviewing the patient surgical journey and the organisational layout, the team documented a clinical pathway for undertaking the pre-surgery screening. It was decided that the screening by phone would be conducted by an Aboriginal and Torres Strait Islander services clinical team member (Nurse Navigator) at seven days and again at three days prior to an Aboriginal and Torres Strait Islander patient's elective surgery. The issues identified from the screening were then communicated to appropriate staff (e.g. surgical case managers and community services) and mitigated prior to surgery.

Data collection and analysis

To ensure data quality and consistency, the baseline and intervention-related data was collected by the service line data manager, with intervention-related data collected monthly over the six-month implementation period. The development phase of the screening tool resulted in a template consisting of 18 dichotomous questions focusing on clinical elements of preparation and seven open-ended questions focusing on cultural elements that may impact preparation or ability to attend surgery.

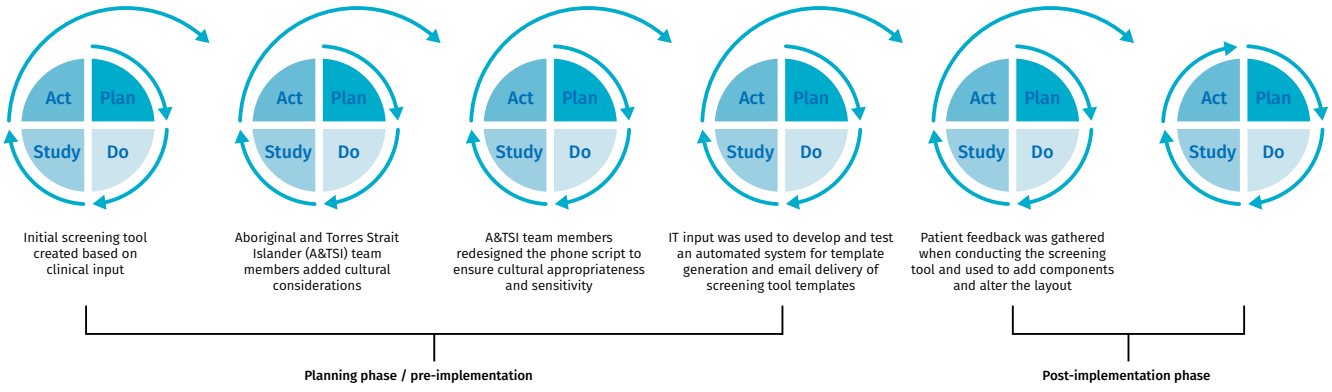

Figure 2: PDSA (Plan, Do, Study, Act) cycles used to refine the pre-surgery screening tool template content and processes

Table 1: Rates of patient-initiated cancellation during the project implementation phase and the same period in the previous year

Patient-initiated cancellations		Jun–Nov 2019	Jun–Nov 2020	% change
Total cancellations		55	30	-45.5
Cancellation subsets	unfit for surgery (condition)	14	13	-7.1
	patient cancelled booking	17	3	-82.4
	failed to attend (day of surgery)	12	8	-33.3
	no longer requires treatment	4	1	-75.0

Quantitative measures

The rate of surgical cancellations that were initiated by Aboriginal and Torres Strait Islander patients on the day of surgery and within twenty-four hours were measured. Of these patient-initiated cancellations, subsets of 'unfit for surgery – condition', 'patient cancelled booking', 'failing to attend – day of surgery' and 'no longer requires treatment' were investigated. The project aimed to reduce the rate of patient-initiated surgical cancellations, of Aboriginal and Torres Strait Islander patients, within six months of introducing the pre-surgery screening. The rate of patient-initiated cancellation was assessed in two ways: results from the six-month implementation phase were compared to the same timeframe in the previous year and changes to the mean rate of cancellations before and after implementation of the screening tool were measured using a control chart with split control limits.

Qualitative measures

The responses to the screening tool questions were collected and thematically analysed to identify the common elements contributing to patient-initiated surgical cancellations of Aboriginal and Torres Strait Islander patients.

Results

To assess the impact of the pre-surgery screening tool, the rate of Aboriginal and Torres Strait Islander patient-initiated surgical cancellations, defined as cancellations on the day of surgery and within twenty-four hours, was measured. During the project timeframe (June to November 2020), 505 pre-surgery screening tool templates were generated and 341 contact attempts were made with 196 pre-surgery screenings successfully completed.

Quantitative results

Results from June to November 2020 (the six-month implementation phase) were compared to cancellation rates from June to November 2019 (Table 1). The results demonstrated a 45.5 per cent decrease in patient-initiated cancellations by Aboriginal and Torres Strait Islander patients. When deconstructing the patient-initiated cancellations it was identified that there was a 33.3 per cent decrease in failing to attend and an 82.4 per cent decrease in patients calling to cancel surgery within 24 hours of surgery.

The mean rate of cancellations before and after implementation of the pre-surgery screening tool were compared. Figure 3 (control chart) shows an improvement to the mean rate of Aboriginal and Torres Strait Islander patient-initiated surgical cancellations during the six months after the screening tool was implemented compared to the period before the screening tool was implemented (decrease in mean rate from 0.078 to 0.060).

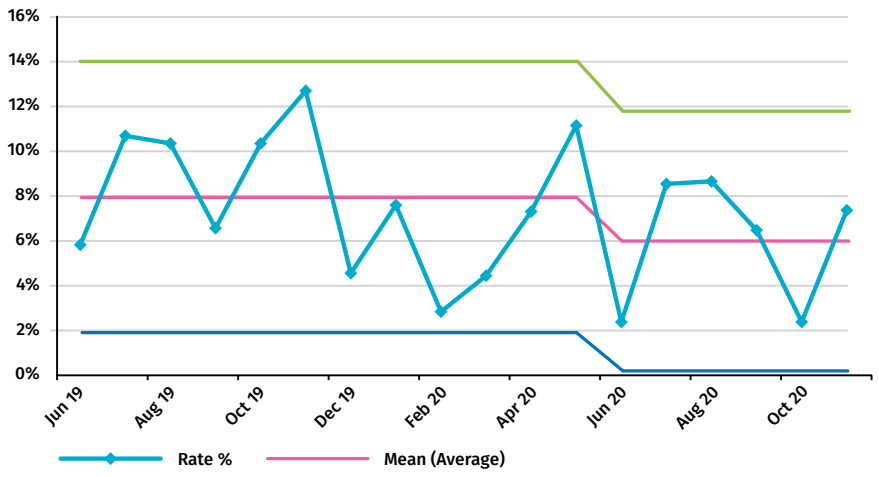

Figure 3: Control chart (split) showing rates of patient-initiated cancellation before and after screening tool implementation

Qualitative results

The responses to the screening tool questions were collected and thematically analysed to gain an understanding of common issues faced by Aboriginal and Torres Strait Islander surgical patients and areas for future focus of care (Table 2). Of the 196 pre-surgery screenings completed, 52 per cent identified patient confusion regarding preparation requirements (ceasing medications, fasting instructions and sourcing help with funding subsidies, accommodation and travel), 21 per cent identified a lack of understanding of information provided regarding the scheduled procedure, 14 per cent identified issues with the patient's medical condition that could lead to cancellation, and 5 per cent identified patients that were not willing to attend their surgery.

Table 2: Themes identified through screening

Theme	n	% (N=196)
Patient confusion regarding preparation requirements	102	52
Lack of understanding of information provided regarding the scheduled procedure	41	21
Issues with the patient's medical condition that could lead to cancellation	27	14
Patient not willing to attend their surgery	10	5

n = number of screenings in which theme was identified

Limitations

The project team identified three limitations that have potentially affected the ability to achieve higher-level results. Of the 505 pre-surgery screening templates generated, 164 were not initiated due to a lack of staffing resources in the form of backfill for leave of the Nurse Navigator conducting the screening. Of the 341 contact attempts, 145 patients were unable to be contacted after multiple attempts. As a result of the COVID-19 pandemic, policies regarding the eligibility for and frequency of elective surgery changed frequently in the early months of 2020. As a result, significantly fewer elective surgeries were booked during this time and, due to day-to-day changes in operating policy, rural and remote patients were less likely to be scheduled and the majority of the Aboriginal and Torres Strait Islander patients live in rural or remote areas. This may account for uncharacteristically low rates of Aboriginal and Torres Strait Islander patient-initiated cancellations for this hospital in the months prior to screening implementation (January to April 2020).

Discussion

The 45 percent decrease in patient-initiated surgical cancellations demonstrated that culturally appropriate pre-surgical screening that checks health, wellness and social wellbeing can positively address preoperative preparation issues encountered by Aboriginal and Torres Strait Islander patients. The early identification of issues gives clinicians time to mitigate the flow-on effect, that leads to surgical cancellations, by connecting patients to appropriate support services. This early mitigation is heavily evident through the large reduction in the reported cancellation types of 'failed to attend surgery' (33.3%) and 'patient cancelled booking' (82.4%), which both only occur on the day of surgery.

The use of software scripting, that enabled automated data collection, data analysis and data display, produced many benefits including eliminating the need for a clinician to spend large amounts of time searching through hundreds of rows of raw data and avoiding human error in searching, as well as providing cost-free design and an adaptable system that could be easily changed in response to feedback.

The clinical pathway allowed Aboriginal and Torres Strait Islander health services staff to mitigate potential surgical cancellations ahead of time by engaging the culturally safe support of community services and escalating identified issues to surgical case managers who were responsible for coordinating the surgical journey.

Barriers between government services have led to the development of silos within services that are often working in the same patient process; this frequently means those writing process policy are not overly involved in the process itself[3]. An effective pre-surgery screening tool must embed culture into the provision of care, due to the great importance Aboriginal and Torres Strait Islander people place on their connection to their country and culture. This is rarely considered in policy or service development[3]. A strength of this project was the focus placed on developing a project team consisting of those most appropriate and regularly involved in the work area. Having Aboriginal and Torres Strait Islander staff conduct the screening

optimised patient engagement by allowing for enhanced patient trust, cultural identity and sense of control. The format of conducting the screening by phone overcame the common issues encountered with self-reporting instruments and allowed for culturally appropriate intervention regarding identification, and treatment of language comprehension and health literacy differences[6]. It remains imperative that a 'yarning' approach or a traditional story-telling approach, highlighting family and social components, is incorporated because these cultural conversational methods build rapport and facilitate meaningful disclosure of personal issues while maintaining cultural integrity and identity[6]. The importance of this meaningful disclosure is evident in the thematic analysis of the responses from patients. The analysis identified significant risk areas that lead to surgical cancellations in Aboriginal and Torres Strait Islander patients preparing for surgery. These risks largely involved untreated health literacy differences that result in confusion about clinical preparation aspects, e.g. medication plan, (52%) and understanding the scheduled operation (21%). This study demonstrates that without the intervention from Aboriginal and Torres Strait Islander staff these issues are unlikely to be identified until the day of surgery.

When considering health, the perspective of Aboriginal and Torres Strait Islander people is more than an individual's physiological wellbeing; rather, health is considered a holistic concept comprising the emotional, social and cultural wellbeing of the all-inclusive community[9]. As Aboriginal and Torres Strait Islander adults are prone to experience high levels of psychological distress when engaging with the health care system, culturally appropriate social and emotional wellbeing screening is imperative[6]. A cross-sectional study examining social and wellbeing screening of Aboriginal and Torres Strait Islander patients, based on medical records from 100 Australian primary health networks, demonstrated that 73.4 per cent of records were not screened. Of those with identified concerns, 25.4 per cent had no further action taken[4]. These outcomes suggest that lack of clear models or guidelines for culturally appropriate and validated assessment of social wellbeing and determinants of health can contribute to poor provision of health screening and poor outcomes for Aboriginal and Torres Strait Islander patients[4]. As this project placed emphasis on including social and wellbeing components in the pre-surgery screening tool – in particular, family and community support, transportation requirements, financial elements and health literacy – risks to surgical attendance could be identified early and action taken to mitigate them.

Conclusions

By developing and implementing a specialised, culturally appropriate pre-surgery screening tool to check the health, wellness and social wellbeing of Aboriginal and Torres Strait Islander patients and using key staff to support the development of trusting relationships, this project was able to advocate for the health and wellbeing of Aboriginal and Torres Strait Islander patients by increasing preoperative communication, reducing patient-initiated surgical cancellations and providing the foundation for future care.

After reviewing the clinical pathway developed, the themed data collected from patients' responses to the pre-surgery screening and the limitations encountered, this paper has three recommendations to make:

1. It is imperative that strong networks are built with community support services to develop methods of contacting patients that are uncontactable via phone calls.
2. Robust governance is required to ensure arrangements are in place to cover leave for the staff member conducting the screening in order to avoid missed opportunities for patient contact.
3. Basic level IT programming should be used to automate data searching and display in order to eliminate non-clinical tasks for clinicians and allow clinicians to spend their time caring for patients.

Implications

As the public hospital where this project was conducted has common industry key performance indicators and similar operational governance to many other hospitals throughout Australia where urban and rural Aboriginal and Torres Strait Islander patients are treated, this quality improvement initiative is highly generalisable.

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Post-operative use of HME filter-protected open tracheostomy circuit during the COVID-19 pandemic

Abstract

Introduction

In the era of the COVID-19 pandemic, the avoidance of aerosol generating procedures (AGPs) is paramount to reduce the risk of viral transmission to staff and other patients. Perioperative management of a new tracheostomy is challenging as routine care, such as suctioning, frequently involves AGPs.

Method

We developed and implemented an apparatus called the heat and moisture exchanger (HME) filter-protected open circuit. This enabled closed suctioning to be performed and allowed spontaneously breathing patients to be managed with an open circuit in a shared environment while reducing the risk of viral aerosolisation. We performed a prospective observational study of 20 cases, recording the incidence of desaturation (<90%), apparatus disconnection, apparatus dislodgement and apparatus replacement. The ease of use of the apparatus for recovery nursing staff and patient comfort were measured on a Likert scale.

Results

There were no incidents of desaturation. There were two circuit disconnections. Apparatus replacement with an alternate circuit was not required for any patient. Most recovery nursing staff agreed or strongly agreed that the apparatus was easy to use and that the apparatus bulk or weight did not interfere with patient care activities. Ninety-five per cent of patients reported that their breathing was comfortable prior to discharge from the Post Anaesthesia Care Unit.

Conclusion

In conclusion, the HME filter-protected open circuit is a relatively safe, acceptable and practical device to use for spontaneously breathing patients with newly created tracheostomies in the perioperative environment.

Keywords: tracheostomy, post-operative, recovery, theatre, COVID-19, aerosolisation, HME filter

Identified problem

In periods of high community transmission during the COVID-19 pandemic, changes to nursing practices in the Post Anaesthesia Care Unit (PACU) have been required to reduce the risks of viral infection for both staff and other patients in the immediate environment[1]. Tracheostomy formations are required for various indications,

including neck dissection surgery for cancers of the upper airway. The routine management of newly created tracheostomies in an awake, spontaneously breathing patient in the PACU involves oxygenation via a tracheostomy aerosol therapy mask or a high flow humidification device. Their post-operative care is challenging as most interventions required to manage them, such as suctioning, are aerosol generating procedures (AGPs)[2,3]. These patients are also more likely to cough post-operatively, leading to droplet and aerosol spread. During the period of increased community transmission of the coronavirus, it was necessary to reduce the performance of AGPs for all patients, including patients who were tested negative for COVID-19, to reduce the risk of viral transmission to staff and other patients. As a result, it was necessary to recover these patients in a negative pressure and isolated environment with airborne precautions[4,5]. This necessitated recovery in the operating theatre, increasing demand on staff and resources and delaying theatre turnover.

Proposed solution

There was limited literature on the ideal system to manage spontaneously breathing patients with a newly formed tracheostomy in the immediate post-operative period[2,3,6–8]. Based on guidance from available literature, we assembled an apparatus to enable the care of these patients in the PACU environment without the risks associated with AGPs.

The components of our apparatus included an in-line suction device connected to a heat and moisture exchanger (HME) filter followed by a 'T-Bag' oxygen enhancement device (T-bag) before connecting to an oxygen source at 6L/min (Figure 1). This circuit design

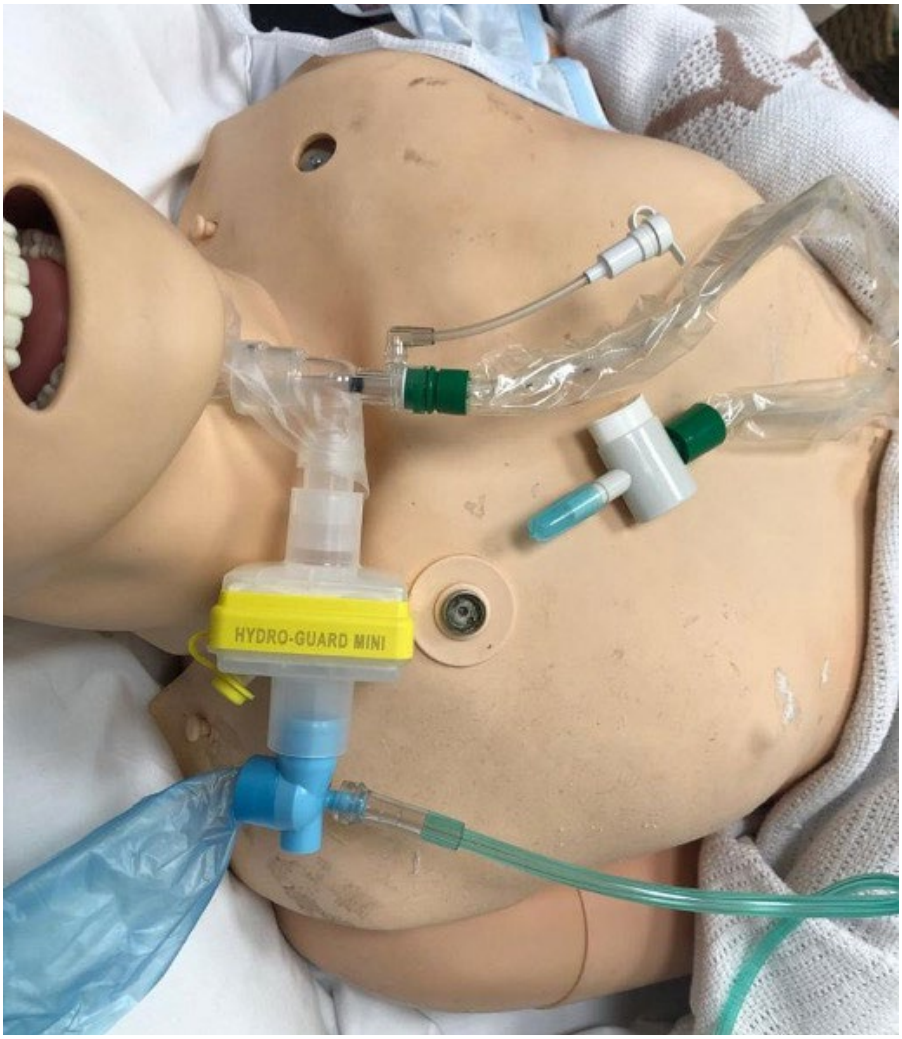

Figure 1: HME filter-protected open circuit

enabled the provision of warm, humidified supplemental oxygen and performance of suctioning without droplet and aerosol generation[3,9–11]. The T-bag was a lightweight, injection-moulded, polyethylene T-piece and shaped reservoir bag of 300 ml volume which allowed the provision of oxygen supplementation with a fraction of inspired oxygen (FiO_2) up to 60 per cent, increasing the margin of safety if ventilation is compromised and to compensate for decreased respiratory drive in the immediate post-operative period.

Project plan

We performed a prospective observational study examining the safety, practicality and patient comfort of using this apparatus. After receiving approval from Melbourne Health Human Research Ethics Committee (QA2020071), we recruited the first 20 consecutive spontaneously breathing adult patients with a newly formed tracheostomy in PACU. We excluded patients who were to be discharged directly from the operating theatre to the intensive care unit with a closed ventilatory system and non–English speaking patients.

The apparatus was attached to the patient immediately after the tracheostomy was formed or at the end of surgery in the negative pressure operating theatre prior to

transfer to recovery. When the patient was deemed ready for discharge to the ward, the PACU nurse would complete the provided questionnaire (supplemental material), recording adverse events including oxygen desaturation of less than 90 per cent, tracheostomy dislodgement and accidental circuit disconnection. Replacement of airway apparatus for any reason was documented. The practicality and ease of use of the apparatus and whether its bulk or weight interfered with patient care activities were assessed using a Likert scale. Prior to their discharge, patients were asked if their breathing was comfortable. Additionally, free-text comments were also collected from PACU nursing staff.

Project successes

The study was conducted between 27 May 2020 and 20 October 2020, which coincided with the second wave of the COVID-19 pandemic in Victoria, Australia. Twenty cases were included in the study and survey data was completed for all cases. There were no patients that were tested positive for COVID-19. Reassuringly, there were no instances of oxygen desaturation of less than 90 per cent for any patient and no tracheostomy dislodgements occurred. There were two cases of accidental circuit disconnection from the tracheostomy tube. Apparatus replacement with an alternative circuit was not required for any patient. Most respondents agreed or strongly agreed that the HME filter-protected open tracheostomy circuit was easy to use (Figure 2). More than half of the respondents agreed or strongly agreed that the apparatus bulk or weight did not interfere with patient care activities (Figure 2). Almost all patients found their breathing to be comfortable at the end of their stay in the PACU.

The implementation of the HME filter-protected open circuit was straightforward, requiring only simple education of anaesthesia and recovery staff and placement of a graphic illustration in theatres. As all the required equipment was readily available, the sourcing of apparatus components was easy. The apparatus was also immediately compatible with a manual bag valve respirator or mechanical ventilator circuit, should the need for assisted or mechanical ventilation arise.

The apparatus was well received by staff at our institution during the COVID-19 pandemic and saw continued use beyond the study period. Since the implementation of this apparatus, we were able to nurse unsuspected COVID-19 patients in the shared PACU environment, including performing suction without the consequence of aerosol generation. As a result, we were able to directly improve theatre utilisation and facilitate turnover of cases. Additionally, resources were saved by virtue of reduced need to use personal protective equipment (PPE), as these patients were able to be nursed under droplet rather than aerosol precautions.

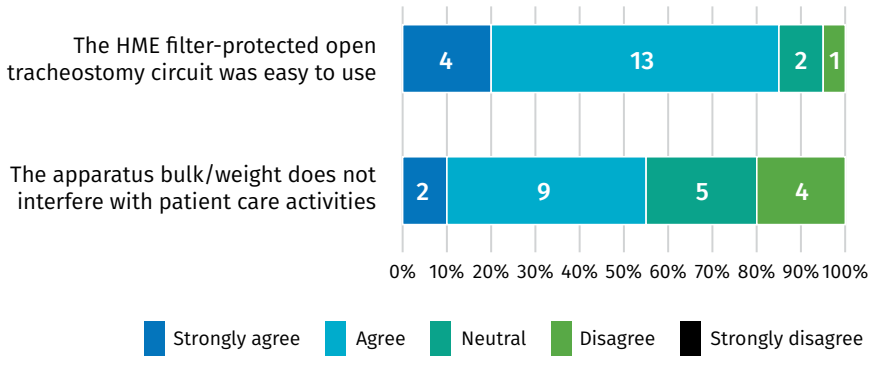

Figure 2: PACU nurse Likert scale responses about ease of use and effect on patient care activities of the apparatus

Opportunities for improvement

As the apparatus was a new implementation, graphic illustrations were helpful to have in the operating theatres for reference during tracheostomy insertion. Furthermore, a discussion at the beginning of the case during surgical time-out was important to ensure that necessary equipment was available.

Recommendations

The HME filter-protected open circuit with closed in-line suctioning was found to be a safe, acceptable and practical device to use for spontaneously breathing patients with newly created tracheostomies in the perioperative environment and could be used during periods of increased risk of viral transmission.

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Post-operative use of HME filter-protected open tracheostomy circuit during the COVID-19 pandemic

Supplemental material: Questionnaire

HME filter-protected open tracheostomy circuit

Case report form number: _____ Date: _____

1 **Questions for PACU staff regarding safety:**

Incidence of desaturation SpO2 <90%: ☐ Yes ☐ No

Incidence of tracheostomy dislodgement: ☐ Yes ☐ No

Incidence of accidental circuit disconnection: ☐ Yes ☐ No

Apparatus replaced with alternative circuit for any reason: ☐ Yes ☐ No

Comments:

2 **Questions for PACU staff regarding satisfaction:**

The HME filter-protected open tracheostomy circuit was easy to use:

☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree

The apparatus bulk/weight does not interfere with patient care activities:

☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree

3 **Patient comfort bedside assessment:**

When the patient is ready for ward discharge, please ask:

'Is your breathing comfortable?' ☐ Yes ☐ No

4 **General comments from PACU staff or patient:**

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Prevention is better than cure: Understanding metabolic syndrome (MetS) and the occupational risks for perioperative nurses

Abstract

Metabolic syndrome (MetS) is a condition with interconnected abnormalities of the metabolic system that has been labelled by the World Health Organization as a main cause of death worldwide. Risk factors for MetS include occupational stress, disturbances to circadian rhythms, sleep disorders and changed eating habits, which are all associated with shift work. As shift work and occupational stress are common in perioperative nursing, the risk of developing MetS is increased for perioperative nurses. This discussion paper aims to bring an awareness and understanding of MetS to perioperative nurses and identifies the occupational risks in the perioperative environment that may lead to its development. It also presents some possible strategies to mitigate the risk factors or prevent this condition for perioperative nurses in the future.

Keywords: metabolic syndrome, circadian misalignment, shift work, occupational stress

Introduction

Metabolic syndrome (MetS) was previously known as 'syndrome x' and was first recognised by Gerald M Raevan in the 1980's[1]. The pathophysiology of MetS is complex and comprises interconnected abnormalities of the metabolic system including lipid and glucose metabolism[1]. MetS is diagnosed by the simultaneous presence of three or more of the following factors: hypertension, dyslipidaemia, central obesity and hypertriglyceridemia[1–4]. The syndrome has been linked to co-morbidities of the liver and reproductive system, thrombotic states and inflammatory diseases. It has been identified as having an increased risk of mortality, with the World Health Organization labelling it as a main cause of death worldwide alongside cardiovascular disease, type 2 diabetes mellitus and breast cancer[1,5,6,7]. Research has also theorised that MetS affects approximately 30 per cent of the adult population world-wide[8].

A systematic review of literature by Ranasinghe et al. in 2017 provided an alternative estimate of the prevalence of MetS, estimating that 20 to 25 per cent of the adult population may be suffering from the disorder[1]. This review was the first to complete a comprehensive systematic evaluation of literature regarding prevalence of MetS in the Asia–Pacific region; however, from a possible 51 countries, only 15 studies were found revealing the importance of further data collection[1]. In Ranasinghe's study several variables were considered, including age, occupation and gender[1]. Females generally had a higher prevalence of MetS except in some specific areas, one of which was rural Australia[1].

More recent studies found similar findings where MetS had an increased prevalence in women; however, data around prevalence in shift workers varied from nine per cent to 30 per cent, with some studies suggesting a two per cent prevalence in nurses specifically[3,6,8,9]. While most studies found age to be a factor in prevalence – the under 40 age group were at high risk – other studies acknowledged the presence of MetS in all age groups[3,4,6,9]. Despite the variation in data and research on the prevalence of MetS, which may be due to different study designs, it is important for the health of all nurses to investigate the occupational risks of shift work and the potential to develop MetS with its associated risk of mortality[10,11].

MetS and periperative nursing

Perioperative nursing often involves shift work, being on-call and changing rosters. Meal breaks can be short, requiring nurses to alter their dietary habits and eat quickly while at work. Perioperative nurses may experience occupational stress with long work hours and physically demanding tasks such as lifting heavy instrument trays, moving and positioning patients and wearing lead aprons. Thus there are a number of occupational risks for MetS associated with working in the operating room.

Shift work

Shift work has been identified as increasing the risk of developing MetS[3,4,6,10,12,13]. A systematic review and meta-analysis by Wang et al. looked at the risk of MetS associated with shift work. The review of 36 studies, with a combined total of 216 527 participants, revealed that shift workers had an increased risk of developing MetS compared to regular day workers (OR = 1.35, 95%CI: 1.24–1.48; I2 = 74.6%)[12]. Wang et al. also identified a further increase of risk in rotating shift workers[12], and this was also highlighted by Khosravipour et al. in their similar systematic review of 38 observational studies[10]. The increased risk of developing MetS in shift workers has been attributed to the desynchronisation, or misalignment, of the circadian rhythm and workers' disrupted sleep–wake cycles[5,6,7,12].

Circadian misalignment

Circadian rhythm influences temperature and the sleep–wake cycle and is synchronised by the retina's exposure to light which stimulates photosensitive cells connected to the suprachiasmatic nucleus in the hypothalamus gland in the brain[14,15]. The suprachiasmatic nucleus then innervates the sympathetic nervous system which regulates humoral, neural and endocrine signals that lead to predictable behaviours of metabolism and physical cellular performance[14,15]. Extended exposure to light disrupts this circadian rhythm, especially in night shift workers, and may result in insulin resistance and glucose intolerance from altered hormonal secretions, potentially leading to the development of MetS[3,14]. A systematic review of metabolic and cardiovascular consequences of shift work by Kervezee et al. identified evidence that disruption to circadian rhythms, or circadian misalignment, is linked to elevated glucose levels and insulin resistance in varying degrees, particularly in the majority of night shift workers[14]. The review also found that shift workers were at a greater risk of developing metabolic disorders from short-term circadian rhythm misalignment[14]. The risk of developing MetS from circadian misalignment is compounded by disrupted sleep and altered eating regimes[7] both of which are common with shift work.

Sleep deprivation and sleep disorders

Sleep deprivation has been theorised to affect the endoplasmic reticulum within cellular structures. These organelles are responsible for processing secretory and membrane proteins which have a link to insulin functionality, lipidystrophy, obesity and type 2 diabetes[7]. Shift work, quick turn-around times between shifts, duration of shifts and night shift may all contribute to the development of sleep disorders, which are known risk factors for MetS[6,7,15]. A small cross-sectional study on MetS in night shift workers (n=60), revealed that insomnia symptoms were found in 40 per cent of the participants[9]. Rosa et al. also identified in their systematic review of randomised control trials and observation studies (n=24) of shift work and nurses' health, that sleep disorders were more prevalent for staff rotating onto morning shift from night shifts when following a 3 x 8-hour rotation schedule[6]. Other studies have suggested night shift workers sleep less than day workers, and some studies show workers on a rapidly changing shift rotation sleep fewer hours than workers permanently on night shift[6,14]. Rosa et al. also noted that all shift-work hours interfere with at least one main meal and that appetite levels are affected by short sleep cycles[6].

Changes in eating regime and appetite

Increased risk of MetS may come from appetite changes in shift workers due to unregulated meal times, sleep disturbances, changes in lifestyle and demands of shift work[6]. Changes to eating regimes can lead to altered insulin responses, and disrupted secretion of appetite hormones may lead to higher caloric consumption[6,14]. A small study by Molzof et al. comparing female

day- and night-shift workers (n=17) and the impact of meal timing on cardiometabolic syndrome indicators, revealed that irregular eating patterns were observed more in shift workers, and that night shift workers' food intake was associated with multiple risk factors specific for MetS[5]. This study also found that increased lipid levels and weight gain was associated with increased food consumption in the evening[5]. While the research by Molzof et al. had a small sample size and was restricted to female shift workers, other studies have also shown that high calorie consumption by shift workers and calorie consumption in the evening increases the risk of developing MetS[2,7]. Another interesting finding, from a cross-sectional data analysis of nurses (n=1638) by Jung et al., is that faster eating speeds have been associated with weight gain and MetS[2]. Jung et al. also found that nurses have meal breaks, on average, between six and 28 minutes long[2]. Higher caloric consumption by nurses during these meal breaks could also be attributed to occupational stressors[16].

Occupational stress

Research has shown that occupational stress may increase the risk of MetS[8]. Increased stress has been associated with shift work, specifically rotating shift work, with research theorising that one in every four nurses are being affected[6]. In addition, the perioperative environment can be a stressful environment. Excess stress during work can increase the production of cortisol which could potentially lead to insulin resistance and development of MetS[17,18]. Cortisol production by the adrenal gland is stimulated by adrenocorticotropic hormone from the hypothalamic–pituitary–adrenal axis in times of stress, leading to increased energy from gluconeogenesis and lipid mobilisation in adipose tissue[7,17]. A cross-sectional analysis of a multicentre cohort of civil servants (n=15 105) by Santos et al. observed that higher levels of cortisol were noted in irregular shift workers on their rostered days off, thereby resulting in prolonged stress responses[13]. Although this analysis did not focus on the nursing profession, the analysis revealed that shift work contributed independently to the risk of developing MetS[13]. Chronic stress can also cause burnout with some studies suggesting a link between burnout and MetS[17]. Others studies suggest there has been no definite association between MetS and burnout, although association with components of MetS were found[18]. Due to the inconsistency of evidence from multiple studies, more research is required on stress-related burnout and MetS[18].

Recommendations

Managers need to have an awareness of the risk factors for MetS and put strategies in place to mitigate the occupational risks that could result in nurses developing MetS[3,6,13]. Strategies include raising awareness of MetS, education about diet and the importance of physical exercise in avoiding metabolic disorders, and promotion of healthy behaviours[2,3,6]. Benefit could be gained by introducing a health care program for staff with increased risk of developing MetS and implementing a food diary to help control calorie consumption[2,16]. It is known that perioperative nurses suffer fatigue due to emotionally and physically demanding work and staffing practices[19]. Thus, managers also need to critically think about shift scheduling and rotations, and frequency and length of shifts, as well as ensuring adequate rest periods to reduce detrimental effects on staff and increase wellbeing[6,15].

As the risk of developing MetS is ever present in the perioperative environment, it is important for organisations to screen workers who are exposed to shift work, identify those at high risk of developing this dangerous disorder and provide education and resources to reduce the risk.

Finally, as research into MetS in the perioperative domain is limited, it is recommended that organisations facilitate research in operating suites across Australia to explore the prevalence of and prevention strategies for this potentially dangerous disorder to improve the health of nurses[6].

Conclusion

MetS is a complex and potentially fatal condition believed to affect nearly a third of the world's population. Shift work and the associated disturbances to circadian rhythms, sleep and eating habits, as well as occupational stress, are recognised as risk factors for developing MetS and are occupational risks for perioperative nurses. Further research into and reporting about MetS will improve the understanding of the physiological mechanisms underlying MetS and the risk factors that contribute to its development. Increasing awareness among the perioperative nursing profession will enable the development and implementation of strategies that may mitigate the risks factors of MetS and reduce its prevalence thus improving the overall health of the perioperative nursing workforce.

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