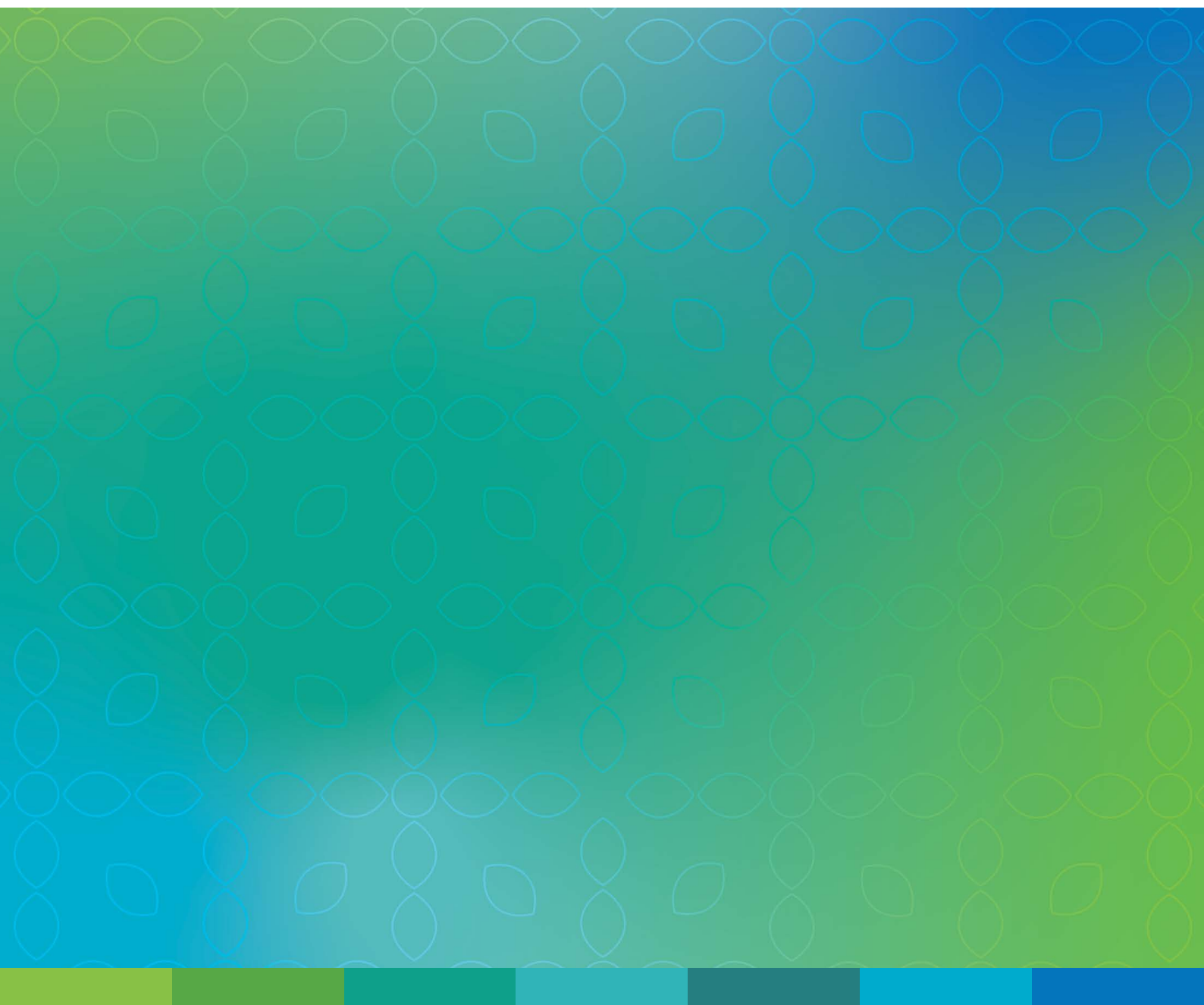




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JOURNAL OF PERIOPERATIVE NURSING



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The new era of aspiration risk: The dilemma of GLP-1 receptor agonists

There is a new wave of aspiration risk heading towards our operating theatres in the coming years. The popular weight loss drugs, glucagon-like peptide (GLP-1) receptor agonists, are providing us with new dilemmas in fasting guidelines and airway management. What does the anaesthetic team need to know?

What are GLP-1 receptor agonists?

The GLP-1 receptor is expressed in the brain, pancreas, heart, liver and gastrointestinal tract. Stimulation of this receptor results in improved glycaemic control, improved cardiovascular risk and weight loss¹. One component of this mechanism of action is delayed gastric emptying, reduced hunger and, therefore, reduced food intake. As of November 2023, Ozempic (semaglutide) is only approved in Australia for glycaemic control in adults with type 2 diabetes mellitus. The Therapeutic Goods Administration (TGA) understands that it is widely prescribed off-label for weight loss².

The newer, oral semaglutide formulation, Wegovy, is not yet available in Australia². The drug has been flagged as a 'breakthrough' in obesity management³, and the semaglutide era is only just beginning. In the next five years, as the Ozempic shortage resolves and newer agents gain approval, we are looking at an increased proportion of our patients arriving on the day of surgery at high risk of aspiration.

How does this affect the anaesthetic team?

Of the airway-related deaths reported in Fourth National Audit Project⁴, 50 per cent were a result

of aspiration – more deaths than were caused by 'can't intubate, can't oxygenate' scenarios⁵. Intra-operative aspiration remains an exceptionally dangerous but well-managed risk in modern anaesthesia⁶. That said, we cannot take this excellent track record for granted.

The current fasting guidelines for adults from the Australian and New Zealand College of Anaesthetists (ANZCA)⁷ recommend that 'limited solid food may be taken up to six hours prior to anaesthesia and clear fluids may be taken up to two hours prior'. Numerous case reports are revealing that patients taking GLP-1 receptor agonists are arriving for elective surgery with a full stomach, sometimes after fasting as long as 18 hours^{1,8}. In elective cases where a laryngeal mask or unprotected airway (such as colonoscopy) would normally be selected, a hidden risk with a potentially fatal outcome exists.

What do the guidelines say?

The 2022 Perioperative Diabetes and Hyperglycaemia Guidelines (Adults), jointly produced by the Australian Diabetes Society (ADS) and ANZCA, suggest withholding GLP-1 receptor agonists on the day of surgery⁹. These guidelines are primarily focused on glycaemic control, and do not make a distinction between

daily and weekly dosed regimens. It remains a low-evidence zone with a wide range of opinions.

The American Society of Anaesthesiologists (ASA) released a consensus-based guideline¹⁰ in June 2023, which states the following for elective surgery.

- For patients on weekly dosing, withhold drug for one week prior to surgery.
- For patients on daily dosing, withhold drug for one day prior to surgery.
- This guidance is regardless of the indication for GLP-1 receptor agonists.
- If patients have not withheld, consider delaying treatment, treating as “full stomach” or performing gastric ultrasound.
- If patient presents with nausea, bloating or vomiting, consider delaying surgery and discuss the risk of aspiration with the patient and surgeon.

The guidelines acknowledge that there is limited evidence for gastric ultrasound, and there is insufficient evidence to depart from the current ASA fasting guidelines¹⁰. There is some evidence demonstrating that the highest risk period for delayed gastric emptying is during the first four weeks of treatment or in patients using the drug intermittently¹¹.

Where to from here?

Here lies the challenge. It only takes one undetected full stomach to cause a perioperative death, and our tolerance of aspiration risk must remain near-zero. The rapid adoption of GLP-1 receptor agonists is only in its infancy, and the anaesthetic team must remain vigilant. Planning for safe airway management is a team responsibility that includes

pre-operative assessment staff, the surgeon, the anaesthetic nurse, the anaesthetist and the patient.

Until we have clear, evidence-based guidelines, the approach should remain conservative. It is important that we provide education to all perioperative staff about the names and implications of GLP-1 receptor agonists. Ideally, education should start with the patient at the time of prescribing. Where feasible, patients should be screened at least one week prior to surgery to allow sufficient time for cessation. For now, we should have a very low threshold for intubation and rapid sequence induction in patients taking GLP-1 receptor agonists.

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Australian elective surgery patients' pre-operative preparation, health literacy, learning preferences and knowledge resource needs: A cross-sectional survey

Abstract

Aim: To investigate self-reported health literacy levels, learning preferences and knowledge resource needs of Australian elective surgery patients.

Background: Surgery contributes significantly to global health care, but surgical waitlists, cancellations and delay remain major challenges for health care systems. Pre-operative preparation and patient education about the surgical journey are essential to reducing these disruptions. Unfortunately, preparation and education are limited by short timeframes and one-size-fits-all approaches. Limited information exists about Australian surgical patients' health literacy levels, learning preferences and knowledge resource needs.

Design and methods: This cross-sectional waiting room survey investigated patient health literacy, preferred education mode and learning styles among elective surgery patients. Data were collected from patients using existing validated questionnaires and open-text questions. Quantitative data were analysed descriptively, and qualitative data were themed using an iterative open-coding approach. The study is reported using the EQUATOR (Enhancing the QUALity and Transparency Of health Research) guidelines.

Results: The study had 100 participants, 68 living in metropolitan areas, 93 having access to a smartphone and 62 possessing adequate health literacy levels. The top surgical challenge was understanding preparation and recovery instructions. Most participants were visual learners preferring face-to-face, digital formats, booklets or leaflets to receive educational information. Half of the participants sought additional surgical preparation information; of those, 60 per cent used the internet.

Conclusion: This study found that many Australian surgical patients have limited health literacy, prefer visual learning and seek information outside of hospital resources. These findings suggest that clinicians should engage with patients to tailor education, provide different forms of learning materials and explore digital formats for education.

Patient or public contribution: This study was designed using insights from a patient representative during intervention development.

Keywords: surgery, patient education, health literacy, pre-operative, preparation, learning styles, elective

Introduction

Surgery is a vital aspect of health care that contributes to 30 per cent of the overall global burden of disease¹. However, despite the increasing demand for surgery, health care services continue to face challenges when developing systems that effectively manage surgical waitlists, streamline operational activity and minimise patient cancellations and delays. Consequently, patients suffer from poor health outcomes, while the health care system incurs significant financial loss due to poor operational efficiency.

The surgical journey is complex, requiring patients to navigate care through various health care teams and locations. Robust systems are needed to ensure patients are adequately educated regarding their surgical procedure and to understand the intricacies of the stages of the surgical journey, from waiting list to at-home recovery. While a wealth of literature is available that discusses the importance and complexities of patient education, more information is needed to investigate the health literacy levels, learning preferences and knowledge resource needs of Australian surgical patients.

Background

Patient education plays a crucial role in improving the outcomes of surgery for patients. Defined as planned educational methods that aim to empower patients to manage their disease effectively, patient education provides patients with the knowledge, skills and self-awareness needed to engage in self-management, modify their lifestyle behaviours and participate in decision-making²⁻⁴.

The perioperative journey comprises three phases – pre-operative,

intra-operative and post-operative. Education during the pre-operative phase, the time before surgery, offers an opportunity to optimise patients' physical, psychological and social health before surgery, which can lead to better surgical outcomes. This period offers a unique opportunity for prehabilitation, which includes health optimisation interventions aimed at reducing the length of hospital stay, decreasing surgery-related morbidity and expediting the return to normal function^{5,6}.

The significance of pre-operative preparation in reducing surgical delays and cancellations cannot be overemphasised. The consequences of surgical cancellations and delays can be severe, both for patients and hospitals. Patients may suffer physical and mental health consequences, while hospitals may experience financial loss and reduced operating room efficiency⁷. Surgical cancellations are a global problem, with cancellation rates reported as between two and 40 per cent in developed countries, and as high as 73 per cent in low-to-middle income countries⁷. Inadequate pre-operative education and preparation can result in surgery being cancelled or delayed in several ways – patients may not adhere to fasting instructions or may fail to stop anticoagulation medications, patients may also arrive late to surgery or fail to notify the hospital of their inability to attend. According to Dimitriadis, Iyer and Evgeniou⁸, these issues are some of the leading causes of avoidable surgical cancellations and delays.

The effectiveness of pre-operative education can be affected by time restraints and patient factors. The limited time frame for traditional pre-operative patient preparation has been identified as a major obstacle to effective education interventions, as a clinicians'

ability to provide individualised, patient-centred education becomes limited^{8,9}. According to Dimitriadis et al.⁸, poor communication and patients' inability to understand or recall information are factors that contribute to non-compliance with pre-operative instructions. This is consistent with other studies reporting that pre-operative assessment and education occur on or soon before the day of surgery when a patient is apprehensive and incapable of fully comprehending information^{10,11}. To be effective, patient pre-operative education must take into account patients' health literacy levels, learning-style preferences and perioperative knowledge resource needs.

Patient education is not a one-size-fits-all concept and must be developed to meet the individual needs of patients. Educational materials are often provided to patients with the assumption that they have the same level of knowledge and understanding as health care staff, but this is rarely the case¹².

Patient education should take into account patients' level of health literacy. Health literacy is a term referring to the extent that a patient is able to understand and make decisions based on health information¹³. In addition, written educational materials should be written for an appropriate reading level to ensure that patients can comprehend the content¹⁴.

Furthermore, while resource content is important, a patients' learning style must also be taken into consideration, as patients will have an affinity with either a visual, auditory or kinesthetic learning style, or a combination of these styles.

In recent years, computerised forms of patient education have been increasingly recognised for their potential to improve health care

outcomes. In 2016, van der Meij et al.¹⁵ reported that computerised patient education has positive effects on patient physical and psychosocial function, pain and satisfaction with care. Additionally, e-health solutions have been found to be effective in improving patient engagement in self-managed care, as well as enabling care to be tailored to a preferred method, providing timely and validated clinical information and incorporating patient-reported outcomes in clinical practice¹⁶. Furthermore, the benefits of e-health interventions extend beyond patient education, with numerous positive outcomes reported in the areas of medication adherence, diabetes management, smoking cessation and lung function^{17–20}.

There is currently limited published data specifically relating to the needs of Australian patients regarding pre-operative education. This study aims to investigate the self-reported health literacy levels, learning preferences and knowledge resource needs of patients undergoing elective surgery at an Australian metropolitan tertiary hospital. This study intends to identify the deficits and opportunities of the current pre-operative education processes to improve the provision of surgical education and patient health outcomes.

Methods

Design

The study used a descriptive, cross-sectional waiting room survey study design. The study was conducted and is being reported against the EQUATOR (Enhancing the QUALity and Transparency Of health Research) reporting guidelines, 'STROCSS2021: Strengthening the reporting of cohort, cross-sectional and case-control studies in surgery'²¹.

Setting and sample

The study took place in the surgical day care unit (SDCU) department of a large, Australian, tertiary, referral hospital that provides comprehensive elective and emergency surgical services to metropolitan and rural regions state-wide. The hospital performs more than 26 000 operations annually in general surgery and surgical specialities including vascular, orthopaedic, maxillo-facial, ophthalmology, thoracic, urology, burns, plastics and reconstructive, neurosurgery, gynaecology and obstetrics, and ear, nose and throat.

Recruitment and data collection were completed between April 2022 and June 2022. Participants were patients aged 18 years and over, undergoing elective surgery on the same day as their admission and able to complete the survey in English. Patients who were unable to complete the survey in English or did not have any support to assist were excluded from the study. Recruitment was undertaken in SDCU by the research team investigators and SDCU registered nurses that were orientated to the study.

Data collection

Data were collected continuously over a three-month period using convenience sampling, until the desired sample size was captured. A sample of 100 patients was selected, which provides a point precision of ± 10 per cent²². Participants were provided with an electronic device that contained the survey tool or a paper-based version of the survey depending on the participant's preference. Participants were assisted by relatives, SDCU staff or the investigators if required.

Instrument

A survey instrument was designed to investigate self-reported patient health literacy, preferred methods of receiving educational information and an assessment of learning styles. The survey was based on two existing validated questionnaires – the Brief Health Literacy Screening (BHLS) tool^{23,24} and the Learning Channel Preference Checklist (LCPC)^{25,26}.

The BHLS was used to measure health literacy. The BHLS is a validated tool comprising four questions that ask individuals to read and interpret common medical terms and concepts. The tool aims to promptly evaluate an individual's level of health literacy^{23,24}.

An abridged version of the LCPC, a learning style questionnaire, evaluated preferences for education methods^{25–27}. The abridged learning style questionnaire consists of a scoring system in which responses to questions were tallied and categorised by learning style (visual, kinesthetic and auditory). The category with the highest score indicated an informal assessment of the participant's preferred approach to learning and receiving information.

The survey also included questions about participant smartphone use and perspectives on preparation for surgery, and optional open-text sections for participants to provide additional feedback and free-text comments. Open-ended questions were used to investigate preparation for surgery and difficulties encountered in relation to surgery because they allowed participants to document opinion and experiences in their own words, as opposed to selecting responses from a predefined list of options.

Table 1: Participant demographics and clinical characteristics

Variable		Number of participants (N=100)
Gender	female	52 (52%)
	male	44 (44%)
	prefer not to answer	4 (4%)
Age in years (missing = 1)	18–24	14 (14%)
	25–34	11 (11%)
	35–44	16 (16%)
	45–54	18 (18%)
	55–64	24 (24%)
	65 and over	16 (16%)
Ethnicity	Aus/NZ/A&TSI only	79 (79%)
	Aus/NZ/A&TSI plus other	8 (8%)
	other	13 (13%)
Location	metropolitan	68 (68%)
	regional	28 (28%)
	rural/remote	4 (4%)
Language	English only	91 (91%)
	English/bilingual	9 (9%)
Previous surgery	no	41 (41%)
	yes	59 (59%)
Previous surgery at the same hospital	no	21 (21%)
	yes	32 (32%)
	missing / not applicable	47 (47%)
Access to a smartphone	no	7 (7%)
	yes	93 (93%)
Confidence with smartphone apps (n=93)	very unconfident	4 (4%)
	not confident	5 (5%)
	somewhat confident	20 (22%)
	confident	23 (25%)
	very confident	41 (44%)

Aus = Australian, NZ = New Zealander, A&TSI = Aboriginal and Torres Strait Islander

Analysis

Participants' responses were provided using a mostly quantitative multimodal approach. Responses to the health literacy questions were provided using a 5-point Likert-type scale, with the total scores ranging between 4 and 20. Scores were categorised into three health literacy levels – limited (4–12), marginal (13–16) and adequate (17–20). Limited health literacy indicates patients are not able to read most low literacy health materials, need repeated oral instructions and should be provided with material composed of illustrations or video tapes. Marginal health literacy indicates patients may struggle with patient education materials and need assistance. Adequate health literacy indicates patients are able to read and comprehend most patient education materials.

Responses to the learning style questions were categorised by learning style, either visual, auditory or kinesthetic, and a score for each style was tallied. The learning style with the highest score indicated an informal assessment of the participant's preferred approach to learning and receiving information.

Participant access to a smartphone device was evaluated on a 5-point Likert-type scale. Patient's perspective of their surgery preparation and challenges encountered were assessed using a combination of 5-point Likert-type scale, categorical, dichotomous and free text options.

Completed questionnaires were entered into a digital format via Microsoft Excel. Data were analysed using the statistical software RStudio²⁸. Missing data were reported as a percentage of totals. All data were anonymised and treated confidentially.

The free-text responses were collated and grouped thematically using an iterative open-coding approach.

Results

Participants

A total of 100 patients participated in the survey with a mean age of between 45 and 54 years old. Just over half the participants (52%) were female, nearly all participants spoke only English (91%) and had access to a smartphone (93%), and most participants (68%) lived in a metropolitan area. Patient demographics and clinical characteristics are presented in Table 1.

Smartphones

Nearly all participants (93%) indicated they had access to a smart phone. Of these 93 participants, 84 (91%) reported a level of confidence in using applications, with 20 (22%) reporting they were somewhat confident, 23 (25%) reporting they were confident and 41 (44%) reporting they were very confident.

Surgical challenges

The challenges most often reported by participants were understanding surgery preparation instructions (15%, $n = 13$), knowing what to expect when in hospital (14%, $n = 12$) and understanding recovery instructions for when discharged home (13%, $n = 11$).

Health literacy levels

Figure 1 shows the number of participants categorised into the three health literacy levels based on responses to the BHLS questions. More than half the participants (62%) were categorised as having adequate health literacy, 26 participants (26%) were categorised as having marginal health literacy and 12 (12%) were categorised as having limited health literacy.

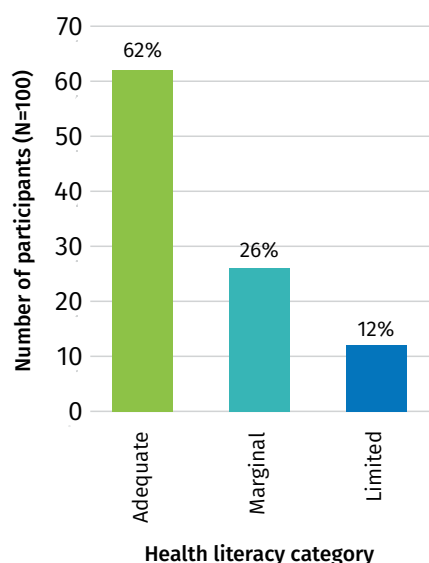


Figure 1: Health literacy level of participants

Learning preferences

Figure 2 shows the number of participants that preferred each of the three learning modalities (visual, auditory or kinaesthetic) as well as the number of participants that preferred a combination of modalities. Responses to the learning style questions indicated that 46 participants (48%) were visual learners, 14 (15%) were kinaesthetic learners and 7 (7%) were auditory learners. Twenty-nine participants (30%) had equal scores for two or more modalities.

Participants also indicated their preferred method/s for receiving educational information. Participants could choose more than one response and 61 participants (61%) indicated that face-to-face delivery was a preferred method, 46 (46%) indicated digital delivery, 44 (44%) indicated booklets and 20 (20%) indicated leaflets.

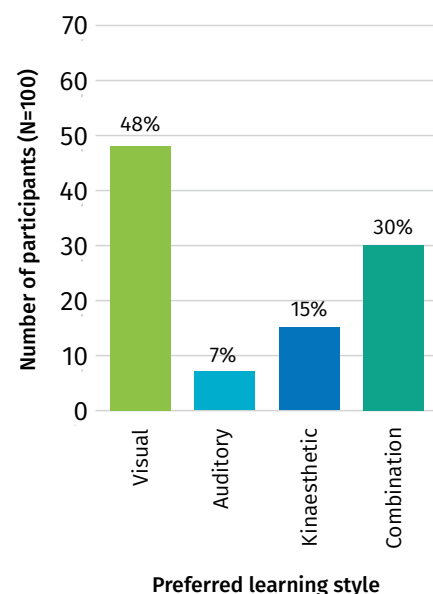


Figure 2: Preferred learning style of participants

Surgical preparation

Table 2 summarises participant perspectives on preparation for surgery. Of the 100 participants in the study, only 37 (37%) reported that they felt very prepared for surgery. Nearly two thirds of participants (63%) reported that they did not feel completely prepared for surgery, and half the participants (50%) indicated that they sought additional information to prepare for their surgery. Of those 50 participants, 30 (60%) stated that they used the internet to source information.

Participants reported a variety of methods by which they received their pre-operative educational information – 47 participants (50%) received a booklet, 24 (26%) received a leaflet, 16 (17%) received digital information and 6 (6%) received verbal information.

Table 2: Participant perspectives on preparation for surgery

		Number of participants (N=100)
Level of preparedness for surgery	Very unprepared	0 (0%)
	Somewhat unprepared	6 (6%)
	Neither prepared nor unprepared	10 (10%)
	Somewhat prepared	47 (47%)
	Very prepared	37 (37%)
Attended preadmission clinic appointment	no	12 (12%)
	yes, in person	60 (60%)
	yes, on the phone	16 (16%)
	yes, via telehealth	12 (12%)
Sought additional information to prepare for surgery	no	50 (50%)
	yes	50 (50%)
Received education booklet, <i>Surgical pathway</i>	no	27 (27%)
	yes	73 (73%)
Would have liked to receive the education booklet (n=27)	no	7 (26%)
	yes	20 (74%)
Method of delivery of the education booklet (n=72*)	in person	65 (90%)
	in the mail	4 (6%)
	QR code	3 (4%)
When the booklet was received (n=71**)	Less than 2 weeks ago	22 (31%)
	2–4 weeks ago	23 (32%)
	1–3 months ago	19 (27%)
	More than 3 months ago	7 (10%)

*73 participants received the booklet, there was 1 missing response about method of delivery.

**73 participants received the booklet, there were 2 missing responses about when it was received.

Discussion

A large proportion of the population surveyed were categorised as having either marginal or limited health literacy. The BHLS tool is a self-reporting tool and therefore may not be an accurate representation of the patient's true health literacy level. However, these health literacy findings are consistent with previously reported global data. A systematic review by Roy et al.¹³ of 51 studies across ten countries found that a third of patients (32%) had limited health literacy. Chang et al.²⁹ also conducted a systematic review of 51 studies assessing health literacy levels, similarly found that a third of patients (34%) reported low health literacy.

It is well known that low health literacy has negative impacts on surgical outcomes and is strongly associated with extended length of stay, complications and reduced adherence to pre-operative instructions¹³. It is suggested that health care teams need an awareness of health literacy to provide patients with beneficial education resources they can understand¹³. An understanding of the surgical patient's health literacy level and availability of a range of educational resources developed to support each level will allow for equity of health outcomes. To ensure effective communication with patients and minimise the risk of miscommunication, experts recommend using universal health literacy precautions, including assuming that all patients and caregivers may have difficulty comprehending health information, and communicating in ways that are easy to understand³⁰.

Although the methods used to assess health literacy are reliable and the hospital context provides a broad patient cohort regarding

geographic location and surgical specialty, it must be noted that health literacy results may vary due to differing cohort characteristics. It is well documented that health literacy levels are impacted by many elements, including a person's age, anxiety level, education level and socioeconomic status^{31–34}. It is therefore recommended that future studies are conducted in an Australian context, focussing specifically on the relationships between these elements and health literacy to gain a greater insight into health literacy levels throughout Australia.

This study found that nearly half of the participants (48%) identified as visual learners. This is similar to the common belief that the general population consists of 65 per cent visual learners, 30 per cent auditory learners and 5 per cent kinaesthetic learners³⁵. There is little information available directly relating to learning styles of surgery patients. Visual learners rely heavily on images and non-verbal cues, such as body language, when trying to understand educational information they receive³⁶.

Although there is an abundance of information available to use when educating patients, the resources provided to patients often remain a reflection of the choices and learning styles of their health care providers³⁷. Based on the findings of the current study that the visual learning style was the most common style, health care providers should consider incorporating more visual aids and non-verbal cues when educating patients about their surgical procedures. It is recommended that health care providers use various forms of visual media, such as diagrams, videos and pictures, to supplement traditional verbal explanations of medical information

to meet the needs of visual learners. It is essential that health care providers, when developing patient education materials, acknowledge patients will have a variety of preferences and learning styles, and education provision requires a multimodal approach.

Half of the participants reported that they searched for additional information regarding their surgical journey, mostly on the internet. This finding is consistent with global data which suggests that 50 to 80 per cent of adults with internet access use it for health care purposes³⁷. The internet can, undoubtedly, support a patient's health journey but only if it is used properly. Easy access to online health information has increased the risk of unreliable information which can lead to negative health outcomes and actions that contradict the advice of health care providers³⁸. According to Arif et al.³⁹, experts suggest health care providers guide patients in selecting high-quality online health information. To mitigate the risks of negative outcomes from patients using unreliable or misleading online health information, health care providers should accept that many patients seek information on the internet and recommend reliable sources of information as well as guiding patients to navigate the internet safely³⁸.

Dimitriadis et al.⁸ attributed patient non-compliance to inadequate pre-operative instructions including poor communication and patient inability to understand or recall information. This is consistent with the current study that found that the challenges most often reported by patients were difficulty understanding their preparation instructions and not knowing what to expect during the surgical journey. These challenges could be exacerbated by patient

information resources that do not take the health literacy or learning styles of the intended recipients into account and resources that contain inadequate information.

In light of these challenges, health care providers and policy makers should prioritise the development of patient education resources that are comprehensive, accessible and tailored to patients' different health literacy levels, learning styles and preferred method/s for receiving educational information. Additionally, future research could investigate the effectiveness of patient education interventions that use multiple modalities, such as multimedia and interactive technologies, to enhance patient understanding and engagement.

More than half the participants in the current study (61%) indicated that their preferred method for receiving educational information was face-to-face. The majority of participants reported receiving pre-operative education as a booklet or leaflet (71%) and only a handful (6%) reported receiving verbal pre-operative education. Seventeen per cent of participants reported receiving educational information in a digital format. Interestingly, 46 per cent of participants indicated they would prefer to receive digital pre-operative education.

According to Waller et al.⁴⁰ eHealth platforms have potential to address information gaps across all surgical journey phases, with interventions targeting each phase to allow for continuity of care, support care delivery models, engage providers and patients, and deliver self-assessment and self-management tools. E-health interventions in the context of surgery have proven beneficial; there is a strong association between pre-operative physical and psychological

preparedness and improved post-operative outcomes⁴¹. Nearly all participants in the current study (92%) had access to a smartphone and many (64%) reported feeling confident in using a smartphone. Given this, it would be appropriate to suggest that digital education provision should be further explored by health care providers.

The strengths of this study include the broad range of data collected due to the survey instrument designed by the research team and the generalisability of data as a result of the setting – a large, Australian, tertiary, referral hospital – that provided access to patients in multiple surgical specialties. A potential limitation of this study is the use of convenience sampling which, due to its non-random nature, may limit the generalisability of the results. An additional limitation of the study relates to data collection occurring prior to undertaking surgery – participants may not have felt comfortable providing responses that they believed could present them in an unfavourable manner.

Conclusion

This study found that more than a third of Australians undergoing elective surgery have marginal or limited health literacy, nearly two thirds are visual learners, half feel they need more information than is provided in hospital education resources, and nearly half would prefer to receive pre-operative education in a digital format. To develop effective surgical education resources for patients, it is recommended that clinicians cater for a low level of health literacy and engage with the end-users of their surgical services to identify the desired content and preferred methods for receiving educational resources. It is also recommended

that educational resources cater for all three learning styles – visual, auditory and kinaesthetic. Further research should focus on the development, provision and evaluation of surgical education materials in a digital format.

Declaration of conflicting interests

The authors have declared no competing interests with respect to the research, authorship and publication of this article.

Funding statement

The first author received financial and academic support for this research through a Queensland University of Technology Postgraduate Research Award Scholarship and from Digital Health CRC Limited.

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'I want to be a member of my heart team': Insights from patients' experiences of minimalist transcatheter aortic valve implantation

Abstract

Background: Internationally, transcatheter aortic valve implantation (TAVI) is the most common approach for treating aortic stenosis. There is growing evidence to support the implementation of a streamlined clinical pathway to optimise outcomes, improve capacity and facilitate safe early discharge home. Best practices that are emerging include adopting a minimalist approach and transition from general anaesthesia to conscious sedation or local anaesthesia only. We aimed to explore what could be learned from patients' experiences of their care in this rapidly evolving context.

Methods: We conducted a qualitative study of patients in the first week after TAVI to explore their perspectives of the procedure and elicit their recommendations. We used interpretive description as the methodological approach to not only inform data collection and analysis but also to generate evidence to inform practice.

Results: We recruited 15 participants, five women and ten men, with a mean age of 83 years (± 5.4) who had transfemoral TAVI with minimal sedation ($n=14$) in a hybrid operating room ($n=6$) or a cardiac catheter laboratory ($n=9$) and were discharged home without complications the day after their procedure. The overarching theme of 'I want to be a member of my heart team during my procedure' emerged, and was illustrated by three themes: 'Who am I to them?' (situating self in relation to the team), 'How can I be a good patient?' (knowing expectations of me) and 'How do I manage this complex wave of emotions?' (interpreting team signals). Participants provided unique recommendations, including patient participation during safety checkpoints, communication protocols, education and raised awareness of patients' needs during minimalist TAVI.

Conclusions: The rapid emergence of minimalist approaches for the treatment of valvular heart disease warrants tailored strategies to integrate patients' needs. Further research is needed to ensure the adoption of patient-centred practices during TAVI.

Keywords: transcatheter aortic valve replacement, peri-procedure nursing, minimalist approach, anaesthesia, patient experience, qualitative

Introduction

Aortic stenosis (AS) is the most common valvular heart disease in older adults. Disease progression is associated with rapid deterioration, poor quality of life, hospital readmission and potential death – if left untreated, mortality rates are as high as 50 per cent two years from symptom onset¹. Timely intervention with either surgical aortic valve replacement (SAVR) or transcatheter aortic valve implantation (TAVI) is associated with excellent outcomes. Following multiple clinical trials comparing both strategies across surgical risk profiles, TAVI has been endorsed by international clinical guidelines in light of clinical outcomes, evidence of accelerated recovery, improved health-related quality of life and longitudinal data^{2,3}.

Increasingly, the adoption of shared decision-making in the treatment of valvular heart disease is changing the conversation between patients and clinicians by considering patients' values, priorities and preferences to achieve a high-quality treatment decision⁴. Consequently, the number of TAVIs performed has grown markedly and the transcatheter approach has become the dominant treatment option for AS in multiple regions^{5,6}. This paradigm shift has rapidly impacted teams performing cardiac procedures and called on clinical programs to adapt their processes of care to meet the unique needs of older adults undergoing minimally invasive valve implantation.

There is growing evidence to support the implementation of a streamlined clinical pathway to optimise outcomes, improve program capacity and facilitate safe early discharge home after TAVI^{7,8}. Significant advances in clinical indications and case selection, imaging, device technology and

procedural approaches have had a synergistic effect on increasing the predictability of TAVI⁹. In addition, raised awareness of the risks of in-hospital complications, primarily in older aortic stenosis patients, has prompted clinical teams to implement interventions and standardised clinical pathways to mitigate risks of functional deconditioning, delirium and other iatrogenic events¹⁰. Together, these changes in practice have prompted a shift from the early focus on 'how we do TAVI' to 'how we care for TAVI patients' to improve clinical outcomes and patients' experiences, increase program capacity and access to care, and reduce costs.

Adopting a minimalist approach to TAVI has accelerated the rapid transition from using general anaesthesia to using less invasive strategies ranging from conscious sedation to local anaesthesia only¹¹. The increased use of the cardiac catheter laboratory (CCL), in addition to or instead of hybrid operating rooms (HOR), has modified staffing models for procedures and required merging of perioperative nursing and interventional cardiology nursing competencies¹². The adoption of these innovative practices reflects the uptake of rapidly evolving contemporary evidence and the aim of minimising patients' physiological stressors, while in hospital, and facilitating rapid reconditioning and safe early discharge home¹². The recent pace of change in TAVI procedure practices highlights the importance of evidence, not only to inform nursing practice but also to guide adaptations to clinical care.

In this context, little is known about patients' experiences while undergoing minimalist TAVI. To date, studies of patient-reported outcomes and experiences have focused on aspects of pre-procedure

care, including factors influencing patients' treatment decisions and changes in functional status before TAVI¹³, and post-procedure outcomes and experiences^{14–16}. The lack of research seeking to understand patients' experiences during the procedure (intra-procedural experiences) constitutes a gap in the research; evidence about intra-procedural patient experiences is foundational to multidisciplinary clinical care for patients with valvular heart disease treated with minimally invasive approaches. There is a pressing need to ensure that clinician-driven changes to practice promote improved patient experiences. Thus, the purpose of this study was to explore what could be learned from patients' periprocedural experiences during minimalist transfemoral (TF) TAVI – that is, patients' experiences not only before and after but also during the procedure – to inform multidisciplinary practice.

Methods

Design

We designed a qualitative study to investigate TAVI patients' experiences. The study was carried out in a single centre with a multidisciplinary team, that included periprocedural nurses, implanting physicians, a dedicated anaesthesiologist and allied health professionals, and treated with a streamlined clinical pathway with a goal of safe next-day discharge home.

We used interpretive description as a methodological approach to inform study design, data collection and analysis. Interpretive description is an effective strategy to meet the knowledge needs of applied disciplines and is conducive to generating new ideas and augmenting evidence in clinical practice¹⁷.

Participants and settings

The study was conducted in a high-volume TAVI program in British Columbia, Canada. We invited patients to participate after being placed on the waitlist and prior to the procedure. Patients who were urgent in-patients, required general anesthesia for clinical reasons, or were unable to communicate in English were excluded. We used purposeful sampling to recruit men and women representative of diverse characteristics, including age, co-morbidities and geographical residence. We aimed for a sample size that was sufficient in information power and driven by the needs of the study¹⁸.

Ethical considerations

The study received institutional research ethics approval (H20-03917) and participants provided informed consent. Participants were informed that their participation in the study was voluntary and that they could withdraw from the study at any time.

Data collection

We conducted individual interviews with participants by telephone within the first week after their procedure. Interviews were conducted by the principal investigator (CP) using a semi-structured interview guide (see supplemental material) informed by our team's pilot work and current evidence. Open-ended questions were designed to explore patients' perspectives of their experiences, including their recall of the procedure, interactions with team members, self-reported experiences and the overall care received, as well as to be flexible and allow for a dialogue between the researcher and the participant.

Participants were prompted to provide recommendations for the

improvement of multidisciplinary practice. Interviews were audio-recorded, transcribed verbatim, de-identified and checked for accuracy. Patient characteristics, procedural details, and post-procedure outcomes were collected from medical records to describe the population.

Data analysis

In keeping with the principles of interpretive description, data collection and analysis were concurrent. We reviewed the transcripts to ensure we had a strong understanding of the content. Using an inductive thematic approach, we highlighted sections of the data that demonstrated key ideas, relationships between the data and emerging themes.

All transcript data were coded using NVivo™ data management software. Three researchers were involved in coding data (CP, SL, FH). To help organise the data into broader concepts, we grouped codes into larger categories that reflected 'bigger picture' thinking. In keeping with qualitative inquiry, we challenged our understanding of the data by comparing and contrasting the participants' experiences and emerging ideas, categories and themes. Throughout data collection and analysis, research team members met regularly to discuss early findings, suitable analytic approaches and emerging trends in the data.

Results

Participant characteristics, procedural details and post-procedure outcomes

We recruited 15 participants between June and October 2021 – ten men and five women with a mean age of 82 (SD=3.2) years. All

participants had severe symptomatic aortic stenosis and presented with one or more comorbidity, including hypertension (n=13, 87%), diabetes mellitus (n=5, 33%), atrial fibrillation (n=4, 27%), severe lung disease (n=3, 20%) and peripheral arterial disease (n=2, 13%). Four participants had previous percutaneous coronary revascularisation and one participant had an existing permanent pacemaker.

The planned TF vascular approach was used for 14 participants; the subclavian artery approach was used for one participant. Procedure locations included the HOR (n=6) and CCL (n=9). Most participants (n=13) received diverse regimens of conscious sedation as follows: remifentanyl only (n=5), remifentanyl and propofol (n=1), dexmedetomidine only (n=2), dexmedetomidine, ketamine and midazolam (n=2), fentanyl and midazolam (n=1), fentanyl and propofol (n=2). One patient received local anaesthesia only, and the patient who underwent the subclavian procedure received general anaesthesia (n=1). The median procedure times were 102 minutes from patient entry to exit, and 56 minutes from skin puncture to closure. All patients had a successful procedure.

Following the procedure, patients were transferred to the cardiac intensive care unit (n=6) or cardiac short stay and cardiac telemetry units (n=9) based on clinical status and bed availability. There were no reports of significant vascular access, neurological or hemodynamic complications. One patient required cardioversion for the management of new atrial fibrillation and one patient received a new permanent pacemaker on the procedure day to treat a persistent high grade atrioventricular delay.

The median length of stay in hospital was one day, all participants were discharged home, were not readmitted to hospital and were alive 30 days after the procedure. Table 1 is a summary of the participants' characteristics, procedural details and post-procedure outcomes.

Thematic findings

I want to be a member of my heart team during my procedure

An overarching theme emerged of participants feeling that they had an important role to play during their

procedure, and a desire to be invited to participate as a member of the team during that time. Participants considered the people in the procedure room who focused on performing their procedure to be members of their heart team and sought to find ways to be included.

Table 1: Participant characteristics, procedural details and 30-day outcomes

Demographic (N=15)			Number of participants (%)
Age in years	83 ± 5.4 (mean, SD)		
Gender	female		5 (33%)
	male		10 (67%)
Medical history	hypertension		13 (87%)
	atrial fibrillation		4 (27%)
	diabetes mellitus		5 (33%)
	severe lung disease		3 (20%)
	peripheral arterial disease		2 (13%)
	previous cerebrovascular accident		2 (13%)
	previous percutaneous coronary intervention		4 (27%)
	previous coronary artery bypass graft surgery		0 (0%)
	left ventricular ejection fraction < 35%		1 (6.7%)
Estimated GFR in millilitres per minute	58 ± 17 (mean, SD)		
Procedural details	Anaesthetic management	general anaesthetic	1 (6.7%)
		conscious sedation	13 (87%)
		local anaesthesia only	1 (6.7%)
	Procedure vascular approach	transfemoral	14 (93%)
		subclavian	1 (6.7%)
	Procedure location	hybrid operating room	6 (40%)
		cardiac catheter laboratory	9 (60%)
In-hospital complications	cardioversion		1 (6.7%)
	pacemaker implantation		1 (6.7%)
30-day outcomes	hospital readmission		0 (0%)
	mortality		0 (0%)

SD = standard deviation
GFR = glomerular filtration rate

This desire for membership of the heart team had three components (see Table 2).

1. Who am I to them? (Situating myself in relation to the team.)
2. How can I be a good patient? (Knowing what is expected of me.)
3. How do I manage this complex wave of emotions? (Interpreting signals from the team.)

Who am I to them?

Participants expressed wanting to situate themselves in relation to the team as they entered an unfamiliar environment, experienced fear of the unknown and found comfort in caring gestures. Participants spoke of wanting to be involved in their care and establish a way to communicate with a group of strangers in the procedure room; however, many participants also spoke about how anxiety, and trying to manage their emotions and expectations, contributed to their difficulty responding and adapting to social cues in an unfamiliar environment. When asked to recall their experience in the procedure room, one participant noted:

Let's be honest ... who wants to go into a room with ten other people and they've all got missions to do something to your body? I mean, that's a very frightening position if you think about it. You can hear people talking ... there's an enormous number of people. They're all very gentle and very nice ... but you can't really get a handle on what they're doing – the ones that are touching you all the time – what they're doing and why they're doing it. But there are other things going on that you really wonder what it is ... anyway, it would be nice to know because you are awake and there's a lot of activity in that room.

74-year-old male

Although many participants expressed feeling like outsiders during their procedure, others discussed how meaningful it was to experience moments of connection with members of the team. These participants relayed the importance of having their emotional needs tended to. When asked to reflect on their interactions with staff, one participant noted.

They acted like they really cared if I lived or died. And who was I to them? But I was something to them. You know what I mean? That's how I felt – very cared for.

93-year-old female

How can I be a good patient?

While participants had differing ideas on how to best prepare and make sense of the procedure, most shared a common desire to be informed and guided to comply with the expected behaviours and unspoken rules of the perioperative environment and procedure process. Participants expressed wanting to be perceived as helpful and unproblematic by their heart team, and to do their part by assuming the role of the 'good patient'. When asked about their experience of having their procedure under light sedation, one participant noted:

The doctor had said to me before I went under, or whatever he was doing, 'don't try and help'. So, I kept quiet ... I was wanting to know how it was going but I didn't ask any questions.

79-year-old female

Similarly, another participant stated:

I tried to relax. I didn't want to tense up, 'cause I thought that if I tensed up, I might create a problem that I didn't want to create.

85-year-old male

Although participants had varying levels of awareness, they described how being conscious affected their experience. One participant stated:

I felt I was a little more in control because I was able to hear what they were saying and be aware of what they were [doing] ... I certainly didn't find it threatening in any way.

81-year-old female

In contrast, another participant stated:

I don't have pleasant memories of the overall experience ... I can't say that that was the most pleasant day of my life. It was maybe one of the scariest in a long time because of the consciousness.

85-year-old male

How do I manage this complex wave of emotions?

Participants discussed experiencing a wave of emotions that started while waiting for the procedure when they felt stress associated with uncertainty, crested during the procedure when they sought signals of hope and danger, and released rapidly once TAVI was successfully completed when they suddenly breathed a sigh of relief. When asked to reflect on their experience, one participant spoke of waiting for the procedure:

The biggest hang-up was the uncertainty of when I was going to get in ... that's the kind of thing that ticks you off because you have to change your life. I, in fact, did change my life.

74-year-old male

During the procedure, participants remained vigilant for signs of potential danger and sought signals indicating the progress of their procedure. One participant recalled:

Perhaps 20 minutes in, they said 'we got a problem here'. I heard that phrase, starkly, and that struck me a little ... you know, these guys got a problem with me or, what's going to happen here? ... that shook me a little bit.

85-year-old male

The same participant shared their experience of feeling emotionally and physically exhausted during TAVI but also the significant wave of relief they felt after hearing confirmation that their procedure was a success.

[I thought] I hope these guys finish quick because I'm not going to be able to hold on here much longer. But as it turned out ... the specialist said ... 'you've got a new valve'. And I was just elated. I was so excited underneath all that stress and everything. And that phrase was all I needed to get me really happy.

85-year-old-male

Although participants did not verbalise the impact of these signals in the moment, they related how meaningful and memorable these small gestures were at the time and how those gestures helped anchor their wave of emotion.

Table 2 summarises the themes and subthemes that emerged and gives exemplar quotes.

Discussion

This novel study adds new evidence to better understand patients' experiences of TAVI and inform multidisciplinary care. In this exploratory qualitative study, we found that patients expressed a need or desire to be part of the procedural team as they sought relational contact with clinicians, tried to meet expectations of how to act and respond, and navigated a range of emotions during the short but intense procedure. To our knowledge,

this is the first study focused on integrating patients' self-reported experiences and eliciting their recommendations in the context of the rapid evolution of streamlined, minimalist transcatheter heart valve procedures.

Evolution of anaesthesia strategies

In the early years of TAVI general anaesthesia was used. This was prompted by not only conventional surgical practices but also concerns for patient safety and comfort and the need to manage potential complications, including hemodynamic instability and vascular injury. In a period of rapid change in practice during 2014 and 2015, overall use of conscious sedation – defined as 'a drug-induced depression of consciousness during which patients respond purposefully to verbal commands, either alone or accompanied by light tactile stimulation' – increased from 11 per cent to nearly 30 per cent across 314 hospitals in the United States of America (USA). Between 2016 and 2019, the use of conscious sedation in the USA further increased from 33 per cent to 64 per cent.¹¹

In 2017, the safety of TAVI with conscious sedation was examined across a high-volume of procedures and reported in the Society of Thoracic Surgeons / American College of Cardiology TVT Registry. Similar findings were reported in the German Aortic Valve Registry (GARY), where local anaesthesia or conscious sedation was used in 49 per cent of cases from 2011 to 2014¹⁹, and the FRANCE TAVI Registry which reported an increase from 31.3 per cent to 48.3 per cent between 2010 and 2015²⁰.

This temporal trend in practice change persists across regions. Studies continue to demonstrate

not only the safety of conscious sedation across TAVI risk profiles but also an association with shorter procedure times, reduced inotrope requirements and delirium, shorter lengths of stay in intensive care and hospital, predictable time to early mobilisation and lower costs, with no difference in clinical outcomes^{21–23}. Importantly, most studies lack granular data to address anaesthesia services' consideration of the risks of obstructive sleep apnoea, difficult airway or high baseline pain medication requirements, or parse the effect of the wide variation along the sedation continuum¹⁴.

More recently, single centres have reported transitioning from a monitored anaesthesia care service model (regardless of the depth of sedation provided) to a 'monitored nursing care' or 'nurse-led sedation/analgesia' delivery model for select patients. This transition results from various factors, including ongoing evolution of the procedure, with the adoption of a default strategy of local anaesthesia with or without very minimal sedation, and competing demands placed on local anaesthesia services^{24,25}. The heterogeneity in practice reported across regions and centres highlights the pressing need for further research to better understand patients' perspectives to augment current evidence in this rapidly evolving context.

Strengthening patients' role on the heart team

The concept of the multidisciplinary team (MDT) emerged in the early years of TAVI to leverage the collective expertise of cardiology and cardiac surgery to guide treatment decisions²⁶. Over time, membership on the team has expanded to other specialised services, including cardiac imaging, anaesthesia services and nursing.

Table 2: Themes, sub-themes and exemplar quotes

Overarching theme: I want to be a member of my heart team during my procedure		
Theme	Sub-themes	Exemplar quotes
Who am I to them?	Entering an unfamiliar environment	Let's be honest ... who wants to go into a room with ten other people and they've all got missions to do something to your body? I mean, that's a very frightening position if you think about it. <i>74-year-old male</i>
	Experiencing fear of the unknown	I was trying to fight the operation itself, symbolically, like not really mechanically ... I was in my mind fighting this thing and saying, I don't want this thing to hurt ... I was frightened that I would feel the catheter and the wires protruding into my body and going bump, bump, bump ... I was as scared as could be. <i>85-year-old male</i>
	Finding comfort in caring gestures	They acted like they really cared if I lived or died. And who was I to them? But I was something to them. You know what I mean? That's how I felt – very cared for. <i>93-year-old female</i>
How can I be a good patient?	Making sense of TAVI	It's almost overkill ... they give you an enormous amount of information ... it's probably too much because it starts to repeat itself as a little bit different so you're never sure which thing to look at. Like, there's quite a pile ... little books and they're not all the same because I guess they were written at different times and some have some things that others don't. <i>76-year-old male</i>
	Seeking guidance on behavioural expectations	The doctor had said to me before I went under, or whatever he was doing, 'don't try and help'. So, I kept quiet ... I was wanting to know how it was going but I didn't ask any questions. <i>79-year-old female</i> I tried to relax. I didn't want to tense up, 'cause I thought that if I tensed up, I might create a problem that I didn't want to create. <i>85-year-old male</i>
	Relating procedural awareness to overall experience	I felt I was a little more in control because I was able to hear what they were saying and be aware of what they were [doing] ... I certainly didn't find it threatening in any way. <i>81-year-old female</i> The idea of jabs and dental freezing scared me a lot, and when I was on the operating table itself ... I was still fighting [the procedure] metaphorically ... if I was knocked out ... off in dreamland somewhere, that would've been nice. <i>85-year-old male</i>
How do I manage this complex wave of emotions?	Experiencing anticipatory stress	Death, I had that on my mind, I got to admit. Like, the night before I was wondering if they asked for a living will for heaven's sake and they asked for a priest ... if they're doing that, they've got some reason to suspect maybe something's gonna go wrong here, you know? <i>85-year-old male</i>
	Tuning into signals of hope and danger	Perhaps 20 minutes in, they said 'we got a problem here'. I heard that phrase, starkly, and that struck me a little ... you know, these guys got a problem with me or, what's going to happen here? ... that shook me a little bit. <i>85-year-old male</i> It was an hour or a bit more into it and I kind of caught the eye of one of the surgeons that was assisting, and he gave me a thumbs up, more or less to say it's going well ... so I thought that was nice. <i>75-year-old male</i>
	Breathing a sigh of relief	... the specialist said ... 'you've got a new valve'. And I was just elated. I was so excited underneath all that stress and everything. And that phrase was all I needed to get me really happy. <i>85-year-old-male</i>

Access to a comprehensive and expert MDT has been integrated across international guidelines for the management of valvular heart disease, and has been credited with improving outcomes and sustaining excellent results and health service delivery models²⁷. Our findings suggest that patients perceive that they have a role to play on their heart team, and are seeking guidance to be competent, engaged and coached participants during the implant procedure.

The shift of culture from clinician-focused to patient-centred health care continues to be a priority when striving to achieve the quintuple aim of improved outcomes, better patient and provider experiences, equitable access to care and decreased costs²⁸. Our findings suggest the importance of raising the team's awareness of patients' communication needs and experiences of being conscious during the procedure. In the surgical environment, caring for conscious patients remains a relatively new and under-researched practice.

Whether TAVI is performed in interventional cardiology or cardiac surgery procedure rooms, the shift to patient-centred care can be supported by strategies such as the repeated use of the patient and clinicians' names during interactions, patient participation during surgery checklist time out procedures²⁹, effective coaching at pivotal times (e.g. vascular access, valve deployment), distraction interventions³⁰ and communication of procedure progress³¹. These strategies may be effective in meeting patient communication needs and creating a standard of care to ensure consistently excellent patient interactions. Although our findings are a start to understanding how to optimise patients' periprocedural experiences, research is needed to further explore interventions to mitigate

the risks of discomfort, anxiety or other preventable adverse patient-reported outcomes.

The early and consistent management of patients' expectations is essential to strengthening their active participation during TAVI. In the same way that patient education, early discharge planning and standardisation of clinical pathways contribute to achieving safe, standard, next-day discharge home^{7,32}, patient engagement and team communication about procedural practices and expected timepoints are effective strategies to strengthen the patient-MDT partnership and improve patients' experiences.

Tailored education resources, consistent communication from all disciplines, and on-going assessment of individual needs can reinforce the predictability of contemporary minimalist TAVI; focused attention on patient comfort and safety is required to achieve this goal. In this setting, the expertise of perioperative and interventional cardiology nurses is ideally suited to strengthen patients' effective participation in their procedure and promote positive outcomes. Figure 1 provides a summary of recommendations for integrating patients' perspectives during TAVI.

Limitations

Participants were recruited from a single TAVI clinic in Western Canada with well-established standardised practices. Although the recruitment goal was to ensure diversity and inclusion, the results may not accurately reflect the experiences of participants in other TAVI programs, especially given the impact of local contexts of care, multidisciplinary practice and care processes. Findings should be interpreted in light of the study design and sample.

Conclusion

We aimed to explore patients' perspectives of their experiences during the TAVI procedure to determine what could be learned to inform care. We have reported novel findings that can help guide and modify interventions to support patients to become members of their procedure team and improve their care experience. We identified opportunities for nurses and other members of the MDT to leverage their expertise and competencies to achieve this goal. Future research is needed to explore the development of standardised care interventions to help enhance patients' experiences and further synchronise patient-reported outcomes and experiences with the evolution of TAVI practices. This work is essential to support the rapid expansion of transcatheter heart valve treatment options and contribute to shifting the culture of care from clinician-focused to patient-centred, especially during intense and impactful procedures.

Acknowledgements

The authors thank Jopie Polderman and Leslie Achtem of St Paul's Hospital, Vancouver, Canada, for their support for research activities.

Conflict of interest declaration

SB Lauck has been a consultant to Edwards and Medtronic. J Sathananthan has been a consultant to Edwards, Medtronic and Boston Scientific, and has received research grants from Edwards and Medtronic. DA Wood has received research grants from Abbott and Edwards. JG Webb has been a consultant and/or received research support from Edwards, Abbott, Boston Scientific and Vivitro Medical.

Pre-procedural patient education	Provide orientation to procedure location, team, steps and duration to clarify expectations using multi-modality and individualised teaching methods.
Pre-procedural patient assessment	Screen for: • risk of excessive periprocedural anxiety (e.g. history of anxiety disorder, past negative procedural experience) • barriers to communication (e.g. language, sensory challenges).
Health care team education	Share updates on contemporary evidence about TAVI anaesthesia strategy and implications of caring for conscious patients. Tailor education to hybrid operating room and cardiac catheter laboratory teams and environments.
Periprocedural protocol	Consider including the following interventions: ✓ identifying barriers to communication ✓ addressing patient and team members by name ✓ including patient in safety checklist and procedural time-outs ✓ designating a ‘most responsible provider’ to communicate with patient ✓ raising awareness about care of the conscious patient ✓ highlighting patient preferences
Communication of TAVI main time points to patient	Patient preparation and draping > Local anaesthesia and puncture > Start of implant procedure > Rapid pacing and implantation > End of implantation > Vascular closure
Communication of patient’s periprocedural role	Provide direction to encourage patient to: ✓ voice discomfort or other issues ✓ remain still at critical moments (e.g. rapid pacing and device deployment).

Figure 1: Summary of recommendations for integrating patients’ perspectives and improving patient’s periprocedural experiences

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'I want to be a member of my heart team': Insights from patients' experiences of minimalist transcatheter aortic valve implantation

Supplement: Interview guide for semi-structured interviews with patients

Section A: Pre-operative care

1. I'm wondering if you could tell me a bit about your experience with aortic stenosis leading up to your TAVI procedure?
2. Before you had the TAVI procedure, how well do you think you understood what was going to happen?
3. How comfortable were you with your understanding of the type of anaesthesia?
 - a. How did you feel about the idea of being awake for the procedure?
 - b. How well prepared do you think you were for the procedure?
 - c. What were you still unclear on about the procedure before having it?
 - d. Could you provide specific examples of what was most helpful in preparing for your procedure?
3. Can you describe your interactions with the health care providers?
 - a. Can you tell me about your experiences with staff during the procedure?
 - b. Can you describe to me what stood out about the care you received during your procedure?
4. Can you tell me what was most important to you during your procedure?
 - a. What was your main concern?
 - b. Can you tell me about your experience in the procedure room in relation to your concerns being met or validated?

Section B: Intra-operative care

1. Can you tell me about your experience during the procedure and what it was like for you?
 - a. What were your experiences with comfort and pain?
 - b. Could you share with me some of your thoughts throughout the procedure?
2. Can you tell me about your experience of being awake for the procedure?
 - a. Can you tell me about the sounds in the procedure room?
 - b. Can you tell me about the sensations you experienced? E.g. at the start of your procedure, when your heart was being sped up by a pacemaker, during the placement of your new valve.
2. What recommendations would you have for the care team to enhance the patient experience during TAVI?
 - a. Is there anything you would have liked to see done differently?
 - b. Would you recommend the procedure to others?
3. What recommendations would you have for other people who might have TAVI?

Section C: Post-operative care

1. Can you tell me about the care you received immediately following your procedure in the hospital?
 - a. How comfortable were you with the teaching you received post-operatively?
 - b. How comfortable were you with the idea of returning home following your procedure?
2. What recommendations would you have for the care team to enhance the patient experience during TAVI?
 - a. Is there anything you would have liked to see done differently?
 - b. Would you recommend the procedure to others?
3. What recommendations would you have for other people who might have TAVI?

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Evaluation of nursing approach to assessment of post-operative respiratory depression using a simulation model

Abstract

Introduction: Assessments of post-operative patients that have been carried out by health care providers before critical opioid-induced respiratory events often do not detect respiratory depression. We hypothesise that opioid-induced respiratory patterns present during sleep may not be properly recognised as providers typically awaken patients for vital sign checks, and awake state assessment is recorded. We used a simulation manikin model to test this hypothesis.

Methods: Nurses who work on a standard post-operative hospital ward volunteered to participate in a study designed to record vital signs on an adult male manikin. None of the nurses had formal critical care or post-operative care unit education. This simulation consisted of an elderly male patient who had undergone a hernia repair and was randomised to have two breathing patterns while asleep – persistent bradypnoea (respiratory rate of six breaths per minute) and intermittent apnoea (respiratory rate of 18 breaths per minute with 30-second pauses); both breathing patterns terminated after nurses woke the patient.

Results: Twenty-seven nurses participated: 14 in the bradypnoea scenario, and 13 in the intermittent apnoea scenario. Upon entering the room, 24 (89%) participants woke the patient to begin respiratory assessment, and three (11%) assessed respirations while the patient remained asleep. Eleven (79%) participants noted abnormal breathing in the bradypnoea scenario, while only one (4%) noted abnormal breathing in the intermittent apnoea scenario.

Conclusion: This simulation model demonstrated that most nurses awaken patients before vital sign assessments, which could prevent detection of respiratory depression present during sleep. Nurses on hospital wards should be educated to follow respiratory status assessment guidelines not to wake the patient for respiratory status assessment.

Keywords: opioid-induced respiratory depression, simulation model, nursing assessment, apnoea, bradypnoea

Background

Post-operative, opioid-induced respiratory depression (OIRD) is a severe, life-threatening condition that can be prevented if recognised early^{1,2}. Evolving technology has allowed better understanding of the phenotypic presentation of OIRD as it presents on post-operative wards³. Despite a widespread perception that the typical pattern of OIRD is bradypnoea, the most common presentation is repetitive apnoea and partial apnoea episodes interspersed with normal breathing patterns^{3,4}.

Severe post-operative OIRD seems to occur suddenly without warning, developing even after apparently reassuring nursing assessments⁵. Analyses have consistently found respiratory depression is indicated in nursing notes documented before these critical events¹. The most common nursing note documented before naloxone administration was somnolence, but not respiratory depression⁶.

Health care workers on hospital wards might not be proficient in recognising a repetitive apnoea as phenotypic presentation of post-operative OIRD. This breathing pattern, which is consistent with respiratory depression, may become extinguished when a patient is woken during routine vital sign checks⁷. In other words, from the nursing perspective the awakened patient with appropriate breathing rate and without respiratory pauses is noted in medical records as 'somnolent'. However, as soon as the nurse leaves the room the patient can resume sleep and this OIRD pattern could develop again.

The aim of this simulation study was to evaluate how nurses perceive two hypothetical breathing patterns that are associated with

respiratory depression (bradypnoea and intermittent apnoea during sleep). In this study enrolled health care workers were asked to evaluate vital signs on a manikin that was programmed to snore loudly and have either of the two breathing patterns consistent with respiratory depression. Specifically, the two breathing patterns were bradypnoea during sleep and intermittent apnoea spells during sleep; both breathing patterns normalised after the patient was woken up. We hypothesise that nursing assessments will readily recognise bradypnoea as respiratory depression, while recognition of intermittent apnoea will be frequently missed.

Materials and methods

Overview

This simulation study was performed in the standardised post-operative surgical ward at our institution, a major academic quaternary medical centre. The study was approved by the local Institutional Review Board. Participation in this research study was completely voluntary. Oral informed consent of the study participants was obtained.

Participants

All participants were nurses working on a general surgical ward; participants had various levels of experience in the clinical setting. The main inclusion criterion was direct involvement in the care of post-operative patients. Participant experience levels, including number of years nursing and being patient care assistant, were self-reported. In addition, participants reported if they had any experience in the intensive care unit (ICU), post-operative care unit or emergency department. By design, we did not collect data which could be used

to identify the participants (i.e. age, gender, name) as this was felt to be a potential barrier to participation.

Participants who met the inclusion criteria and provided oral informed consent were randomly assigned to one of two simulated scenarios for assessing the vital signs of a post-operative patient. In one scenario the manikin had sustained bradypnoea, in the other scenario the manikin had intermittent apnoea spells.

Study protocol

All participants were asked to perform a routine post-operative assessment of vital signs on a manikin in a general care ward. They were given a form (see supplemental material) that included scenario details, patient information and a previous set of vital signs of the patient. They were asked to enter the patient room and assess and record vital signs, including temperature, heart rate, blood pressure, respiratory rate and oxyhaemoglobin saturation, as well as assess level of pain on a standard ten-point numeric pain score ranging from 0 (no pain) to ten (worst pain imaginable). They were then instructed to indicate if they observed any abnormalities.

The simulation scenario consisted of a 75-year-old, male patient with an elective ventral hernia repair and a history of hypertension and hyperlipidemia. He was admitted to the general care ward after being discharged from the Post Anaesthesia Care Unit (PACU) two hours earlier. The high-fidelity adult male manikin SimMan 3G (Laerdal Medical Corporation, Wappingers Falls, NY) was set up as a patient. For a realistic patient presentation, the manikin was programmed to speak and make snoring sounds, as well as display physical features including respiration and pulse.

In addition, the manikin had a nasal cannula, a blood pressure cuff attached to his arm and an abdominal dressing.

During the case presentation, participants were located outside the 'patient ward', so they could hear the snoring and breathing pattern of the manikin. For the sustained bradypnoea scenario, the manikin was programmed to snore loudly and have a respiratory rate of six breaths per minute (supplemental audio file 1). For the intermittent apnoea scenario, the manikin was programmed to snore loudly and have a respiratory rate of 18 breaths per minute with periodical 30-second respiratory pauses (nine missed breaths) due to temporal cessation of breathing (supplemental audio file 2).

The snoring sounds continued when the participant entered the room. Once the participant woke up the patient, the snoring sounds stopped and the manikin opened the eyes. For the bradypnoea scenario, the respiratory rate remained six breaths per minute. For the intermittent apnoea scenario, the respiratory rate remained at 18 breaths per min, but the apnoeic pauses ceased. The other vital signs were identical in the two scenarios. The temperature was 36.9 °C, heart rate was 74 beats per minute, blood pressure was 132/65 mm Hg and oxyhaemoglobin saturation was 95 per cent. After assessing the vital signs and writing them down, participants were asked to record if patient had any of the following conditions: tachycardia, bradycardia, hypotension, hypertension, bradypnoea, tachypnoea, hypoxaemia, apnoea, dysrhythmia, or none of them.

There was an embedded participant in the room to explain how the manikin worked, facilitate the flow of the scenarios and write down

comments and observations related to the performance. Another person was controlling the manikin's vital signs and changing respiratory rate and snoring pattern according to the randomisation information.

Statistical methods

Participants were randomly assigned to the apnoea or bradypnoea scenario. Blocked randomisation was performed using blocks of size N=4 to ensure that after every fourth participant was randomised there were an equal number of participants assigned to each treatment condition. Descriptive statistics were used with results summarised as median, with interquartile range (IQR), and number, with percentage, as applicable.

Results

Twenty-seven nurses were enrolled, 14 in the bradypnoea scenario and 13 in the intermittent apnoea scenario, and all completed the trial. Participants had median work experience of five years (IQR 4 [8-4]); two had prior experience working in an emergency department, but none had experience working in an ICU or PACU.

Upon entering the patient room 24 participants immediately awoke the manikin by announcing they were there for a vital sign check. Of the three participants who initially quietly observed the manikin, two awakened the manikin within 30 seconds to start the assessment. The third participant observed the snoring (apnoea) patient for two minutes and then recorded the pulse oximetry score without assessing respiratory status while asleep.

Bradypnoea scenario

Out of 14 participants in the bradypnoea scenario, 13 (92.9%) awoke the manikin before evaluation

of vital signs. Participants in this scenario recorded a median respiratory rate of seven breaths per minute (IQR 3.5 [9.5-6]) with one of them recording a rate of 15 breaths per minute. Nine (64.3%) participants indicated the manikin had bradypnoea, and two (14.3%) participants indicated apnoea (see Figure 1). Three participants expressed concerns for the patient. One of them asked if the patient was sleeping or feeling dizzy. The other one asked if the patient was 'doing okay'. The third participant vocalised that the respiratory rate was less than seven breaths per minute.

Apnoea scenario

Out of 13 participants in the intermittent apnoea scenario, 11 (84.6%) awoke the manikin before evaluation of vital signs. Participants in this scenario recorded a median respiratory rate of 18 breaths per minute (IQR 2 [20-18]) with no respiratory rate below 16 breaths per minute. Two (15.4%) participants interpreted the breathing pattern as tachypnoea. One (7.7%) participant interpreted the breathing pattern as apnoea (see Figure 1), but interestingly recorded a respiratory rate of 18 breaths per minute. One of the participants noticed the patient was snoring while asleep but did not verbalise any concerns about the presence of apnoea.

The majority (89%) of post-operative vital signs assessments were performed after the patient had been awoken from sleep, which resulted in failure to witness respiratory depression that was present only during sleep, and not present following stimulation in an awake state. The green background in Figure 1 indicates an inappropriate clinical practice of assessing respiratory effort while the patient is awake.

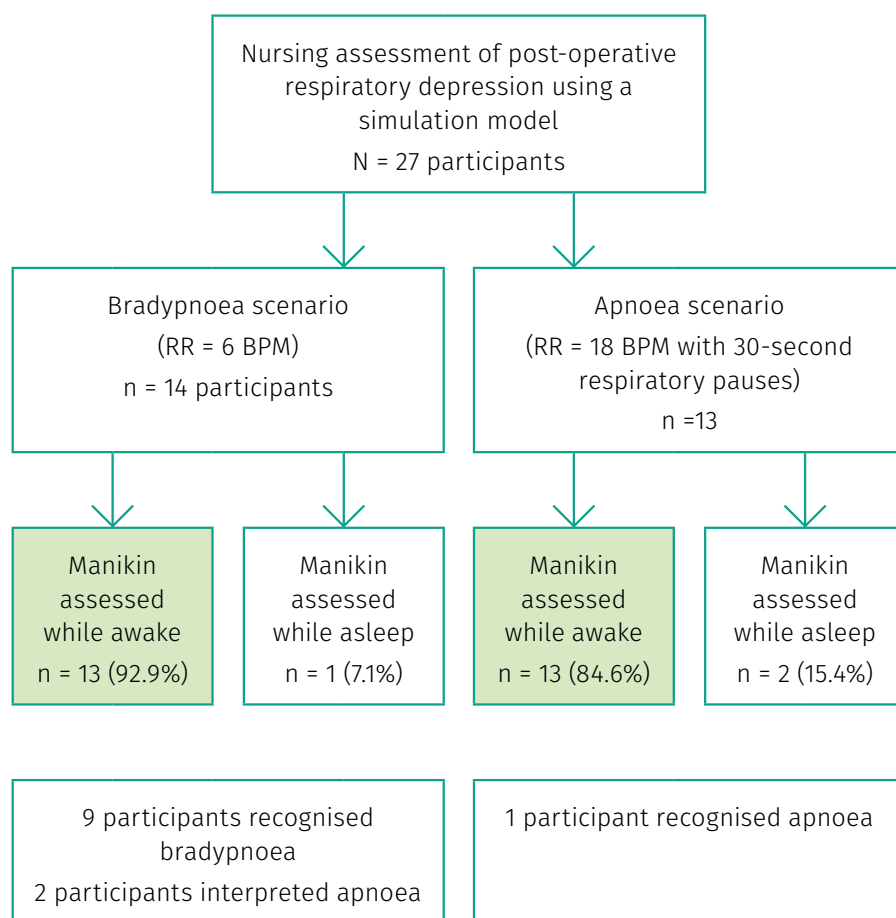


Figure 1: Study design and nursing approach to assessment of vital signs on manikin model.

RR = respiratory rate; BPM = breaths per minute

Discussion

The aim of this study was to explore nursing assessment of post-operative OIRD using a simulation model. The important observation is that the nursing staff, with no formal training in monitoring post-operative or ICU patients, typically woke patients before beginning the assessment of vital signs. The act of waking patients from sleep can extinguish abnormal sleep-disordered breathing patterns.

Most of the participants in the in bradypnoea scenario recognised abnormal breathing. In contrast, only one participant in the intermittent apnoea scenario recognised the

presence of apnoea. This supports our hypothesis that nursing staff are more adept at recognising bradypnoea as a concerning breathing pattern; they frequently miss sleep-disordered breathing patterns because they almost routinely wake up the patient for vital sign evaluations.

A prospective, multicentre, international observational study which used bedside capnography and pulse oximetry (blinded to health care providers) on general care wards found that 46 per cent of patients (614 of 1335 subjects) receiving parenteral opioids experienced respiratory depression episodes, and 97 per cent

of these consisted of apnoeas^{3,4}. In that study opioid complications were only recognised in 18 patients using routine clinical care³. Another study which used bedside pulse oximetry (blinded to health care providers) on post-operative patients on general care wards found 90 per cent of episodes of hypoxaemic events ($SpO_2 < 90\%$ for > 1 hour) were missed by routine vital sign assessments². This suggests that there is a need for further investigation and renewed emphasis on training nurses to assess the respiratory status for patients administered opioids and other sedating medications⁷.

In 2020, the American Society for Pain Management Nursing (ASPMN) issued revised guidelines on monitoring for opioid induced sedation and respiratory depression⁸. These guidelines recommend assessing the patient before administering an opioid and during peak effect of the opioid (with or without another sedating medication) to ascertain the patient's level of sedation, respiratory rate and quality of breathing, and oxyhaemoglobin saturation⁸.

Furthermore, the ASPMN guidelines recommend assessing the respiratory rate first while the patient is asleep and then when the patient is awake⁸. The observation during sleep should last at least for one minute and the nurse should look for signs and patterns similar to those present in patients with obstructive sleep apnoea⁸.

Our simulation model replicated the scenario of a patient with OIRD present during sleep; however, it was clear that our participants did not use the recommended assessment approach; rather, the majority simply woke the patient prior to the assessment. A recent review regarding the nursing role

in opioid management research found that only seven per cent of published papers addressed health care provider education⁹. This suggests that there is a need in nursing education for further emphasis on how to properly assess the respiratory status of patients receiving medications with potential to induce respiratory depression.

Technologies which can monitor not only oxyhaemoglobin saturation but also respiratory effort are becoming more readily available for routine clinical care¹⁰. It has been envisioned that such monitors could be integrated into the health care environment to overcome human health care providers limitations in detecting respiratory depression¹⁰. However, even if these monitors were used, health care staff would still need to understand that it is critical to assess respiratory status while the patient is asleep⁸. One could envision the scenario where a monitored sleeping patient develops OIRD, generating an alarm. The OIRD extinguishes once the patient is woken, providing false reassurance. Alternatively, health care staff trained to quietly assess respiratory status (without waking patients) could recognise OIRD and therefore could take corrective action before the respiratory status deteriorated to a critical level⁸.

Strengths and limitations

This report represents only a hypothesis-generating study and has several limitations. Although simulation is a powerful tool, it has its own disadvantages. We used a high-fidelity manikin as it can reproduce consistent vital signs, including respiratory rate, which would be impossible to maintain at a rate of 6 breaths per minute in a real person. At the same time,

the manikin cannot fully simulate the OIRD patient. Specifically, it cannot maintain a conversation or imitate somnolence that would be concerning for nurses. The issue of model fidelity (the artificiality of the manikin) can influence participants' engagement level, and this represents a limitation to our study design. This limitation needs to be considered in any health care study with the use of simulation models.

Further, the presence of research personnel in the study room may have introduced a distraction and/or Hawthorne effect for the research participants¹¹ (i.e. people will modify their behavior because they are being observed). Thus, post-operative assessments with real patients may render different results than that described in the current study.

Conclusion

Recognition of OIRD is critical in the post-operative period to avoid severe complications. We demonstrated that nurses are adept at recognising bradypnoea as a concerning breathing pattern; however, they fail to recognise respiratory depression related to sleep-disordered breathing patterns because of a flaw in their assessment technique – they wake the patient for vital signs assessment. Our study indicates that there is a need for additional education of hospital ward nurses to train them in proper assessment of respiratory status for patients administered medications with sedating potential. Our small pilot study suggests that nursing staff working on hospital wards should receive formal training in assessment and recognition of respiratory depression.

Declaration of conflicting interests

The authors have declared no competing interests with respect to the research, authorship and publication of this article.

Funding statement

TNW reports financial support from Medtronic Corporation, Merck, Enalare Therapeutics Inc., Takeda Pharmaceutical Company Limited and Trevena Inc.

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Evaluation of nursing approach to assessment of post-operative respiratory depression using a simulation model

Supplement: Clinical scenario and data collection sheet completed by the study participants

Scenario/debrief form

Patient data and baseline state				
Name: Doug Eyota, Minnesota, USA		Medical record number: 0-000-001		
Gender: male	Age: 75 years	Weight: 82 kg	Height: 182 cm	BMI: 24.8 kg/m ²
Current condition: POD#0 elective ventral hernia repair				
Past medical history: HTN, hyperlipidaemia, former smoker (quit 2003)				
Current medications: amlodipine, atorvastatin				
Allergies: sulfa				
Laboratory data: Hg 15 mg/dL, Plt 245.000, Cr 1.1 mg/dL				

Assessment			Conditions (circle all that apply)	
Time	14:00	16:00	none	febrile
temperature (°C)	36.8		tachycardia	bradycardia
heart rate (beats per minute)	73		bradypnoea	tachypnoea
Blood pressure (mm Hg)	139/68		hypoxaemia	apnoea
Respiratory rate (breaths per minute)	16		dysrhythmia	
Oxyhaemoglobin saturation	95		Other (please write)	
Cardiac rhythm	normal			
Pain score	4			

Your experience			
Years nursing		Year PCA:	
ICU/Pacu/ED experience			

M = male, BMI = body mass index, POD = post-operative day, HTN = hypertension, Hg = haemoglobin, Plt = platelet, Cr = creatinine, PCA = patient care assistant, ICU = intensive care unit, PACU = Post Anaesthesia Care Unit, ED = emergency department

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Effect of using virtual reality to manage needle phobia in adults undergoing medical procedures: A rapid review

Abstract

Background: Needle phobia, also known as blood–injection–injury (BII) phobia, is a severe form of needle fear that affects from 20 to 50 per cent of adolescents, 20 to 30 per cent of young adults and less than 5 per cent of the older adult population. When faced with venepuncture, approximately 75 per cent of patients with needle phobia will undergo an extreme physiological response which can lead to a vasovagal or fainting episode. An emerging therapy for medical phobias is the use of virtual reality, a three-dimensional environment generated by a computer that creates a sense of immersion.

Aim: To evaluate the effect of virtual reality on the severity of patient fear or anxiety induced by needle phobia during medical procedures.

Methods: We employed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to identify studies that used virtual reality to treat or manage needle phobia in adult patients. Two reviewers assessed each article with a third reviewer to resolve disagreements. We searched Medline, Embase, PsycINFO, PubMed and Web of Science from inception to search date. Articles were included if they contained original research and used virtual reality to treat or manage needle phobia in adult patients.

Results: Five articles were included – two randomised controlled trials (RCTs) that used virtual reality exposure therapy for the treatment of needle phobia in adults, one cross-sectional study examining reduction of dental anxiety using virtual reality, and two case studies that used virtual reality as a distraction therapy in adults, one for an adult with needle phobia and another for an adult with needle induced dental phobia.

Conclusion: We found a paucity of research into virtual reality as either a treatment for needle phobia or as a distraction modality in adult patients. Further research is required to contribute to the evidence on the effectiveness of virtual reality as management or treatment for needle phobia.

Keywords: virtual reality, virtual reality exposure therapy, VR, VRET, needle phobia, BII, blood injection injury

Introduction

Needle phobia, also known as blood–injection–injury (BII) phobia, is a severe aversion to needles¹. It is a heightened fear of injections and transfusions such that the patient actively avoids undergoing any procedure that involves exposure to needles or injections² and the sight of a needle can trigger adverse physiological responses³. Needle phobia has also been associated with avoidance of vaccinations, diagnostic tests and treatment of both acute and chronic conditions⁴.

Approximately 75 per cent of patients with needle phobia will undergo an extreme physiological response when faced with venepuncture and will experience symptoms such as a physiologically significant increase in heart rate and blood pressure followed by a response reversal leading to a vasovagal or fainting episode⁵. In his seminal work on needle phobia, Hamilton⁶ analysed patient case studies and reported 23 deaths attributed to needle phobia–related vasovagal episodes. Although these deaths were attributed to the patients having a previously compromised cardiovascular system, such as atherosclerosis or impaired sinoatrial or atrioventricular node that resulted in ventricular fibrillation or asystole, the deaths were catalysed by needle phobia⁶.

The prevalence of needle phobia in the general population is dependent on age. It ranges from 20 to 50 per cent in adolescents, aged 10 to 19 years, and 20 to 30 per cent in adults aged 20 to 40 years⁴. The percentage of patients with needle phobia decreases with advancing age at a rate of 8.7 per cent per decade with an overall prevalence of less than five per cent in the ageing population⁴. Despite the lower rate of needle phobia in older patients, the impact is magnified because of age-related morbidity⁷.

Management strategies for needle phobia include use of benzodiazepines, sedation, topical anaesthetic agents and hypnosis^{8,9}. Each of these strategies has its benefits and limitations. For instance, topical anaesthetic agents reduce needle-related pain; however, they require time and have clinical implications¹⁰. Benzodiazepines and sedation are effective for reducing anxiety but require medical supervision and monitoring⁸. Other therapeutic options such as virtual reality need to be explored.

Virtual reality is an emerging innovative therapy for medical phobias and is typically defined as an artificial three-dimensional environment generated by a computer that creates a sense of immersion by transporting the user to an interactive environment¹¹. The patient's presence in the environment is generated via visual stimuli in a head-mounted display that tracks head motion and displays images or video footage that move around in the virtual space which, combined with audio, gives the patient a sense of presence in this simulated environment¹². Virtual reality works for phobias as either a method of distracting the patient or as a method of exposure¹³. Virtual reality exposure therapy (VRET) has been successfully used as treatment for specific phobias such as fear of falling, fear of flying and social anxiety^{14–16}.

Review question

This is a rapid review of virtual reality as an intervention method for needle phobia in adults undergoing medical procedures requiring the use of a needle, such as injections or venous access. The primary question is 'What is the effect of virtual reality on the severity of patient experienced–fear or anxiety induced by needle phobia during medical procedures?'

Secondary review questions are:

- What types of virtual reality technology are being used and how are they being used, i.e. as exposure or distraction therapy?
- What are the characteristics of the patients who use virtual reality, i.e. age, gender?
- What, if any, are the characteristics of the patients who benefit the most from virtual reality?
- What, if any, are the side effects of using virtual reality and what, if any, are the characteristics of the patients who react negatively to virtual reality?

Methods

This review complied with the Preferred Reporting Items for Systematic reviews and Meta-Analysis (PRISMA) framework. This study is registered with PROSPERO registration number CRD42021285261.

Unlike systematic literature reviews and meta-analyses, there is no universally recommended methodological framework for rapid reviews. Haby et al.¹⁷ recommend that authors of rapid reviews outline their methods to enable readers to make a quality assessment. Rapid reviews draw from components of other forms of review¹⁸. This rapid review was performed following the framework for literature reviews outlined by Peters et al.¹⁹ and Arksey and O'Malley²⁰, that has four steps:

1. identifying the research question
2. identifying relevant studies
3. selecting studies to include
4. extracting and charting the results.

Additional steps were also undertaken to reduce bias and increase the outcome of the rapid review, as per Pluddeman et al.²¹, including publishing the protocol in

a peer-reviewed journal²², verifying all studies, having a second reviewer appraise risk of bias and quality, and using detailed appraisal tools.

1. Identifying the research question

This rapid review investigated the application of virtual reality for the treatment and/or management of needle phobia in patients undergoing medical procedures involving a needle. The question was framed around the PICOS (participants/population, intervention, comparators, outcomes, study type) format²³ as follows:

- Participants – adults, aged over 18 years.
- Intervention – virtual reality.
- Comparators – no virtual reality, placebo, another intervention, standard care.
- Outcomes – severity of fear or anxiety experienced by the participants.
- Study type – all types of study design.

2. Identifying relevant studies

A concept map incorporating medical subject heading (MeSH) terms and keywords was created by CG and TR, in consultation with a research librarian, to assist with defining the search terms (see Table 1). Five databases, Medline, Embase, PsycINFO, PubMed and Web of Science were searched from inception to the 18 July 2023. In addition, a hand search of bibliographic references of included publications was undertaken to identify potential additional articles that met the inclusion criteria.

Table 1: Concept map

Concept 1: Population	Concept 2: Intervention (virtual reality)	Concept 3: Condition (needle phobia)
adult (MeSH term)	virtual reality (MeSH term) virtual reality exposure therapy (MeSH term)	belonephobia (MeSH term) aichmophobia (keyword) blood injection injury (keyword) needle fear (keyword) phobia, needle (keyword) phobia, injection (keyword) trypanophobia (keyword)

The search was conducted independently by CG under the guidance and supervision of TR and IB. The resulting list of titles and abstracts was imported into Endnote X9™ and duplicates were automatically removed by Endnote before manual deduplication was carried out. All articles were then imported into Covidence²⁴, an online tool, for screening.

3. Study selection

Study screening and selection were performed by two reviewers (CG and TR) who independently performed title and abstract screening for relevance. In the first instance, disagreements between the two independent reviewers were resolved by consensus, while IB acted as an adjudicator of disagreements if consensus could not be reached. If relevance could not be determined from the

Table 2: Search criteria

Inclusion criteria	Exclusion criteria
Original research articles about using virtual reality for the treatment or management of needle fear or related phobias	Articles exclusively about needle phobia in children or paediatric participants (participants under 18 years of age)
Articles about research involving adult participants	
Articles either written in or translated into English	

title and/or abstract, screening progressed to the full article. Next, the full texts of articles deemed to have relevant titles or abstracts were retrieved and assessed for inclusion against a priori criteria for inclusion and exclusion (see Table 2).

4. Extracting and charting the data

The primary author, CG, was responsible for data extraction under the supervision of TR. Data extraction included:

- Study characteristics – the year and country of publication, study design and setting, main study findings.
- Intervention – the identified treatment or management with virtual reality and types of virtual reality equipment used.
- Population – adults with symptoms or clinical diagnosis of needle phobia.
- Participant characteristics – age, gender, medical procedure.
- Outcomes – including anxiety levels, blood pressure (BP), heart rate (HR), vasovagal response, qualitative experience and feedback.
- Side effects – any unintended consequences of using virtual reality, including symptoms of motion sickness.

5. Study quality appraisal and risk of bias

Risk of bias of included studies was assessed with the Cochrane risk of bias tool, for randomised controlled trials (RCTs)²⁵, and Joanna Briggs Institute Critical Appraisal Checklists and transferability to different contexts^{26,27}, for all non-RCT studies. Primary assessment was performed by CG with TR providing supervision and secondary independent appraisal to ensure reliability.

6. Data analysis and synthesis

Data from the included studies were first summarised using a descriptive narrative framework to capture the context and content of the research landscape. This narrative synthesis allows for a nuanced interpretation of included study outcomes, contextualising them within the broader scope of the existing literature. In doing so, we elucidated key trends, identified gaps and presented an organised summary that offers a cohesive understanding of the use of virtual reality in the management of needle phobia in adult patients undergoing medical procedures involving needles.

In addition to the descriptive narrative, we also conducted a pooled data analysis on data obtained from RCTs included in this review. This quantitative synthesis serves to aggregate findings to generate more robust conclusions than could be provided by an individual RCT. The analysis aids in clarifying the effectiveness of virtual reality interventions or treatments and offers insights that individual studies may lack due to limited sample sizes or varied methodologies.

Results

An electronic search of five databases returned 1477 titles and abstracts and one from snowball search. After automatic and manual duplicate removal, 978 records were screened for relevance and the full texts of 30 records were assessed for eligibility. Five unique studies met the inclusion criterion for this review (see Table 3).^{28–32} This is represented in Figure 1 as the PRISMA flow diagram.³³

Risk of bias and quality appraisal assessments

Risk of bias assessments, transferability assessments and quality appraisals were undertaken for all the identified studies. The RCTs were assessed using the revised Cochrane risk of bias tool for randomised control trials, version two (RoB 2)²⁵. Table 4 shows the results of the assessments for each domain. Both RCTs scored some concerns during the risk of bias assessment, this is due to the study design and the participants being aware of which intervention they were allocated to.

The non-RCTs were all assessed using the Joanna Briggs Institute (JBI) checklists and the results are presented in Table 5. All the studies recorded high transferability, meaning that the findings are generalisable to other settings, populations and contexts. The studies scored a yes in each domain of their respective checklists with the exception of confounding factors and adverse events as outlined in Table 5. The completed checklists are included as supplementary materials.

Included studies were few and widely varied in their design. Also, potential data errors were identified in one of the RCTs²⁸. Consequently, results are presented as a critical appraisal and narrative of each individual study and a combined synthesis.

Jiang et al.²⁸ conducted a pilot study that assessed the effectiveness of a single session of virtual reality exposure therapy for BII phobias. The study randomly allocated forty-three participants to either an intervention or a waitlist control group. Participants were aged between 18 and 48 years and diagnosed with either sub-clinical or clinical BII phobia.

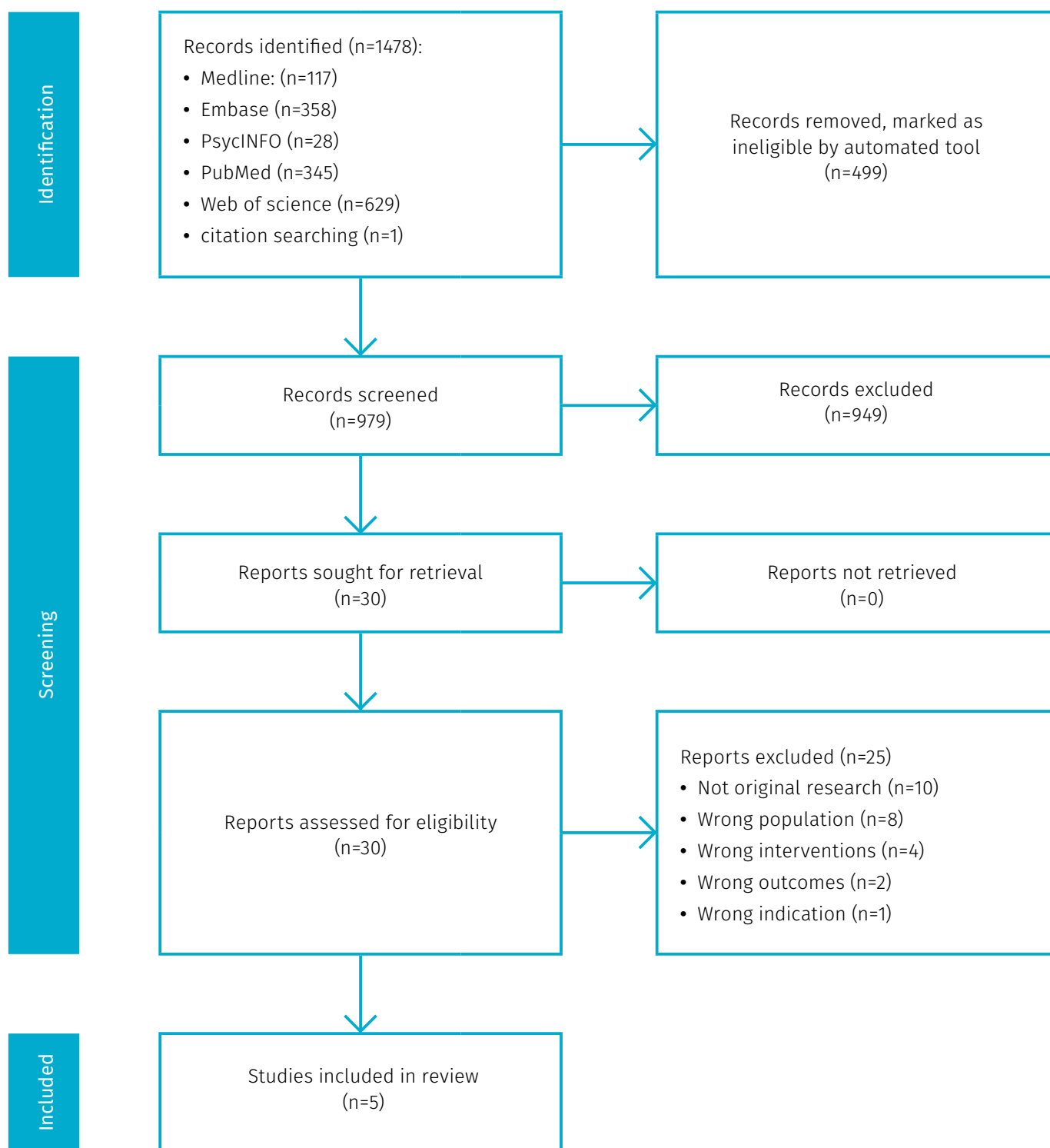


Figure 1: PRISMA flow diagram of paper selection process

Table 3: Data extraction of included studies

Author (year) Country Setting	Study design Measure/s	Population and participant characteristics	Equipment used	Study outcome/s and side effects of using virtual reality	Study limitations
Cheruvattoor et al. ³⁰ (2021) Malaysia Penang International Dental College	cross-sectional study HAM-A,	176 participants (50% female) requiring endodontic therapy or tooth extraction, aged 18–50 years.	Smart phone (underwater environment and music). Exact type of virtual reality headset not reported.	Change in anxiety levels Patients experience with the intervention Physiological observations were not reported. Virtual reality sickness was not reported.	Lack of control group. Only one simulation used.
Jiang et al. ²⁸ (2020) Australia Single session of VRET at University of New South Wales, Sydney	RCT MFS, MBPI, MDAS, ADIS-5, credibility and expectancy questionnaire	43 participants (81.4% female) with diagnosed clinical or sub-clinical BII phobia, aged 18–48 years (M = 23.44, SD = 6.42).	Samsung Gear VR™ headset Samsung Galaxy™ S7 mobile smart phone Dental Gear VR™ package	Change in participants' medical fears (primary) Participant expectations of treatment and rating of treatment rationale credibility (secondary) Physiological observations were not reported. Virtual reality sickness was not reported.	A pilot study has a lower generalisability of findings. The majority of participants were female (n=35, 81.4%), students (n=31, 72.1%) and of Asian descent (stated not specified).
Kunusoth et al. ³¹ (2022) India Department of Oral and Maxillofacial Surgery, MNR Dental College and Hospital, Sangareddy	Case study Patient-reported experience of extraction	1 female participant with phobia of local anaesthesia injection and history of traumatic tooth extraction experience during childhood, aged 20 years.	Smart phone playing soothing video of patient's choice through Iruku mini virtual reality headset.	Demonstrated the efficacy of virtual reality as a distraction for a patient with a dental phobia triggered by exposure to needles. Blood pressure and heart rate were monitored but not reported. Virtual reality sickness was not reported.	None reported
Lacey et al. ²⁹ (2023) New Zealand Participants independently used a mobile health application combining self-guided virtual reality exposure and cognitive behaviour therapy	RCT Severity Measures for Specific Phobia – Adults, PHQ9, FMS scale, Brief Fear of Negative Evaluation Scale	126 participants (80% female) with a fear of flying, heights, spiders, dogs or needles, aged 18–64 years (M = 42.2 years, SD = 13.2).	oVRcome™ app, a mobile health application used on smart phone. Exact type of virtual reality headset not reported.	Change in phobia severity Depressive symptoms Symptoms of social phobia Participant experience with the intervention Physiological observations were not reported. Virtual reality sickness measured (M = 3.3)	No diagnostic interview to confirm phobia. COVID-19 lockdowns limited participant exposure to phobia. Small number of participants in two phobias.
Meindl et al. ³² (2019) USA Baseline and generalisation session in doctor's office. VRET sessions completed in participant's home.	Case study Changing criterion design with generalisation probes	1 male participant with autism spectrum disorder (ASD) and a history of extreme needle phobia, aged 26 years.	Tzumi Dream Vision™ headset iPhone 6s™ smart phone Customised software simulating a doctor's office	Demonstrated the efficacy of a low-cost VRET DRO in increasing compliance with blood-draw procedure for an adult with ASD who had a severe needle phobia. Physiological observations were not reported. Virtual reality sickness was not reported.	The changing criterion design could have been strengthened.

HAM-A = Hamilton anxiety rating scale, MFS = Medical Fear Survey, MBPI = Multidimensional Blood Phobia Inventory, MDAS = Modified Dental Anxiety Scale, ADIS-5 = Anxiety and Related Disorders Interview Schedule for Diagnostic and Statistical Manual of Mental Disorders 5th edition, BII phobia = blood-injection-injury phobia, M = mean, SD = standard deviation, VR = virtual reality, PHQ9 = Patient Health Questionnaire 9 – quick depression assessment, FMS scale = Fast Motion Sickness scale, VRET = virtual reality exposure therapy, DRO =

Table 4: Risk-of-bias assessment results for RCTs

Study	D1: Bias due to randomisation	D2: Bias due to deviations from the intended interventions	D3: Bias due to missing data	D4: Bias due to outcome measurement	D5: Bias due to selection of the reported results	Overall
Jiang et al. ²⁸	Low	High	Low	Low	Low	Low
Lacey et al. ²⁹	Low	High	Low	Low	Low	Low

The outcomes of the Jiang et al. study²⁸ suggest that single-session VRET may offer benefits in terms of reducing catastrophic cognitions and specific fears associated with BII phobia. However, it should be considered as a potential adjunct or preliminary step before traditional in vivo exposure therapy rather than a stand-alone treatment. Furthermore, some potential data errors were identified in the publication. In Table 3 of the study which showed observed means, standard deviations and effect sizes for the clinician-administered outcome measures, the mean and standard deviations columns presented the same figures. Without further data

and considering these potential issues, the interpretation and generalisation of the study's findings may be affected.

The study by Jiang et al.²⁸ also found that between the baseline and one-week post-treatment the intervention group had improvements in BII phobia severity and the cognitions assessment coping score, as rated by clinicians, as well as a demonstrated decrease in their perceived likelihood of the negative experience during the needle exposure and the severity of any negative experience that could occur. These results are suggestive that single-session VRET was

effective in reducing the participants' needle fears.

Lacey et al.²⁹ conducted a study that assessed the effectiveness of the mobile health application 'oVRcome™' in treating specific phobias, including needle phobia among other common fears. The study was part of a two-arm, six-week RCT. In the context of needle phobia, the study found that self-guided use of the oVRcome™ app was effective in reducing the severity of symptoms. The active group, which used the app, showed a greater reduction in needle phobia severity compared to the waitlist control group.

Table 5: Joanna Briggs Institute checklist results for non-RCTs

Study	JBİ checklist	Transferability	Confounding factors	Adverse event
Cheruvatoor et al. ³⁰	JBİ Checklist for Analytical Cross-Sectional Studies ²⁶	High	No	N/A
Kunusoth et al. ³¹	JBİ Critical Appraisal Checklist for Case Reports ²⁷	High	N/A	No
Meindl et al. ³²	JBİ Critical Appraisal Checklist for Case Reports ²⁷	High	N/A	No

JBİ = Joanna Briggs Institute, N/A = not applicable for the checklist

The effect size for the needle phobia subgroup was small to moderate (Cohen's $d=0.266$). This effect size underscores the practical significance of the intervention, suggesting that the oVRcome™ app had a noticeable impact on alleviating needle phobia symptoms. While the effect size is relatively modest, it is important to consider that even small to moderate reductions in phobia severity can have meaningful clinical implications for individuals struggling with needle phobia. Participants were assessed for virtual reality sickness using the Fast Motion Sickness tool (0: no motion sickness – 20: frank sickness) with a mean score of 3.3 and no participants withdrawing due to sickness.

Collectively, these two RCTs underscore the potential of technology-based interventions in the treatment or mitigation of needle phobia symptoms. These findings offer promising avenues for enhancing the accessibility and effectiveness of treatments for individuals grappling with specific phobias. Despite this, the two studies have notable limitations, as outlined in Table 4.

Cheruvatoor et al.³⁰ conducted a cross-sectional study looking at the use of virtual reality as an audio-visual distraction tool in the reduction of dental anxiety during local anaesthesia. The study recruited 176 patients undergoing endodontic therapy or tooth extraction. This study was included as needle exposure is an important reason patients experience dental fear.^{34–36} The authors evaluated participant perception of the use of virtual reality to reduce the level of dental anxiety during local anaesthetic injections.

The participants were introduced to the virtual reality headset and then completed the Hamilton

anxiety rating (HAM-A) scale³⁷. This scale consists of 14 questions, with each question scored from zero to five, for a score range between 0 and 56. The participants then viewed a three-minute video on the headset while the local anaesthetic was administered, then the dental procedure was performed. Immediately after the dental procedure, the HAM-A was readministered, and a feedback questionnaire provided to the participant.

The primary outcome being measured was the change in anxiety levels as measured by the HAM-A scale before and after the virtual reality exposure. The mean anxiety score on arrival to the dental clinic was 3.73 (SD=3.226) and post-intervention it had reduced to 1.80 (SD=2.54, $p < 0.001$). The authors articulated that these findings highlight the effectiveness of the intervention in reducing the levels of anxiety in patients with dental phobia.

The secondary outcomes of the study found that 62.1 per cent of participants felt that the virtual reality intervention was beneficial in reducing their levels of dental phobia and 59.7 per cent of participants would use virtual reality in future appointments.

Kunusoth et al.³¹ conducted a single-patient case study where virtual reality was used to manage dental anxiety during a tooth extraction. The patient was a 20-year-old female with an impacted molar who required dental surgery. Upon examination, the patient reported a traumatic tooth extraction during childhood and a phobia of local anaesthetic injection.

The patient was counselled by the staff that the procedure would be pain free and asked to undertake meditation and deep breathing techniques. Once the patient relaxed,

the procedure was attempted using musical and audio-visual distraction methods. This technique was unsuccessful, and the patient was required to be calmed again using peaceful conversation and meditation techniques.

Since seeing the syringe triggered anxiety in the patient, the virtual reality headset was used to alter their vision and distract them using a soothing video of their choice. The dental work was then undertaken with the patient being surprised after the procedure that the procedure was completed without pain. The patient's heart rate and blood pressure were recorded before and immediately after the procedure. The authors reported that the virtual reality headset was highly effective in controlling the dental phobia for this patient, with the patient reporting that they were happy that the procedure had been completed without pain, increasing their confidence to undergo regular dental check-ups³¹.

Meindl et al.³² conducted a single-participant case study where VRET was used to reduce needle phobia. The participant was a 26-year-old male diagnosed with both autism spectrum disorder and a moderate intellectual disability who required annual blood tests. Due to the participant's severe needle phobia, venepunctures were normally conducted in a paediatric facility by five or more adults using physical restraint and no other patients in the facility at the time of the venepuncture. Before this study, an attempt that did not include virtual reality was made to desensitise the participant to needle exposure by using exposure therapy and differential reinforcement of other behaviours was undertaken that did not include generalisation to the doctor's office.

The study used a changing criterion design methodology to increase the participants' compliance with venepuncture. Each session commenced with the therapist gathering the required equipment and concluded when a pre-determined step was achieved or the participant demonstrated avoidance behaviour. When a targeted step was achieved the participant was rewarded with something to eat. On the other hand, if the participant exhibited avoidance behaviour the session was ceased and recommenced after one minute. One session was required without avoidance before the target step was increased. No more than four sessions were conducted per day. A total of 14 sessions were required for the participant to successfully complete all steps.

Upon completion of the desensitisation process, with all steps completed, generalisation was tested with four sessions conducted one week apart in the same environment but with a primary difference. In the first generalisation test the nurse who was present during the training process undertook a blood draw; in the second generalisation test, a new nurse undertook the blood draw; in the third, the patient's other arm was used, and in the fourth and final test, a new therapist accompanied the participant. Finally, maintenance was assessed by a follow-up session one month after the fourth generalisation test. The patient maintained the improved level of compliance in the test settings and over time, and the authors concluded that virtual reality combined with exposure therapy may be an effective intervention for medical phobias.

Combined synthesis

The primary question being examined by this literature review was the effect of virtual reality on the severity of patient fear or anxiety induced by needle phobia during medical procedures.

Jiang et al.²⁸ and Lacey et al.²⁹ conducted RCTs and found virtual reality to be an effective exposure therapy in adult patients with needle phobia. Lacey et al.²⁹ used the Severity Measures for Specific Phobia – Adults, a self-reporting measurement tool, and all participants reported a reduced level of anxiety ($M = 15.1$, $SD = 10.7$). Meindl et al.³² conducted a successful single-participant case study of a patient with a diagnosis of autism spectrum disorder, finding that virtual reality combined with exposure therapy improved the patient's compliance when having blood drawn. Combined with the findings of Jiang et al.²⁸ and Lacey et al.²⁹, these results suggest that virtual reality exposure therapy has the potential to be an effective tool in desensitising patients to their needle phobia.

Two of the five studies^{30,31} used virtual reality as a distraction therapy in the adult population and concluded that virtual reality could be used to reduce anxiety in dental patients. However, given that these studies were conducted in the context of dental care, it is not clear if the findings are transferrable to medical care. The lack of studies in other related areas presents the opportunity to translate the findings and experiences with virtual reality from dental care to different medical contexts, especially considering the common component of needle fear.

The secondary review questions we examined involved the types of virtual reality technology that

were used, in terms of hardware and software. While all the studies used smart phones connected to virtual reality headsets, the software chosen by researchers was different in each study. The commonality of using mobile phones may be a result of the relatively low cost and availability of this technology. This implies that out of the myriad of virtual reality technologies on the market, no one option stood out as superior in terms of benefits to the patients. This has implications for practice and future studies to consider the different headset options and their impact on patient experience.

In summary, three of the studies^{28,29,32} used virtual reality for VRET, with positive results in reducing patient fear and anxiety. These collective results suggest that VRET could be a successful therapy for patients with needle phobia. Two studies used virtual reality as a distraction therapy and found it to be an effective method of distraction for adults undergoing a needle-based procedure. Although further research is needed, overall, there is potential for virtual reality interventions to reduce needle phobia.

Discussion

The purpose of this rapid review was to investigate the effect of virtual reality on the severity of patient fear or anxiety induced by needle phobia during medical procedures. In addition, we examined the types and characteristics of the virtual reality systems that are in use, any side effects of virtual reality therapy and the characteristics of the patients who used or derived benefit from virtual reality for needle or needle-related phobias.

Only five journal articles were identified as meeting the inclusion criteria. Two of them described

using virtual reality as part of VRET for treating needle phobia. Exposure therapy encourages the confrontation of a feared stimulus with the aim of reducing the level of fear experienced³⁸.

Exposure therapy is the most effective empirically supported treatment for several anxiety disorders, including acrophobia, agoraphobia, arachnophobia, fear of flying, dental phobia, fear of driving and fear of snakes^{39,40}. It uses systematic and controlled exposure to phobic stimuli with the aim of adjusting the inhibitory processes of the prefrontal cortex during exposure and inducing structural changes in the hippocampus following successful therapy⁴¹. It is also highly effective without exposing the patient to the actual fear-inducing stimuli⁴². The downside to exposure therapy is the cost of setting up the individual exposure scenarios⁴³. VRET sessions require one simulation to be created which can be used for multiple sessions and, if clinically appropriate, multiple patients.

Two of the publications included in this rapid review were case studies that used virtual reality either as a distraction therapy or in conjunction with exposure therapy. Only one of these case studies examined a patient specifically with needle phobia. No RCTs were identified that focused specifically on adults with needle phobia, highlighting gaps in this area. Only one cross-sectional study that examined the effect of virtual reality as a distraction for reducing the anxiety levels experienced by people undergoing dental procedures. A contributing factor that we identified during our search is that research into virtual reality for needle phobia in adults has only emerged as recently as 2020²⁸. Several studies were

identified that researched virtual reality for paediatrics; however, research into using virtual reality with adults is only now emerging.

Several systematic reviews evaluating virtual reality as a method of distraction therapy were identified during this rapid review. The studies included in those systematic reviews were all excluded from this review as they related to paediatric patients; however, the systematic reviews indicated that virtual reality was an effective distraction modality in paediatric patients with needle phobia and this may be applicable to the adult population.

A key point to note is the distinction between VRET and virtual reality-based distraction therapy. Unlike VRET, distraction therapy does not focus on the treatment of the wearers' phobia, it distracts the wearer from the pain or fear-inducing stimulus. VRET is a longer-term solution to the patient's phobia, whereas distraction therapy is a potential solution to the acute clinical requirements of a situation where the patient is exposed to a phobic stimulus.

As a concept, distraction therapy has been previously studied for the management of BII and needle phobia in adults^{44–47}; however, none of these studies used virtual reality as the means of distraction in the adult patient. Virtual reality is superior to traditional distraction therapy as it involves the wearer's auditory and visual processing and, in theory, demands more attention than the traditional methods of distraction^{48,49}. The participant's sense of immersion in the virtual environment is increased by increasing the quality of the virtual reality headset⁵⁰ and the addition of auditory stimulus⁵¹. Virtual reality has been found to be beneficial for

medical procedures in adult patients including burn dressing changes⁵², minor procedures^{53,54} and medication injections⁵⁵. It has been found to reduce the level of pain experienced, thereby reducing the amount of analgesia required. As a result of the reduction in pain experienced, patient satisfaction levels have been increased.

One of the strengths of this rapid review is that we followed the PRISMA guidelines and the framework for literature reviews as outlined by Peters et al.¹⁹ and Arksey et al.²⁰ with additional steps outlined by Pluddemann et al.²¹ to reduce bias and increase the outcome of the review. The PROSPERO registration and the rapid review protocol were published before conducting the review to increase the transparency of the findings. A possible limitation of this review is that the literature search was limited to five databases. It is possible that there are relevant publications in databases that were not searched.

Conclusions

Based on the studies identified, there is evidence, albeit limited, that virtual reality can alleviate the symptoms of needle phobia. We found a paucity of research about virtual reality as either a treatment for needle phobia or as a distraction therapy in adult patients. Most of the identified studies demonstrated benefits of virtual reality for needle phobia during dental procedures. A potential field of research exists for researchers as further research is required into the effectiveness of virtual reality as either a desensitisation procedure for treating needle phobia or a management technique for reducing fear and anxiety in the acute phase of needle exposure. Our team is conducting a feasibility study to

examine the use of virtual reality as a distraction therapy for a needle phobic patient during acute needle exposure.

Author contributions

CG conceived and designed the study, CG performed the database searches, CG and TR screened and determined the eligibility of articles. CG performed the data extraction, data synthesis and risk of bias assessment under the supervision of TR. CG authored the paper with contribution and editing from TR and IB.

Declaration of conflicting interests

The authors have declared no competing interests with respect to the research, authorship and publication of this article.

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Barriers to and facilitators of using cognitive aids in perioperative emergencies: An integrative review

Abstract

Problem identification: Perioperative emergencies, although infrequent, may lead to significant morbidity and mortality associated with anaesthesia and/or surgery. Human factor errors account for between 43 to 65 per cent of sentinel events in the perioperative environment. Cognitive aids were introduced to reduce a user's cognitive workload and assist in adherence to key interventions during emergencies. Despite the availability of these aids, implementation of their use remains low. This integrative literature review will identify the barriers to and facilitators of the implementation of cognitive aids during perioperative emergencies.

Literature search: An electronic database search of EBSCO databases (CINAHL Complete, Health Source: Nursing/Academic Edition, MEDLINE, MEDLINE Complete), Pubmed and Scopus were conducted to obtain contemporary literature. Duplicates were removed and inclusion and exclusion criteria were applied. A total of 14 articles were identified for inclusion.

Data evaluation and synthesis: Included articles were critically analysed and appraised using the JBI critical appraisal tools to assess for the methodological quality of the research, and the National Health and Medical Research Council (NHMRC) evidence hierarchy to assess for reliability and validity. A data extraction table (literature matrix) was used to record the article's author, date of publication, research title, population, study design, level of evidence, key findings, implications for practice and limitations. This aided in synthesis of the selected studies, thematic analysis and drawing conclusions.

Implications for practice: Strong design and staff education were identified as facilitators of cognitive aid implementation while poor design and lack of organisational support were identified as barriers to cognitive aid implementation. Nursing leaders and educators have a vital role to play in gaining organisational support to provide staff education and training and develop appropriately designed cognitive aids.

Keywords: cognitive aids, emergency manual, perioperative, operating room, anaesthesia

Introduction

Critical events in the perioperative period, although rare, can be a significant cause of morbidity and mortality in surgical patients¹. Recent studies have found that, during this highly stressful situation, human factors such as impaired clinical decision-making, lack of team communication and absence of situational awareness, led to poor management and negative patient outcomes in the operating theatre^{2,3}. In fact, it has been reported that 43 to 65 per cent of sentinel events that occur in the operating theatre are due to human factor errors². It is essential for perioperative nurses, as part of the multidisciplinary team, to be familiar with human factor principles and possess non-technical skills to ensure patient safety during emergencies⁴.

To mitigate human factor error, the introduction of cognitive aids was implemented during crisis resource management in the perioperative setting^{5,6}. Cognitive aids are defined as tools that assist in completing key tasks to effectively manage critical emergencies during the perioperative period^{2,7}. These can be in the form of checklists, emergency manuals, algorithms or flowcharts^{5,8}. Cognitive aids assist in reducing cognitive workload and stress and increasing adherence to timely recall of key interventions during critical events^{6,9,10}. Previous studies have shown the effectiveness of using cognitive aids in improving team performance during simulated crises⁹. Other studies have found increased clinical performance after the use of cognitive aids was implemented in their clinical practice^{2,6}.

Problem Identification

Despite the availability of published cognitive aids in the workplace,

successful implementation of their use remains a challenge². Routine use of such aids during actual critical events in the operating theatre remain significantly low². Hence, this literature review will aim to answer the research question 'What are the barriers to and facilitators of the implementation of the use of cognitive aids during perioperative emergencies?'

Review methods

Search strategy

An integrative review methodology was employed using the guidance outlined in Whittemore and Knafl's¹¹ stages of integrative review. This integration of both qualitative and quantitative data allowed for a fully inclusive examination of this phenomenon¹¹.

An electronic database search was conducted to find the contemporary literature available. Databases searched were EBSCO databases (CINAHL Complete, Health Source: Nursing/Academic Edition, MEDLINE, MEDLINE Complete), Pubmed and Scopus. The following medical subject headings (MeSH) terms, Boolean operators and truncation were used for the search: "cognitive aids" AND "perioperative", "cognitive aids" AND "operating room", "cognitive aids" AND surgery, "cognitive aids" AND anaesthesia, "cognitive aids" AND nurs*, "cognitive aid" AND "perioperative", "emergency manual" AND perioperative.

Inclusion and exclusion criteria

To ensure contemporary scholarly literature, only peer-reviewed published papers were searched between 2018 to 2023. Full-text papers written in the English language were included in this review due to constraints in language interpretation. Research

papers older than five years were cited forward through the Scopus database to obtain contemporary literature relevant to the chosen topic. Reference lists from searched papers were also reviewed and included. Studies that were not related to the perioperative setting or context, were published in languages other than English, reported poor-quality research or were published in non-peer reviewed journals were excluded from the study (see Figure 1).

Data evaluation and synthesis

The studies reviewed were primary research papers using quantitative, qualitative and mixed-methods methodologies to facilitate direct analysis of key findings for each study. Data extraction for this review included the author, date of publication, research title, population, study design, level of evidence, key findings, implications for practice and limitations. Included research papers were critically appraised and synthesised through thematic analysis. A data extraction table (see supplemental material) was used to record data related to barriers to and facilitators of the implementation of cognitive aids in the operating theatre. Based on these main themes, similar data were identified to generate subthemes for discussion and drawing conclusions.

Quality appraisal

To assess the reliability and validity of the research papers included in this review, the National Health and Medical Research Council (NHMRC) evidence hierarchy was used. Each paper was assessed for strength of evidence, possible risk of bias, clinical significance and relevance to the use of cognitive aids during perioperative emergencies.

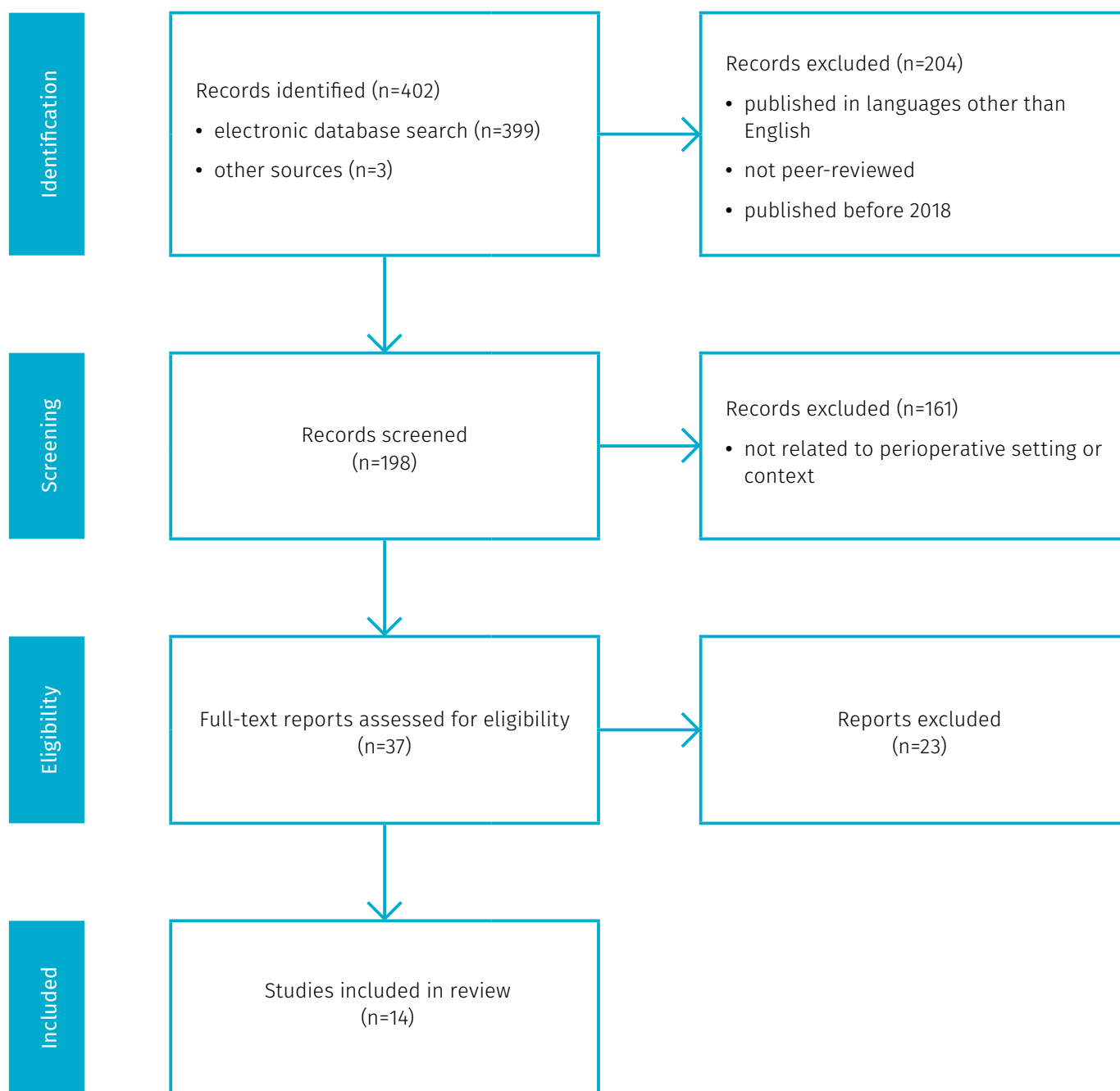


Figure 1: Flow diagram of paper selection process

Furthermore, included studies were critically appraised using the Joanna Briggs Institute (JBI) critical appraisal tools to assess for the methodological quality of the research. Each study was evaluated against eight to thirteen criteria with allocated scores of 'yes', 'no', 'unclear' and 'not applicable'. The overall appraisal of the quality of each research paper was interpreted by the author as low, moderate or high.

Results and discussion

A total of 14 research papers^{1-3,5-10,13-17} were identified that reported on the use of cognitive aids during emergencies in the operating theatre and met the inclusion criteria. There were five level II randomised controlled trials (RCTs)^{1,2,7,10,15}, two level III-2 quasi-experimental studies^{6,16}, two level IV cross-sectional studies^{3,5}, one mixed-method study¹⁴, one narrative review¹⁷ and three qualitative studies^{8,9,13}. After critical examination of these papers, two key themes emerged – barriers to implementing cognitive aids and facilitators of implementing cognitive aids. These themes and sub-themes are discussed below.

Barriers to implementation of cognitive aids

Barriers to implementation may be defined as a 'factors that hinder, limit or prevent people from engaging in a certain behaviour'^{12, p.2}. The two sub-themes identified were 'lack of organisational support' and 'poor cognitive aid design'.

Lack of organisational support

Two cross-sectional studies^{3,5} and one qualitative study⁸ found that lack of organisational support was a significant barrier to effective implementation of cognitive aids during perioperative emergencies.

A cross-sectional study by Aldina et al.³, where 368 surveys were completed by various perioperative professions, explored the key factors that influence effective implementation of cognitive aids during critical events in the perioperative period. The study found a statistically significant correlation between reduced success implementing cognitive aids and both lack of leadership support ($p < 0.0001$) and the absence of an organisational driver for change ($p = 0.0112$).

Training and knowledge sharing are aspects of organisational support that may also influence implementation of cognitive aids. In their cross-sectional study of anaesthesia providers in France and Canada, Blanie et al.⁵ found that only 23 per cent of French anaesthetists and 27 per cent of Canadian respondents received formal training in the use of cognitive aids during medical emergencies in their workplace. In addition, Swedish Registered Nurse Anaesthetists (RNAs) who participated in a phenomenographic study by Knudsen et al.⁸ reported a lack of knowledge about difficult airway algorithms. Knudsen et al.⁸ found that the RNAs in their study viewed difficult airway algorithms as tools that were used by other members of their team but not shared with them.

Poor cognitive aid design

Another common barrier to implementation that emerged from the literature was poor design of cognitive aids^{7,10,17}. In their 2019 narrative review, Kolawole et al.¹⁷ reported that cognitive aids with simple, linear designs were preferred to complex branching algorithms. In an earlier RCT, involving 20 anaesthetist-anaesthetic assistant dyads, McIntosh et al.⁷ investigated the usability of three cognitive

aids in managing a simulated local anaesthetic (LA) toxicity emergency. Common issues identified by most dyads were dense text, excessive information and poor use of colour which led to prolonged and difficult retrieval of vital information during a simulated anaesthetic emergency⁷. Moreover, two-sided cognitive aids, cognitive aids with multiple-streamed flow and inappropriate use of coloured-text influenced users clinical performance, e.g. key interventions were missed and drug doses miscalculated.

These findings were supported by Clebone et al.¹⁴ in a mixed-method study of anaesthetic residents and RNAs ($n = 23$). Traditionally, cognitive aids use a linear design with step-by-step presentation of information. Clebone et al.¹⁴ investigated whether non-linear cognitive aids that used design features to enable faster retrieval of information were also perceived as easier to use than cognitive aids with a more traditional linear design.

This research used a survey with ratings between 0 to 100, 100 being the highest level of agreement, and structured interviews to assess how participants perceived the usability of cognitive aids. Findings revealed that non-linear cognitive aids that were designed for retrieval of specific information were viewed as easier to use than linear cognitive aids ($p < 0.01$ on each aid)¹⁴. The cognitive aids designed for the study had colour-coded, categorised and clustered content and were perceived to be more useable than the alternative step-by-step cognitive aid¹⁴. The researchers also highlighted that grouping crisis-specific interventions has significant implications for timely retrieval of vital information during crisis resource management¹⁴.

Facilitators to implementation of cognitive aids

Facilitators to implementation may be defined as 'factors that favour, facilitate, or help people to engage in a certain behaviour'^{12 p.2}. The two subthemes identified were 'strong cognitive aid design and content' and 'staff education and training'.

Strong cognitive aid design and content

The importance of design is supported by another study by Clebone et al.¹⁰ who noted that health care providers may use 'sampling' when looking at cognitive aids during an emergency as they only need specific information. The researchers hypothesised that cognitive aids that were designed to enable sampling would allow users to find relevant information more quickly¹⁰. Their study compared speed of information retrieval and eye-tracking data of 23 anaesthesia care providers using one of three cognitive aids to manage one of three common intra-operative emergencies in a low-fidelity simulation. Cognitive aids 1 and 2 were designed according to cognitive science principles, with 'clustering' of information that shares a common thread, to enable sampling, and cognitive aid 3 had a more traditional step-by-step or linear design. The emergencies were anaphylaxis, hyperkalaemia, and LA toxicity.

Analysis of response times revealed a statistically significant correlation between the layout and design of cognitive aids and the time to gain critical information ($p = 0.006$ cognitive aid 3 vs cognitive aid 1; $p < 0.001$ cognitive aid 3 vs cognitive aid 2). Eye-tracking data showed that participants using the step-by-step cognitive aid spent more time obtaining critical information than

participants who used either of the aids designed to enable sampling¹⁰. Although clinical performance was limited to a low-fidelity simulation, the researchers concluded that cognitive aids designed according to cognitive science principles may allow faster retrieval of information¹⁰ thus enabling timely implementation of key interventions in actual perioperative emergencies.

King et al.¹³ also reported that cognitive aids designed for accessibility of information allowed faster retrieval of specific information which may be a significant factor in the successful implementation of cognitive aids during a perioperative emergency. In an observational study of 12 anaesthetic professionals, King et al.¹³ investigated the accessibility of key information in five published cognitive aids for managing malignant hyperthermia (MH). Using a calibrated eye tracking system, they measured each participant's cumulative time spent in obtaining information from these cognitive aids. Although participant's level of experience did not show any correlation with the research outcomes, findings revealed that retrieval of vital information was more rapid from the cognitive aid with potentially advantageous design features ($p < 0.001$) compared to the other four MH cognitive aids tested¹³. Potentially advantageous design features identified by the researchers included minimal colour blocking, simple typeface, single-page presentation and a linear, step-by-step layout¹³.

Design that accommodates delayed access may also facilitate implementation of cognitive aids. Clebone et al.¹ hypothesised that most clinicians will have already instigated initial interventions prior to accessing a cognitive aid. They

reanalysed previously published data from a range of simulated paediatric emergencies and found that in 95 per cent of the trials the time between emergency event trigger and cognitive aid use was between 90 and 354 seconds, depending on type of emergency¹. The authors concluded that cognitive aids may be more effective if designed to accommodate being accessed at times after the event trigger. This finding is consistent with earlier studies by Clebone et al.¹⁰ and King et al.¹³ that support the importance of design and justify the need for better design of cognitive aids with more focus on the crisis-specific interventions. This could further assist clinicians in timely and effective decision-making when managing perioperative emergencies, which may also increase the uptake of cognitive aids in future critical events¹.

Staff education and training

Staff education and training also emerged as a facilitator of cognitive aid use within the perioperative environment. A quality improvement project by Gallegos and Hennen¹⁶ found that staff were more willing to use a cognitive aid and perceived it in a more favourable light after in-service training about it. Similarly, Gleich et al.⁶ evaluated anaesthesia team member performance after implementation of an emergency manual including cognitive aids and reported that familiarity and accessibility are crucial. In contrast, an RCT involving 25 senior anaesthetic trainees by Siddiqui et al.¹⁵ found that overall uptake of a cognitive aid during simulated events was only 17.9 per cent, despite formalised education about the cognitive aid. The authors speculated that this may have been because the cognitive aid education was part of the general

orientation for trainees and so it was overshadowed by other material.

The positive impact of staff education was also shown by Zasso et al.² in their RCT involving 40 teams of three (anaesthesia resident, anaesthetic nurse and respiratory therapist). In that study, participant teams were randomly assigned to either the intervention group or the control group. Both groups received education about crisis resource management including team communication and the idea of cognitive aids. The intervention group also received extra training that familiarised participants with using a cognitive aid for managing airway emergencies; the control group did not receive this extra training. The teams in both groups then participated in a simulated airway emergency, 'can't intubate, can't oxygenate' (CICO) with the cognitive aid on display during the simulation. Videos were taken of all teams managing the simulation and the videos were rated by three independent raters. It was found that the clinical decision to perform front of neck access was made significantly faster in the intervention group than the control group (mean SD, 80.9 54.5 vs 122.2 55.7 s, difference (95% CI) – 41.2 (- 76.6 to -6.0, $p = 0.023$)². It was also found that the intervention group used the cognitive aid more than the control group. Furthermore, an intention to use the cognitive aid, if available, in the future was indicated by nearly all participants in both groups (93.3 vs. 96.7%, $P = 0.67$)².

While these results indicate that training may facilitate the use of cognitive aids, the authors identified certain limitations to their study – in particular that results from a simulation scenario may not be transferrable to clinical situations, that the mostly junior participants

may not be representative of the wider clinician population, and that the time between training and the simulation for teams varied between one and four weeks².

Training in and familiarisation with cognitive aids was also demonstrated to have a positive impact during an intra-operative emergency as reported in a case study by Merrell et al.⁹ This qualitative study was carried out in a tertiary training hospital where introduction of cognitive aids, in the form of an emergency manual, had been supported by training and familiarisation for perioperative staff. The researchers interviewed the six clinicians who had been present during an intra-operative cardiac arrest and analysed the interview transcripts. The study revealed that cognitive aid use during an intra-operative emergency facilitated effective team performance through appropriate delegation of key roles and responsibilities, fostered a 'calm work environment' and reduced stress among the perioperative team^{9 p.10}. Finally, a cross-sectional study by Alidina et al.³ found that dedicated time to train staff was associated with more successful implementation of cognitive aids ($p = 0.0189$).

Limitations

This review was limited by the small sample size of included primary research. In addition, most of the included studies were performed in a simulated or controlled environment and involved anaesthesia team cohorts. Hence, care must be taken in generalising results from research in this review to real-life situations and perioperative emergencies where all perioperative staff, not just anaesthesia staff, would be involved.

Implications for perioperative nursing practice or research

The aim of this review was to identify and understand the barriers to and facilitators of implementation of cognitive aids during perioperative emergencies. Strong design and staff education were identified as facilitators of cognitive aid implementation while poor design and lack of organisational support were identified as barriers to cognitive aid implementation.

If cognitive aids are to be more widely implemented in perioperative settings cognitive aids must be well designed and their implementation must be supported by health service organisations. Nursing leaders and educators play a vital role in promoting quality improvement initiatives by supporting staff training and education in the use of cognitive aids during perioperative emergencies, not just the for the nursing team but for all multidisciplinary team members. Furthermore, findings from this review can assist nursing leaders to evaluate and improve existing perioperative cognitive aid designs using contemporary evidence-based literature and guidelines from professional bodies.

While most of the studies involved cognitive aids used in simulation training, there is still limited evidence of their effectiveness in actual clinical practice. For this reason, it is recommended that further research is conducted into the use of cognitive aids in real-world emergency situations. Likewise, due to a relatively small sample size of studies and studies involving only anaesthesia professionals, further research is needed with the multidisciplinary team to understand other factors that influence successful cognitive aid implementation.

Conclusion

This review identified lack of organisational support and poor design of cognitive aids as barriers to implementation and strong design and staff education and training as facilitators of implementation of cognitive aids. Organisational support, staff education and training, development of appropriately designed cognitive aids and effective implement processes are key to encourage increased use of these important tools.

Declaration of conflicting interests

The authors have declared no competing interests with respect to the research, authorship and publication of this article.

Acknowledgement

This paper was submitted to the University of Tasmania as part of the fulfilment of subject CNA803 Advanced Clinical Nursing Practice for the Master of Clinical Nursing (Anaesthetic and Recovery Nursing). The author sincerely wishes to thank Dr Paula Foran, unit coordinator, for her continued guidance throughout the master's course and work in preparing for this paper for publication.

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Barriers to and facilitators of using cognitive aids in perioperative emergencies: An integrative review

Supplement: Literature matrix

Search strategy

Databases used: EBSCO databases (CINAHL Complete, Health Source: Nursing/Academic Edition, MEDLINE, MEDLINE Complete), Pubmed, Scopus.

Search terms, keywords and phrases: “cognitive aids” AND “perioperative” (127), “cognitive aids” AND “operating room” (29), “cognitive aids” AND surgery (28), “cognitive aids” AND anaesthesia (131), “cognitive aids” AND nurs* (52), “cognitive aid” AND “perioperative” (22) “emergency manual” AND perioperative (10)

Author (year)	Title (intent) Study design (level of evidence)	Population/sample	Key findings	Conclusions, implications and recommendations	Limitations of the study
Alidina et al. ¹ (2018)	Factors associated with the use of cognitive aids (CAs) in operating room crises: A cross-sectional study of US hospitals and ambulatory surgical centres (To examine organisational context and implementation process factors influencing the use of CAs for operating room crises.) Cross-sectional study (Level IV) The relationship between main outcome and covariates was analysed. The main outcome was reporting more successful versus less successful implementation; the covariates were facility quality improvement experience, implementation processes, diverse uses for CAs.	368 surveys (1796 survey responses were collected from individuals who downloaded CAs, of which 1428 were excluded leaving 368 surveys as the final dataset.) Survey responses were excluded if they were incomplete, respondent's workplace had used CAs for less than six months, respondents had not used the downloaded CA, deployment of the CA was still in process, respondents indicated uncertainty about CA use, respondents were outside the United States of America.	Barriers (mentioned by a higher percentage of respondents from facilities with less successful CA implementation): • lack of institutional commitment to improving patient safety ($p=0.0026$) • lack of leadership support ($p<0.0001$) • absence of an implementation champion ($p<0.0001$) • provider resistance to using CAs ($p=0.0155$). Facilitators (mentioned by a higher percentage of respondents from facilities with more successful CA implementation): • institutional commitment to improving patient safety ($p=0.0007$) • leadership support ($p<0.0001$) • time to train staff ($p=0.0332$).	Building strong organisational support and following a well-planned multi-step implementation process will likely increase the use of operating room CAs. Recommendations: • perform quality improvement initiatives to create a 'quality culture' • build leadership support • make time available for training • address reasons for resistance to enhance willingness to use CAs • follow a multi-step implementation process • use CAs in different contexts (e.g. simulations, preparation, debriefing, educational review) to encourage their use.	Research based on surveys can be influenced by many biases. The outcome measure is a perception rather than an actual measurement, and there may be same-source bias since dependent and independent variables came from a single respondent. The analysis is limited to reporting associations and not causality. There is a small possibility of more than one respondent from a single facility. The researchers were not able to adjust for clustering. The analysis is reflective of implementation experience surrounding two specific tools, the experience with other tools may be different. The survey was given at a single point in time, limiting the ability to better understand sustainability.

Author (year)	Title (intent) Study design (level of evidence)	Population/sample	Key findings	Conclusions, implications and recommendations	Limitations of the study
Blanié et al. ² (2020)	Use of cognitive aids: Results from a national survey among anaesthesia providers in France and Canada (To assess the knowledge and use of cognitive aids (CAs) by anaesthesia providers in France and Canada.) Cross-sectional study (Level IV) Statistical analysis was not performed because of the low response rate.	912 (survey 1) from individuals in France 278 (survey 1) from individuals in Canada 28 (survey 2) from simulation centres in France (Survey 1 was emailed to French and Canadian anaesthesia providers in 2017 through their respective national societies. Survey 2 was emailed to French simulation centres.) 70% of the French respondents and 85% of the Canadian respondents were anaesthetists, mostly with more than five years of experience.	- Although 56% of French and 92% of Canadian respondents knew about CAs and 66% of French and 85% of Canadian respondents indicated CAs were available in their workplace, only 38% of French and 44% of Canadian respondents had actually used them. This confirms the well-known difficulties of implementing new strategies. - Only 25% (225/912) of French and 45% (126/278) of Canadian respondents had received formal training in how to use CAs. This is a very important finding as unfamiliarity with a CA has been shown to lead to suboptimal care. 82% of simulation centres used CAs in their high-fidelity simulation sessions in anaesthesia.	CAs were better known in Canada than France, but their actual use in real life was low in both countries. Simulation appears to play a potentially important role in training anaesthesia providers in the use of CAs.	The main limitation of this study is the low response rate (7% in France and 11% in Canada). There is also a possible selection bias as some respondents may have taken the time to complete the questionnaire because they knew and had some interest in using CAs.
Clebone et al. ³ (2019)	Matching design to use: a task analysis comparison of three cognitive aid designs used during simulated crisis management (To compare a linear cognitive aid (CA) with non-linear CAs designed according to cognitive science principles to optimise acquisition of specific information.) Randomised controlled trial (Level II) Participants were surveyed before and after the simulated scenarios. Eye-tracking was used to determine where participants were looking while accessing the CAs	23 participants Participants were recruited from the anaesthesia department of an academic tertiary care medical centre and from a national paediatric anaesthesia conference and comprised 17 anaesthesia faculty members, 3 senior residents or fellows, 3 nurse anaesthetists.	- The CAs with non-linear design facilitated faster information acquisition during a spectrum of critical event scenarios that required different types of information for successful patient management. - Eye-tracking data confirmed that participants seeking information spent more time searching the linear than the non-linear CAs.	Incorporating specific CA design features is feasible and may facilitate efficient acquisition of crucial information during patient crisis management.	Findings from this study may not be generalisable to other anaesthesia providers. Potential confounding variables were not accounted for. Participants were assigned tasks that could bias performance in favour of the experimental aid designs. Limitations in eye-tracking technology, variability in how the tracking device was worn and incomplete eye-tracking information for more than 50% of participants may have influenced the data.
Clebone et al. ⁴ (2020a)	The effect of cognitive aid design on the perceived usability of critical event cognitive aids (To compare the perceived usability of a linear cognitive aid (CA) with non-linear CAs designed to optimise discrete information transfer.) Mixed methods (Level IV) Participants used CAs during low fidelity simulation scenarios. A quantitative assessment of perceived usability was performed and structured knowledge elicitation interviews conducted.	23 participants Participants were recruited from the anaesthesia department of an academic tertiary care medical centre and from a national paediatric anaesthesia conference and comprised 17 anaesthesia faculty members, 3 senior residents or fellows, 3 nurse anaesthetists.	- The non-linear CAs were perceived as more usable than the linear CA across a range of hypothesised situations. On a 0–100 scale the median (IQR) rating was 25 (18,23) for the linear aid and 89 (80,95) and 81 (65,90) for the two non-linear designs with a higher number indicating greater ease of use ($P < .01$ for each). - Narrative responses suggested specific features that improved usability, including simplicity, accessibility and content.	CAs designed for retrieval of discrete information are perceived as easier to use by anaesthesia clinicians involved in critical event management. Design of CAs may improve clinician responses to critical events and increase overall compliance with CA use. Further research in CA design is needed to optimise the utility and usability of these important tools.	Findings from this study may not be generalisable to other institutions or anaesthesia providers. Responses were not stratified by training level or role and experience may affect perception of CAs. The effect of CA design on clinical outcomes was not evaluated. Nevertheless, because clinician willingness to use CAs is a major barrier to their adoption, improving perceived ease of use and reducing cognitive workload is an important aspect of increasing implementation.

Author (year)	Title (intent) Study design (level of evidence)	Population/sample	Key findings	Conclusions, implications and recommendations	Limitations of the study
Clebone et al. ⁵ (2020b)	The timing of cognitive aid access during simulated paediatric intra-operative critical events (To measure the time from critical event trigger to cognitive aid (CA) use, and the number and type of key behaviours performed by simulation participants prior to CA access.) Randomised controlled trial (Level II) Previously published simulation data was reanalysed to measure the time from event trigger to CA use, and the number and type of key behaviours performed by simulation participants prior to CA access.	65 trials (Simulated paediatric intra-operative events divided into six types: arrhythmia, venous air embolus, hypoxemia, malignant hyperthermia, hypotension and supraventricular tachycardia. Participants were 89 anaesthesia residents and student nurse anaesthetists.)	- The average time from event trigger to first CA use was 258 seconds. - In 95% of trials (62/65) the CA was accessed after at least one key behaviour had already been performed. - The time from event trigger to CA use varied by type of scenario ($P = .03$, $df 5$, adjusted H 12.78), with the shortest time for 'supraventricular tachycardia' (90 [66,156] seconds (median [IQR]) and the longest time for 'hypoxemia' (354 [192,492] seconds).	In simulated critical events, anaesthesia residents and student nurse anaesthetists often consulted a CA only after first performing at least some key behaviours. Incorporating the possibility of delayed access into critical event CA design may facilitate the effectiveness of that aid. Because clinicians may access the CA after already initiating a response Designing CAs to accommodate access after a response to a critical event has been initiated may facilitate interest in and increase use of CAs by making them easier to use. The design of critical event CAs should consider the type of critical event being addressed, how familiar the practitioner already is with that event, and whether the CA is likely to be used for decision support, key pieces of information or both.	Findings from this study may not be widely generalisable because: - it was a retrospective analysis of data from simulated critical events involving certain scenarios - participants represented a limited number of roles, all were residents in training or student nurse anaesthetists - participants were emailed the CAs several days before the trials which is unlikely to occur in real-world conditions.
Gallegos et al. ⁶ (2022)	Malignant hyperthermia preparedness training: Using cognitive aids and emergency checklists in the perioperative setting (To prepare perioperative staff to respond to a malignant hyperthermia crisis effectively with the assistance of a cognitive aid (CA) and assess participant willingness to use it.) Quasi-experimental study (Level IV) Participants received in-service education about the CA, participated in a simulation exercise and completed pre- and post-implementation surveys.	13 perioperative staff members at a military ambulatory surgical centre participated in the training. (Participants included 5 registered nurses, 2 registered nurse anaesthetists, 5 operating room technicians, 1 participant who did not state their job title. Participant years of practice varied from less than four years to more than 20 years.) 9 participants completed the post-implementation survey.	- Staff positive perception of and willingness to use the CA improved after implementation of an education session and simulation exercise using the CA. - Participants felt the training was beneficial in treating a patient with malignant hyperthermia and in the use of CAs in general. - Many clinicians were distrustful of or biased against the use of CAs if they had not been previously trained to use them.	Introduction of the CA to multidisciplinary perioperative staff with an in-service and simulated malignant hyperthermia scenario improved staff perception of CA use during emergencies. Use of CA checklists during simulated perioperative emergencies was shown to reduce missed critical treatment steps.	
Gleich et al. ⁷ (2019)	Emergency manual implementation in a large academic anaesthesia practice: Strategy and improvement in performance on critical steps (To implement a cognitive aid and subsequently evaluate team member performance on critical steps.) Quasi-experimental study (Level IV) Phases of emergency manual (EM) implementation were observed and utilisation of the EM was tested using a standardised verbal simulation of three crisis events both pre-implementation and six months post-implementation.	Pre-implementation phase: 59 participants Post-implementation phase: 60 participants (Participants were equal proportions of anaesthesiology attending physicians, resident physicians, nurse anaesthetists and student nurse anaesthetists.)	- Significantly improved performance (adherence to critical steps) on three verbal-simulated crisis events were recorded when subjects used the EM after implementation. - The time and cost needed to custom design a new EM was prohibitive. - Familiarity and accessibility are crucial when introducing a new EM. - Despite a wide range of verbal and e-mail communication to the department staff, a minority of practitioners (42%) used the EM during our verbal simulation study of intra-operative crisis events six months after implementation.	Implementation of an EM in a large academic anaesthesia practice is not without challenges. While full integration of the EM was not achieved, we demonstrated improved performance on simulated crisis events. Future efforts will be directed toward increasing familiarity and use to achieve more culture change and, ultimately, full integration. Recommendations: - use an existing EM and modify it to meet local institution needs - include surgical staff in implementation of and training in an EM.	Findings from this study may not be widely generalisable because: - only staff from the anaesthesiology department - were included - the sample size was small - there was no control group - intergroup analysis was not performed - there may have been confounding factors from participant characteristics, such as intellectual ability and experience level, and the study duration, such as factors that changed with time over the six months of the study.

Author (year)	Title (intent) Study design (level of evidence)	Population/sample	Key findings	Conclusions, implications and recommendations	Limitations of the study
King et al. ⁸ (2018)	Using eye tracking technology to compare the effectiveness of malignant hyperthermia cognitive aid design (To compare the accessibility of five malignant hyperthermia cognitive aids (CAs).) Observational study (Level IV) Eye-tracking was used to measure time taken to answer three questions and time to first gaze fixation.	12 attending anaesthesiologists (a convenience sample from a single university-affiliated Veterans Affairs hospital)	- Participants demonstrated the shortest cumulative time to answer when viewing the Society for Pediatric Anesthesia (SPA) CA compared to the four others. - Potentially advantageous design features of the SPA CA include linear layout on a single page and simple typescript with minimal use of single colour blocking.	Eye tracking technology may provide useful data in the design of future CAs. This represents a new application within the field of medicine and warrants further research.	The sample size was small and based at a single institution to allow easy access to the study site for all participants. Generalisability is limited to the set of CAs and topic studied. Metrics related to CA performance using eye tracking in this experimental setting may not translate to performance in other real-life settings such as clinical simulation or actual clinical care. The differences in eye tracking metrics between CAs can be measured in seconds, and we do not yet know if these differences are clinically relevant.
Knudsen et al. ⁹ (2022)	Swedish registered nurse anaesthetists' understanding of difficult airway algorithms (To explore Swedish registered nurse anaesthetists' different ways of understanding difficult airway algorithms.) Qualitative study, phenomenographic approach (Level IV) Individual interviews were conducted and the data analysed.	18 nurse anaesthetists working at three hospitals in Sweden	- Nurse anaesthetists have different ways of understanding difficult airway algorithms. - Some participants viewed algorithms as a tool for anaesthesiologists that is not communicated to or available for them. - Most participants viewed airway algorithms as an important supportive shared plan to improve teamwork. - Many participants considered it important for nurse anaesthetists to communicate airway procedures and difficult airway algorithms to enforce compliance. - Many participants reported that having a shared algorithm allowed them to feel prepared when they were alone and airway problems arose.	Airway algorithms for management of difficult airways were understood in three different ways: - Algorithms constitute a plan not communicated at the clinic. - Algorithms constitute a shared plan to improve teamwork. - Algorithms constitute a plan for how to think and work systematically. Airway management algorithms should: - be discussed more openly at the workplace - easy to remember - practiced repeatedly in simulation scenarios - not be adhered to too strictly but adapted in response to the situation.	Small sample size. Limited generalisability. Length of time (five years) between data collection and results may be a limitation but, based on their clinical experience, the authors believe the findings are still valid.
Kolawole et al. ¹⁰ (2019)	Use of simulation to improve management of perioperative anaphylaxis: A narrative review (To address the deficiencies in management of perioperative anaphylaxis by appraising the training and assessment of individuals and teams, and the potential to enhance clinical processes.) Narrative review (Level I) The PICO (population/problem, intervention, comparators, outcome) framework was used to formulate the search strategy applied to MEDLINE and Embase databases.	41 relevant papers	- Simulation has played a key role in presenting and developing cognitive aids (CAs). - The design of CAs has recently undergone some examination using simulation, with more simple, linear designs being preferred over complex branched algorithms. - One of the main problems of CAs is having them immediately available and remembering to use them. Simulation training may also play a key role in educating anaesthetists on when and how to use CAs.	Perioperative anaphylaxis is used widely as a scenario in simulation training and as part of competency assessment. Although studies linking training, assessment and system performance to improved management of anaphylaxis or patient outcomes were not identified, this review found evidence that <i>in situ</i> simulation and the use of CAs lead to improved teamwork and task performance. It is recommended that research priorities shift towards <i>in situ</i> simulation to improve team and system performance.	The review focusses on published literature on simulation and anaphylaxis, there may be relevant literature published on simulation and other perioperative crises.

Author (year)	Title (intent) Study design (level of evidence)	Population/sample	Key findings	Conclusions, implications and recommendations	Limitations of the study
McIntosh et al. ¹¹ (2018)	Using simulation to iteratively test and re-design a cognitive aid for use in the management of severe local anaesthetic toxicity (To conduct formative usability testing of three existing cognitive aids (CAs) in order to develop, via a user-centred design approach, a new CA.) Randomised controlled trial (Level II) Participants were interviewed after using one of three CAs in a simulation. Interview information was used to develop a fourth CA which was subjected to further testing and re-design by the fourth group.	20 anaesthetists 20 anaesthetic nurses (Participants were paired into anaesthetist-anaesthetic assistant dyads and then randomised into four groups that used one of four CAs.)	- Many features of the existing CAs appeared useful in a non-emergency situation but those same features were detrimental in a simulated crisis. - The three tested existing CAs appeared easy to understand in a non-emergency situation but they were reported to be not useful in a simulated crisis and, in many instances, were discarded immediately. - The new aid was reported to be easy to use without prior familiarity or training. However, this does not negate the need for education – the literature suggests that familiarity and/or ongoing education on specific aids may make them more likely to be used appropriately in crises. - Features of the new, preferred aid that were identified during testing, such as use of colour, providing a single stream of information and limiting the information to that required during the crisis, are consistent with recommendations made by human factors engineering experts.	Utilisation of formative usability testing and simulation-based, user-centred design resulted in a visually very different CA and reinforces the importance of designing aids in the context in which they are to be used. Simplified tools may be more appropriate for use in emergencies but more detailed guidelines may be necessary for training, education and development of local standard operating procedures. Iterative simulation-based testing and re-design is likely to be of assistance when developing aids for other crises, and to eliminate design failure as a confounder when investigating the relationship between use of CAs and performance.	Study participants included junior trainee and senior consultant anaesthetists. However, given the purpose of the CA is to support clinicians of all levels of experience it was important the aid was tested by a range of potential users. Quantitative supporting validity evidence was not collected; the primary focus of the study was on the design of the aid.
Merrell et al. ¹² (2018)	Use of an emergency manual during an intra-operative cardiac arrest by an interprofessional team: A positive-exemplar case study of a new patient safety tool (To identify and synthesise the impacts of emergency manual (EM) use on clinical team functioning, delivery of patient care and planned future use during applicable crises.) Positive-exemplar case study (Level IV) All six clinicians present during the crisis were interviewed, interview transcripts were iteratively coded and thematic analysis was performed.	6 interviewees (The six clinicians present during the crisis – anaesthetist, surgeon, surgical resident, surgical technician, circulating nurse, nurse anaesthetist.)	- The EM provided clear guidance, reduced individual stress and intrateam tension, improved communication and enabled effective clinical team functioning. - The EM fostered a calm work environment, helped focus attention on the patient and supported efficient and effective delivery of key patient care management actions. - All six participants expressed their positive intentions to use the EM during applicable crises in the future. - All team members commented on the successful use of a reader role, which facilitated effective team EM use and efficient delivery of patient care.	Our results suggest the potential clinical utility of EMs in the operating room (and likely beyond) and identify issues for future research in clinical settings. Recommendation: Optimise local implementation of an EM by: - ensuring the EM meets local needs (create a new EM or modify an existing tool) - familiarising staff with the EM (including training) - enabling effective use of the EM (including clinical accessibility and reader role) - integrating the EM into local culture.	Interviews were conducted four to five months after the crisis. However, participant accounts were vivid and consistent with each other suggesting that veracity had survived. Eyewitness accounts are not always accurate. To mitigate this a low-stakes context for the interviews was created, biased framing was avoided and neutral language was used throughout the interviews. Participants may have exhibited recall bias and social desirability bias. These were mitigated during the interview process. As this is one in-depth case study, the specific impact of the EM remains unknown relative to other factors affecting team performance. However, the individual members of the team do not regularly practice together, and multiple participants remarked on the calmness and ease of teamwork. It is important to note that the participants themselves believed that the EM was useful and made a difference to their patient care.

Author (year)	Title (intent) Study design (level of evidence)	Population/sample	Key findings	Conclusions, implications and recommendations	Limitations of the study
Siddiqui et al. ¹³ (2019)	Impact of critical event checklists on anaesthetist performance in simulated operating theatre emergencies (To determine the uptake of Society for Pediatric Anesthesia (SPA) critical events checklists (CECs) in a simulated operating theatre emergency and the performance enhancement conferred by using the SPA CEC.) Randomised 2x2 factorial study (Level II) Participants were randomly assigned to four groups to participate in orientation and simulated emergencies. Videos of simulations were rated by trained expert raters.	25 senior anaesthesia trainees 78 simulation encounters (Participants were senior anaesthesia trainees at a single university-affiliated tertiary level paediatric hospital.)	- The overall uptake of the SPA CECs in the simulated critical events was 17.9%. - The uptake of the SPA CECs was not significantly different whether participants received an e-module or a didactic orientation to the SPA CEC (16% vs. 20%, respectively, $p = 0.690$). - The proportion of encounters where the SPA CEC was used did not differ significantly whether the SPA CEC was available (in clear view) or not (20% vs. 16%, respectively, $p = 0.690$). - There was significantly greater uptake of the SPA CEC in scenarios that required a diagnosis-based SPA CEC (45%) than ones which required the use of a generic event (altered-physiology) SPA CEC (2%). - Clinical performance was enhanced by the use of a CEC, with a mean difference in global rating scale of 0.57 (out of six).	Uptake of CAs is poor despite formalised orientation. Certain types of CAs are used more frequently than others. When individuals did use the SPA CEC, they performed better in simulated events than participants that did not use the SPA CEC. Recommendation: Further research needs to be conducted surrounding novel means of orientation and education surrounding CAs as they have important implications for patient safety and medical education.	SPA CECs are meant for whole-team use, rather than just the anaesthetist. The intent of the current study was to examine uptake of SPA CECs and their impact during uniprofessional simulation training. The impact of the independent variables was not analysed at a later stage; therefore, the study cannot detect, for example, whether the modes of orientation had a delayed impact on uptake of CAs.
Zasso et al. ¹⁴ (2021)	Effects of prior exposure to a visual airway cognitive aid on decision-making in a simulated airway emergency: A randomised controlled study (To investigate the effects of a visual airway cognitive aid (CA) on decision-making in a simulated airway emergency scenario.) Randomised controlled trial (Level II) Participants were randomly assigned to two groups to participate in orientation and simulated emergencies. Main outcome measures were decision-making time to perform a front-of-neck access (FONA), airway checklist actions, teamwork performances and a post-scenario questionnaire.	40 teams of three individuals (Teams comprised an anaesthesia resident, a nurse and a respiratory therapist. Teams were randomly assigned to an intervention group ($n=20$) and a control group ($n=20$). Demographics for age and years of clinical practice were similar between intervention and control groups.)	- Decision-making time to perform a FONA was significantly faster in the intervention than control group (mean $\pm$ SD, 80.9 ± 54.5 vs. 122.2 ± 55.7 s, difference (95% CI) -41.2 (-76.5 to -6.0), $P = 0.023$). - The intervention group reported using the CA during the simulated scenario more than the control group (63.0 vs. 28.1%, $P < 0.001$). A higher proportion of the intervention group perceived the CA as important than in the control group (73.3 vs. 50.0%, $P < 0.01$). - A high proportion of the participants in both groups indicated they would use the CA in the future if it was available in a clinical airway emergency (93.3 vs. 96.7%, $P = 0.67$).	Prior exposure to and teaching of a visual airway CA improved decision-making time to perform a FONA during a simulated airway emergency. Furthermore, increased use of the aid did not appear to have negative effects on the total time of scenario completion and the checklist task scores. These findings may have important clinical implications for the role of a visual airway CA in airway emergencies, particularly with decision-making. Familiarisation and availability of a CA in airway management might be an important tool in the clinical setting.	The study was conducted in a laboratory setting rather than the clinical environment. As with all simulation, performances may suffer from the Hawthorne effect. The use of junior anaesthesia trainees may hinder generalisability to practising physicians who are experts in airway management. The time of simulation scenario assessment varying from 1 to 4 weeks after the teaching session may have introduced a confounding factor. The sequence of the post-scenario debriefs and completion of the questionnaire was variable among the teams; teams which were debriefed first may have been influenced when completing the questionnaire. Teamwork performances were similar between the intervention and control groups; however, the reported interrater coefficient between the raters was low (ICC 0.4), possibly because team performances are more complex to assess than individual performance.

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Nursing implications for transgender and gender diverse perioperative patients: A discussion paper

Abstract

Perioperative nurses must provide culturally competent care to all surgical patients, and understanding gender identity and gender diversity may be the first step to creating an inclusive perioperative practice for transgender and gender diverse patients. In the nurse–patient relationship, limited exposure to and knowledge of diverse populations may negatively affect the health of this important demographic.

When nurses are unaware of how care can be affected by explicit (conscious) or implicit (unconscious) bias, they may use transphobic stereotyping behaviours or act with microaggressions, like using excessive protective attire. Such care may invalidate gender identity and impede trust. In contrast, nurses practising gender-affirming care validate the patient's gender identity and life experiences, which supports autonomy and creates trust.

The aim of this paper is to provide perioperative nurses with a deeper understanding of factors that may affect gender diverse patient's perioperative outcomes. In addition, understanding the social determinants of health affecting this demographic may result in better health outcomes. As such, the holistic care of the transgender and gender diverse patient is the optimal goal, with clinicians employing a non-judgemental, sensitive and compassionate attitude.

Keywords: transgender and gender diverse, perioperative nurse, gender-affirming care, bias

Introduction

The United Nations Office of the High Commissioner for Human Rights defines gender identity as 'each person's deeply felt internal and individual experience of gender, which may or may not correspond with the sex assigned at birth'¹. The term gender diversity refers to the range of gender identities, experiences and expressions of gender that exist. The term trans refers to 'persons who identify with a different sex than the one assigned to them at birth'¹. The term transgender and gender diverse (TGD) is a comprehensive term² and

includes people who are non-binary, and do not identify as any sex. The term cisgender refers to people who identify as their birth sex.

Gender identity often intersects with social issues (ethnicity, socio-economic status, support systems and education), resulting in discrimination and poor health outcomes.^{3–6} TGD individuals may experience gender dysphoria, the mental distress caused by the physical body not aligning with the sense of self.^{7,8} Transitioning, beginning to live according to one's gender identity, aligns one's physical expression to one's sensorium.⁹ To

alleviate mental distress, some TGD individuals choose to transition, either socially (clothing, chest binding or name change), medically (hormone-blocking) or surgically (gender-affirming surgery).¹⁰ Even within the lesbian, gay, bisexual, transgender, intersex, queer, asexual and other sexually or gender diverse (LGBTIQA+) community, TGD people experience significant marginalisation and health disparities^{5,9,11-15}.

As recently as 2013, gender dysphoria was pathologised within the medical profession¹⁶ while formal TGD education within health care remains limited^{3,5,13,14,17} and further compounds the health outcomes of this cohort^{10,13,18}. To build professional maturity, nurses must be self-educated about the social issues and gender-affirming care of this cohort^{3,6,12,19}. This discussion paper hopes to advance TGD perioperative care by raising nurses' awareness of the TGD population and their positionality, and encouraging gender-affirming practices.

Discussion

This paper endeavours to highlight types of bias to ensure perioperative nurses seek mitigation strategies to avoid experiencing a visceral response²⁰ towards the TGD patient^{9,21,22}. The author undertook extensive reading of high-quality scholarly literature on nurse bias and gender-affirming care, and assessed the quality of the papers using accepted critical appraisal tools. Thematic analysis, critique and evaluation identified themes that informed the structure of the paper which is presented under the headings 'some facts about TGD', 'the self-aware nurse' and 'gender-affirming care'. By providing a basic understanding of the internal factors at work, it is hoped that nurses

may be guided to self-reflection^{17,20}. By combining self-reflection with understanding of the social and health issues faced by TGD people, nurses will be able to practise culturally sensitive care^{6,10,14,19}. To care for TGD patients, nurses must remain connected to ethical values for care embedded in the International Council of Nurses Code of Ethics for Nurses²³, the Nursing and Midwifery Board of Australia (NMBA) standards for practice^{24,25} and the Code of Conduct for Nurses²⁶. As policy improves, frontline staff must build upon self-learning to implement the new practices that are shown to optimise the care of TGD patients²⁷.

Some facts about TGD

TGD people are becoming more accepted in Australia²⁸, and Carmen et al.²⁹ and Lyons et al.³⁰ reason that between 3.5 and 11 per cent of the Australian population now identify as TGD, though these figures are not definitive³¹. Australia was founded on colonial values that centred around white dominance, male or female sexes and heterosexuality¹³, resulting in the embedding of these values within the power structure^{3,13}. This has pushed marginalised groups, like the TGD population, to the peripheries and reduced their access to mainstream resources³². Moreover, as no census questions relate to sexual orientation or gender identity, governmental resource allocation for this group is directly affected^{19,31,33}. This structural discrimination results in a lack of health equity for marginalised groups such as the TGD population^{3,14}.

Barriers to equitable health remain prevalent throughout the lifespan of people in many marginalised populations⁴. The foundation of patient engagement is trust³⁴; therefore, the TGD patient may not engage if trust is damaged by discrimination from health

care providers⁹ with limited understanding^{5,35}. The TGD surgical patient is known to be at greater risk of complications and post-surgery death than their cisgender counterparts due to the social determinants that frame their ongoing health care problems^{11,14}. TGD individuals are twice as likely to delay connecting with health care than their cisgender counterparts (30% versus 17%)³⁶, and this delay has resulted in chronic levels of psychosocial stress, mental health issues and emergency presentations^{6,19,33}.

Sadly, suicide has been attempted by 40 per cent of the TGD population¹⁴. Drug use has become normalised in the TGD community to cope with the chronic stress^{11,14}, and illicit sexual behaviour has often been employed as a means to survive¹⁴. These and other complications of the TGD population become a prescient pressure for the health system^{11,37}. As the health sector moves towards improving outcomes for marginalised groups, gender appropriate nursing care will be pivotal to the success of patient-centred care of a higher standard¹⁴.

The self-aware nurse

Research has shown that, unfortunately, nurses have bias levels comparable to the general public³⁸ and this may result in a lack of compassion³⁸. Explicit bias has been found among nurses when caring for elderly³⁹, obese³⁸, LGBTIQA+⁴⁰ and mentally ill patients⁴¹. A nurse's critical thinking can be compromised by biased processes^{5,42}, which continue the power imbalance³ and maintain the passivity of the TGD patient⁴³. This negative approach reduces trust^{12,33} and may manifest as a lack of engagement by TGD patients in their ongoing health care¹². Through self-awareness and maturity of practice,

nurses can provide non-judgemental care^{17,20}.

One's sense of self is based on belonging to a social group or place⁴⁴ and is built upon in childhood to understand family and have a wariness of others²⁰. Acknowledging one's sense of self⁴⁵ may enable nurses to provide impartial care by counteracting biases, destructive stereotyping¹² and microaggressions⁶ that diminish the TGD patient^{27,38}. Self-awareness enables a nurse to practise not only with empathy and sensitivity⁴⁶ but also to combat automated responses⁴⁷. Automated civilised responses⁴⁵ can be based on explicit or implicit bias, societal influences, experiences or wilful ignorance^{33,48} and may directly impact the safety of the perioperative environment for the TGD patient^{27,38,47,48}. The self-aware nurse accepts the diversity of patients and calibrates the care to optimise the TGD patient's outcome⁴⁶.

Through a self-reflective lens²², nurses can acknowledge the sense of self and use mindful strategies to diminish personal emotions that may adversely affect the therapeutic relationship²⁰. One strategy that encourages reflection and may improve the nurse–TGD patient relationship is the 'STOP' technique⁴⁹. This mindfulness technique involves four steps – Stop what you're doing, Take some deep breathes, Observe thoughts, emotions and body feelings and position, Proceed with something supportive⁴⁹. Practising mindfulness can help nurses provide culturally appropriate, ethical and compassionate care for TGD patients²⁰.

In addition to self-awareness, culturally appropriate care for TGD patients also requires knowledge of the health issues and the social determinants, such as homelessness, mental health issues, drug use and

violence^{11,12,17,36}, that impact the TGD population. This combination of self-awareness and knowledge about the TGD population results in holistic care, which may optimise health outcomes for TGD patients^{22,27,50}.

Some health advisories endorse mindful strategies to engage the nurse consciously²⁰, while others recommend focusing on the individual instead of the cohort⁵¹. Regardless, nurses remain exposed to many pressures, such as colleague conflict when advocating for the patient¹⁸, inadequate staffing levels²⁰ and finite engagement time^{12,18}. All these may affect nurses' ability to achieve self-awareness¹² and without regular training such pressures increase the risk of automated practice returning^{11,12,18}. Training in and practise of strategies to cope with such pressures can facilitate understanding another's viewpoint, allow one to see from the other's perspective and provide insight^{6,33}.

Gender-affirming care

Culturally appropriate care strengthens the relationship between the nurse and the TGD patient^{10,12,52}. Gender-affirming care validates the TGD patient through inclusive language^{9,10,19,33} and involves cultural humility and patient advocacy.

TGD patients require gender validation⁵³; therefore, to create a positive nurse–TGD patient relationship, the nurse must see the patient as the patient sees themselves^{9,19}. The nurse being genuine, allows the TGD patient to trust and the nurse to care holistically^{3,4}. A critical component of inclusive care is for carers to communicate the TGD patient's gender identity, name and pronouns at each handover of care to ensure continuity of the gender-affirming care^{5,10}.

Maintaining the safety and privacy of TGD patients requires conscious practice by nurses, for example, remembering to use the patient's preferred pronouns and not using societal norms such as 'mister' or 'missus' when they were not provided by the patient¹⁹. Nurses should establish an inclusive tone for the nurse–patient relationship on initial contact by introducing themselves with their name and pronouns to highlight the culture and safety of the engagement³³. For example, 'Hello, my name is Jane, she/her'. This is an ethical and respectful approach that may help to enlist the TGD patient as an active participant in the relationship^{54,55}.

While patient safety has previously focused on clinical consequences⁵⁶, psychological safety is also important for TGD patients, and nurses adopting an attitude of cultural humility¹⁰ and providing gender validation protects TGD patients' privacy and sense of self during their time in the operating suite^{19,37}. Avoiding assumptions is also important; for example, where a TGD patient would feel most comfortable recovering after surgery must be discussed with them before the surgery, as isolating the TGD patient in recovery can be considered discriminatory³⁶.

Just as gender validation and cultural humility is needed, so too is advocacy, and this is more readily accepted when a culture of consideration exists¹⁸. When advocating for TGD patients, perioperative nurses must aim for optimal health outcomes while limiting anxiety caused by a lack of culturally sensitive care⁴⁴. Privacy must also be considered part of this culturally sensitive care¹⁰, and limiting the number of staff to the core requirements for surgery and recovery is desirable¹⁹. Further,

advocacy may include allowing a support person to be present during investigations¹⁹, or appreciating the TGD patient's right to decline investigations³³. Caring for the TGD patient may involve removing items, such as chest binding, immediately before induction and replacing them appropriately to diminish the patient's anxiety upon waking in recovery⁹.

Though individual nurses can promote an inclusive environment¹¹, the health of the TGD cohort can only be improved through a unified approach that has support from management including formalised education and regular training^{4,17}. Simulation training within health care is a supportive and hands-on environment where skills needed to care for the TGD patient can be practised¹⁷.

Two TGD simulations in the literature highlighted positive outcomes. A study by Altmiller et al.¹⁷, focused on nursing students, found that more senior nursing students (third-year students) assimilated a greater level of knowledge. The researchers identified this as the professional maturity needed for TGD care¹⁷. The other study, by Lund et al.³⁶ concentrated on the anaesthetic team and was a voluntary learning session attended by a sample size of 37 within a large facility of 51 theatres. Busy surgical lists were cited as a barrier to attendance³⁶. Both simulations demonstrated a significant increase in understanding of the social issues affecting the TGD population and improved humility when caring for TGD patients^{17,36}.

Notwithstanding formalised education, the perioperative nurse must remain knowledgeable about appropriate care of TGD patients to optimise surgical outcomes as a collaborative team member^{3,12,33}.

Ultimately, safe care places the TGD patient at the centre of their care^{3,4,13,57}. Many perioperative nurses have limited exposure to TGD patients currently⁶ and these studies highlight the significance of initial and ongoing education across disciplines to facilitate optimal care of TGD perioperative patients^{3,4,13,17,20,36}.

Conclusion

This discussion paper has provided some vital information about the TGD population to aid perioperative nurses understanding of this marginalised group. The health disparities experienced by the TGD community have been contextualised to inform the need for culturally appropriate care to improve the health outcomes of this demographic. With greater understanding, perioperative nurses' ability to provide advocacy for these patients may also be enhanced.

Perioperative nurses who are unaware of how care can be affected by explicit or implicit bias may inadvertently employ transphobic stereotyping behaviours or act with microaggressions. In contrast, self-awareness may enable a perioperative nurse to practise with greater empathy and sensitivity, while always trying to overcome what may be automated responses of the past. By employing self-awareness, understanding gender-affirming care and undertaking further education, perioperative nurses can engage the patient to better support them during the surgical journey.

As there is a paucity of research into perioperative care of TGD patients, this discussion paper recommends that further research be conducted to provide evidence on best practice outcomes for this important group of patients.

Declaration of conflicting interests

The authors have declared no competing interests with respect to the research, authorship and publication of this article.

Acknowledgement

This paper was submitted to the University of Tasmania as part fulfilment of subject CNA803, Advanced Clinical Nursing Practice, for the Master of Clinical Nursing (Anaesthetic & Recovery Nursing). The author sincerely wishes to thank Dr Paula Foran, unit coordinator, for her guidance throughout the master's course and work in preparing this paper for publication.

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