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## The effects of staffing practices on safety and quality of perioperative nursing care – an integrative review

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# The effects of staffing practices on safety and quality of perioperative nursing care – an integrative review

## Abstract

### Problem identification

Patients undergoing invasive procedures are highly vulnerable to adverse outcomes. From 2012 to 2013, 5.5 per cent of all inpatient admissions reported an adverse event. Perioperative nurses play an important role in providing safe patient care and acting as the patient advocate. This review of literature aims to examine the effects of perioperative staffing and patient safety. Three common staffing themes that impact the safety and quality of patient care were identified; namely, nurse-to-patient ratios, staff training and staff fatigue.

### Literature search

An integrative literature search to identify empirical data surrounding perioperative nursing staffing was conducted via the use of databases which included CINAHL, JBI, Medline and PubMed. Duplicates were removed, and the preferred reporting items for systematic reviews and meta-analysis (PRISMA) guidelines were followed. A total of 216 articles were identified.

### Data evaluation synthesis

Scholarly literature including both qualitative and mixed methods primary research studies, that collected both qualitative and quantitative data, and some secondary research were identified for review. Articles were appraised for relevance by the researcher. Inductive thematic analysis and structured reporting was undertaken to synthesise the data. To ensure the rigor of articles Mixed Methods Appraisal Tool (MMAT) and Standard Quality Assessment Criteria for Evaluating Primary Research Papers (QualSyst) appraisals were undertaken. Out of the 216 articles, 15 research papers were identified as suitable for use within this review.

### Implications for practice

The review demonstrated that empirical data surrounding perioperative nursing staffing is widely available. Fatigue, perioperative nurse education and nurse-to-patient ratios have a significant impact on the safety of patients undergoing invasive procedures. However, there is a lack of quantitative data surrounding these staffing factors.

**Keywords:** perioperative, staffing, nursing, fatigue, ratio, training

## Problem identification

The provision of safe, quality patient care is central to all health care professionals, including nurses. Nursing care is seen to exemplary levels within the perioperative nursing field; the vulnerability of patients as well as the complex and invasive procedures undertaken make the perioperative nurse a powerful patient advocate<sup>1</sup>. Advocacy for safety and quality care is integral to perioperative nursing<sup>1</sup>. However, the effects of staffing, staff training and rostering practices can greatly affect the safety of patients<sup>2-5</sup>. This integrative review describes some of the effects of these staffing practices in relation to patient safety within the perioperative nursing field. This review found significant literature surrounding nurse satisfaction in relation to staffing, rostering practices and training. However, there is a lack of contemporary Australian literature related to these practices and patient safety. This literature review focused specifically on fatigue, staff training and nurse-to-patient ratios in relation to patient safety within perioperative nursing<sup>1</sup>. Each of these components, if managed appropriately, can significantly improve the quality and safety of patient care.

## Literature search

The research question that provided guidance for this review was 'how does perioperative nurse staffing effect safe patient care?' An integrative literature search for mixed methods, qualitative and quantitative research was conducted through the use of databases which included CINAHL, JBI, Medline and PubMed. Appropriate inclusion/exclusion criteria and search terms were used. Preferred reporting items for systematic reviews and meta-analysis (PRISMA) guidelines were followed<sup>6</sup>.

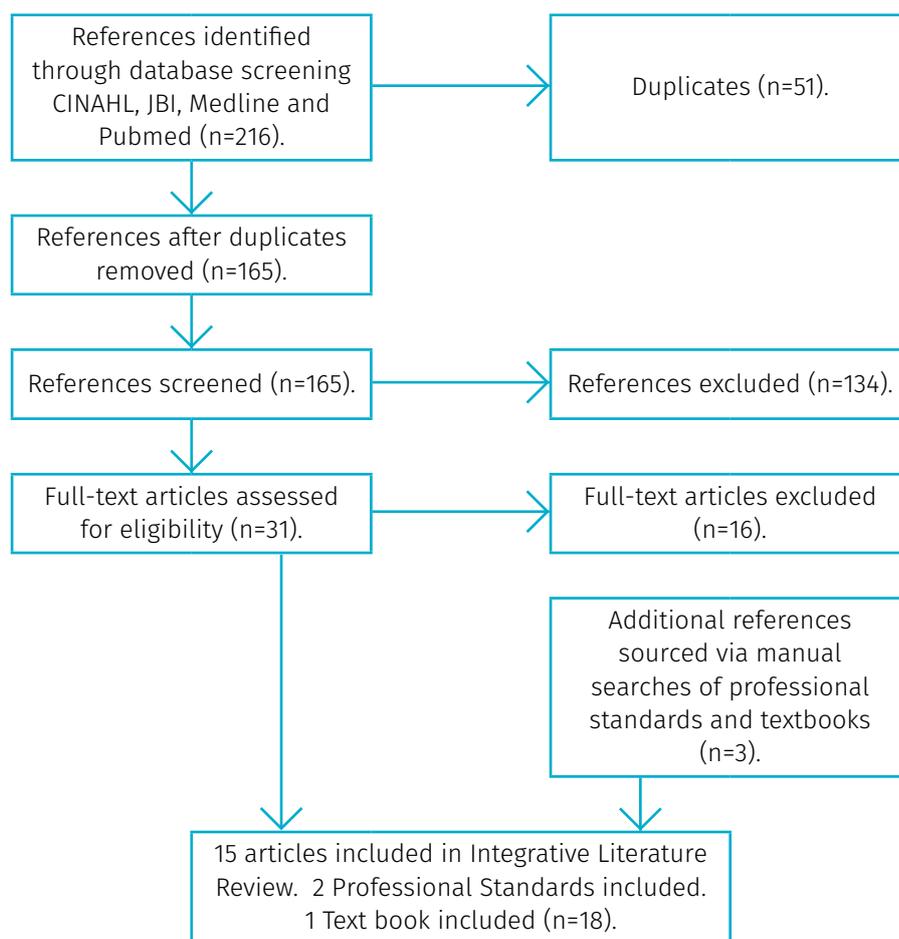


Figure 1: PRISMA flow diagram of integrative review

Figure 1 demonstrates the PRISMA review undertaken. A literature review matrix is included in the supplemental material. Additionally, a manual search of 'Fatigue'<sup>7</sup> and 'Staffing for safety'<sup>8</sup> in the 16<sup>th</sup> edition of the Australian College of Perioperative Nurses (ACORN), *Standards for Perioperative Nursing in Australia*<sup>3</sup> (the ACORN Standards), was performed, and a relevant textbook was identified<sup>9</sup>. This integrative review indicated the contemporary empirical literature and limitations surrounding perioperative nursing staffing and allowed for in-depth review of the literature.

## Inclusion and exclusion criteria

Pertinent inclusion and exclusion criteria were set for the literature review to ensure relevance and applicability of the articles. Relevance was confirmed as all articles were related to perioperative, nursing and staffing factors. Age filters were applied to ensure contemporary literature was used. The search looked for articles published after 2015; however, some older articles (n=3) were included as they provided seminal research and are referenced in contemporary articles. Literature was also selected to provide

appropriate breadth and depth of review. Articles that were not written or officially translated in English were excluded from the review. Articles included were required to be full-text and peer-reviewed. Primary and secondary research has been used.

## Search strategies

A computerised search of databases was undertaken to find relevant literature to support the research question. Search terms used were 'perioperative', 'nursing', 'staffing', 'safety', 'fatigue', 'ratio' and 'training' as well as derivatives and synonyms of these. Boolean operators of 'AND', 'NOT', and 'OR' were used. Examples of search strings used to search for literature include 'perioperative nursing AND fatigue', 'perioperative nursing staffing AND safety', and 'training FOR perioperative nurses'. Reference lists of the searched literature were also assessed to find relevant sources such as seminal research and primary studies that were referred to in secondary research.

## Data extraction and synthesis

The references and articles identified for this review comprised primary studies, primarily qualitative, and mixed methods as well as secondary studies. Articles were appraised for relevance and synthesised. Synthesis used inductive thematic analysis and structured reporting. Themes generated related to perioperative nurse staffing in relation to fatigue, rostering practices, nurse training and nurse-to-patient ratios. Data extraction included collecting data on author, publication year, country, study aims, methodology, results, discussion and limitations. (Refer to the supplemental material: Literature matrix for data collection.) Data verification was completed by one

reviewer to ensure that articles were relevant and met inclusion criteria.

## Quality assessment and quality scores

Quality assessment of the articles was undertaken using the Standard Quality Assessment Criteria for Evaluating Primary Research Papers (Quantitative & QualSyst) tool<sup>10</sup> and the Mixed Methods Appraisal (MMAT) tool<sup>11</sup>. These tools provide a framework to review research articles and allow for quantitative scoring of primary research articles to ensure their quality and rigor. Table 1 shows the scores given for each paper. Based on the QualSyst tool, a conservative cut-off of 0.75 was chosen for article inclusion, and an MMAT score of less than 15.

Using tools such as QualSyst and MMAT allowed the reviewer to analyse and critique research articles using a series of frameworks and criteria. The diversity of these tools allowed a wide variety of articles to be examined, taking into consideration the vast array of different methodologies available. Using these tools has ensured that all articles included in this literature review are rigorous and of good quality.

## Discussion

A multitude of factors exist that effect patient safety and quality of care within perioperative nursing. The perioperative field offers unique hazards and complexities which place patients at risk of suffering an adverse outcome during their admission. In the 2018–2019 report, the Australian Institute of Health and Welfare reported 2.6 health care-associated complications per 100 admissions across Australian public hospital facilities<sup>2</sup>. Undeniably there is a direct link between perioperative staffing and safe surgical care of

perioperative patients<sup>8</sup>. ACORN has provided specific guidelines for perioperative nursing practice since 1977 when the first ACORN standards were developed<sup>12</sup>; however, ACORN's contemporary standards allow for a more dynamic staffing process to take place<sup>8</sup>. This process allows for assessment of patient acuity, turnaround times, procedure complexity and appropriate staffing to be implemented to provide safe and quality patient care<sup>8</sup>. Discrepancies occur when budgetary factors override these staffing standards and jeopardise patient safety<sup>8</sup>. The current ACORN Standards views nursing staff as valuable assets in perioperative care, and therefore cost-saving initiatives should not jeopardise safe staffing<sup>8</sup>.

A review of the available literature uncovered three common staffing themes that effect patient safety and the quality of care, these were; fatigue, nurse-to-patient ratios, and staff training<sup>1,3,4,6,8-25</sup>. The findings of this review in relation to these three themes will be examined, limitations will be noted and recommendations made for practice and future research.

## Fatigue

Fatigue is a rapidly growing staffing concern that surrounds perioperative nursing<sup>7</sup>. The perioperative environment is fatiguing for a multitude of reasons, including physical, emotional and cognitive demands; prolonged standing; limited breaks; rostering practices; on-call shifts; wearing of heavy lead aprons and manual handling<sup>7</sup>. High levels of fatigue may also lead to practitioners developing compassion fatigue<sup>13</sup>. Compassion fatigue is a concern as it can cause nurses to avoid interactions with patients, and provide services that are of low quality<sup>13</sup>.

**Table 1: Summary of article appraisal scores**

	Article	Score
QualSyst Scores	Platt M, Coventry T, Monterosso, L. Perioperative nurses' perceptions of cross-training: a qualitative descriptive study. <i>Journal of Perioperative Nursing</i> 2019;32(1):19-25. Available from: <a href="http://www.journal.acorn.org.au/jpn/vol32/iss1/4/">www.journal.acorn.org.au/jpn/vol32/iss1/4/</a>	0.8
	Gutierrez L, Santos J, Peiter C, Megegon F, Sebold L, Erdmann A. Good practices for patient safety in the operating room: nurses' recommendations. <i>Rev Bras Enferm</i> 2018;71(6):2775-2782. doi: <a href="http://dx.doi.org/10.1590/0034-7167-2018-0449">http://dx.doi.org/10.1590/0034-7167-2018-0449</a>	0.9
	Sonoda Y, Onozuka D, Hagihara A. Factors related to teamwork performance and stress of operating room nurses. <i>J Nurs Manag</i> 2018;26:66-73. doi: 10.1111/jonm.12522	0.8
	Saver C. Staffing ratio trends – a survey of perioperative nurse managers. <i>AORN Journal</i> 2005;81(5):1041-1044. Available from <a href="https://doi.org/10.1016/S0001-2092(06)60470-5">https://doi.org/10.1016/S0001-2092(06)60470-5</a>	0.85
	Foran P. Effects of Guided Undergraduate Perioperative Education on Recruiting Novice RN's and Retaining Experienced RN's. <i>AORN Journal</i> 2015;102(3):254-61.	0.9
MMAT Scores	Beitz J. The perioperative succession crisis: A cross-sectional study of clinical realities and strategies for academic nursing. <i>Nursing Economics</i> 2019;37(4):179-197. Available from <a href="https://search.proquest.com/openview/0f9eca76b5ce61aa7f9957cb4d397b88/1?pq-origsite=gscholar&amp;cbl=30765">https://search.proquest.com/openview/0f9eca76b5ce61aa7f9957cb4d397b88/1?pq-origsite=gscholar&amp;cbl=30765</a>	16
	Newhouse R, Johantgen M, Pronvost P, Johnson E. Perioperative nurses and patient outcomes - mortality, complications, and length of stay. <i>AORN Journal</i> 2005;81(3):508-528. doi: 10.1016/s0001-2092(06)60438-9.	17
	Vortman R, Gergren M, Baur K, Floyd V. Nurse retention in the operating room after perioperative core curriculum completion. <i>ORNAC Journal</i> 2019;37(3):13-27. Available from <a href="http://www.researchgate.net/publication/336671816_Nurse_Retention_in_the_Operating_Room_After_Periooperative_Core_Curriculum_Completion">www.researchgate.net/publication/336671816_Nurse_Retention_in_the_Operating_Room_After_Periooperative_Core_Curriculum_Completion</a>	16
	Foran P. The value of guided operating theatre experience for undergraduate nurses. <i>Journal of Perioperative Nursing in Australia</i> 2016;29(1):10-8.	25
SOACEPR*	Foran P. Undergraduate surgical nursing preparation and guided operating room experience: A quantitative analysis. <i>Nurse Education in Practice</i> . 2016;16(1):217-24.	0.85

**\*Standard Quality Assessment Criteria for Evaluating Primary Research – Quantitative scores**

Current research demonstrates that 17 hours without sleep degrades nurses' performance to similar levels as having a blood alcohol concentration of 0.05 per cent<sup>14</sup>. This data reveals the implications of fatigue and the additional risk to patient safety caused by fatigued nurses<sup>14</sup>. Qualitative research conducted over a one-month period showed that 14 per cent (n=393) of nurses worked shifts over 16 hours<sup>14</sup>.

During this period 199 errors and 213 near-misses were reported (total=412 incidents) which were attributed to fatigued nurses<sup>14</sup>. The age of this research is seen as a limitation; however, it is still relevant and used as seminal research in contemporary studies.

Research undertaken by Sonoda, Onozuka and Hagihara assessed the implications of stress and fatigue in

the perioperative nursing arena<sup>5</sup>. The results reported that 40 per cent of participating perioperative nurses (n=279) felt stress throughout the work day due to the complexity of work and poor rostering<sup>13</sup>. These high levels of nursing staff stress attributed to increasing levels of fatigue<sup>5</sup>. The implications of this study show that stressful and complex work environments lead to significant fatigue among staff<sup>5</sup>. A

limitation of this research is that it included only one Japanese hospital with the majority of participants (96 per cent) in the study being female.

Fatigue endangers patient safety – perioperative nurses as fatigued staff are significantly more likely to make errors<sup>15</sup>. Traditionally, health care organisations have been slow to adopt anti-fatigue policies<sup>16</sup>. The implications of this are increased staff fatigue causing a higher risk of errors that compromise patient safety, and a poor workplace culture<sup>16</sup>. Conversely, the implementation of anti-fatigue policies causes a significant positive shift in patient safety and quality of care<sup>16</sup>. This in turn, fosters a culture that creates staff satisfaction and a positive work ethic<sup>13</sup>. Additionally, perioperative nurses should be aware of the signs of fatigue, and manage their own fatigue appropriately<sup>7,13</sup>.

## Nurse-to-patient ratios

The ratio of perioperative nurses to patients has been a topic of debate for some time<sup>4,8</sup>. This discussion is further complicated by the inclusion of anaesthetic technicians and surgical assistants<sup>8</sup>. ACORN acknowledges that nursing staff have an integral role within the perioperative setting in ensuring staff safety<sup>8</sup>. Current Australian standards recommend the operating room have a minimum of 3.5 nurses per session or per patient<sup>8</sup>.

For this review, only registered nurse (RN) staffing was reviewed in terms of patient safety and quality of care. The direct correlation between nurse staffing levels and patient safety is well examined in historic and seminal literature; however, there is a lack of current literature exploring this topic<sup>4,8</sup>.

A series of mixed method surveys and audits completed in the

United States of America show the importance of maintaining safe staffing levels within the perioperative setting<sup>17</sup>. This primary research revealed that as nursing staff levels increased per operating room, patient outcomes also improved<sup>17</sup>. From the hospital cohort (n=32) included in this study, 90 per cent (n=28) only had one nurse per operating room<sup>17</sup>. These hospitals saw 9 per cent of patients having a surgical complication and 7 per cent mortality during their inpatient stay<sup>17</sup>. Hospitals that had more nurses per procedure demonstrated improved outcomes for patients and decreased length of stay<sup>17</sup>. Despite this research being from 2005, it is highly relevant and continues to be referenced in contemporary research. An important limitation to recognise is the complexity of influences on patient outcomes; therefore, it is difficult to ascertain the direct correlation between staffing and patient outcomes.

Similar results were found in a seminal qualitative study conducted by Saver in 2005 where 1075 surveys were completed by nurse managers and directors across multiple health care sites<sup>18</sup>. Findings revealed that 67.33 per cent of participants stated that their department maintained staffing levels of two nurses and one technician per patient<sup>18</sup>. Following on from Saver's work, another large seminal paper was published in 2008 by Garrett, conducting a cross-sectional analysis performed with 10 184 nurses and 232 342 patients revealing that each additional nurse per patient in the operating theatre increased safety and improved patient outcomes by 7 per cent<sup>16</sup>.

The unique complexities of the perioperative department do not allow for traditional nurse-to-patient ratio formulas to be applied, instead staffing should be seen as a dynamic

process<sup>8</sup>. Thus, recommendations to uphold 3.5 nurses per patient per procedure should be strictly followed<sup>8</sup>.

## Training

The education and training requirements of perioperative nurses has long been discussed and researched<sup>18</sup>. This review found numerous articles, both historical and contemporary, relating to perioperative nursing staffing and education<sup>17–21</sup>. Perioperative nursing is not taught in the core curriculum of all Australian undergraduate nursing courses which presents two possible problems: difficulty recruiting new nurses to the perioperative specialty, and a lack of surgical and perioperative nursing knowledge<sup>19–21</sup>. Thus on graduation, novice nurses who enter the perioperative environment lack the theoretical knowledge and specialist practical skills to enable them to work in this specialist field<sup>22</sup>. This in turn may require timely and costly orientation programs to assist novice perioperative nurses to gain rudimentary skills and may cause significant stress to both staff and resources<sup>22</sup>. Secondly, if undergraduate nurses have not experienced perioperative nursing, they are unlikely to choose this as a possible career following graduation raising concerns for recruitment of future staff<sup>19–22</sup>.

More recent qualitative literature shows the importance that nursing staff place on education<sup>23</sup>. In a hospital-wide study (n=220), participants stated that two important recommendations for perioperative departments were systematic professional development around new technologies and equipment, and managerial support for continuing education<sup>23</sup>. Participants also felt that further education allowed them to provide

higher quality and safer care to patients<sup>23</sup>. A limitation of this study was that only 35 per cent (n=75) of participants were from the perioperative environment. Replications studies have, however, been conducted using more contemporary and rigorous research methods<sup>3,24</sup>.

Using a cross-sectional mixed method design, data collected from perioperative managers in the United States of America demonstrated that managers and directors (n=27) believed that on-the-job training and didactic training for new perioperative nurses improved the practitioner's safety and efficiency<sup>3</sup>. Fifteen of the participants provided graduate programs for new staff members to complete<sup>3</sup>. Similar studies have also found that, in addition to increasing patient safety and quality of care, perioperative training improves staff retention rates<sup>24</sup>. Staff retention rates across 13 new graduate nurses improved from 59 per cent to 87 per cent after completing an advanced perioperative training course provided by the institution<sup>24</sup>. This mixed method research concluded that experienced perioperative nurses are paramount to surgical safety<sup>24</sup>.

Staff training is also important for reducing staff shortages<sup>4</sup>. Experienced and educated staff prevent maldistributions and allow nurses to work across multiple areas in the perioperative setting<sup>4</sup>. This allows more nurses to be assigned to areas of high acuity, thus improving patient safety<sup>4</sup>.

## Implications for perioperative nursing practice

This review identified the importance of staffing levels on patient safety

and quality of care, which is integral to perioperative nursing. The literature included in-depth discussions about staffing and patient safety in regard to fatigue, staffing ratios and education and training. Five articles unanimously agree with the importance of managing nursing fatigue<sup>5,7,13,15,16</sup>, four supported the provision of perioperative undergraduate experience<sup>19-22</sup>, five consistently supported further postgraduate education and training for perioperative nurses<sup>3,4,17,23,24</sup>, and three determined safe nurse-to-patient ratios within the perioperative setting<sup>14,17,18</sup>.

Fatigue has been shown to be significantly detrimental to perioperative nurses' performance which, in turn, effects their ability to perform duties safely<sup>14</sup>. Overworking, long shifts and challenging situations can cause nurses to suffer from compassion fatigue, which affects the holistic care that a nurse can provide for patients<sup>15</sup>. It is of paramount importance that fatigue is mitigated, identified and managed by health service organisations and practitioners to ensure that quality patient care can be provided in the perioperative environment.

This review has also highlighted the importance of nurse-to-patient ratios within the perioperative setting as a significant factor relating to patient safety and positive outcomes. Current Australian standards recommend that 3.5 nurses are allocated per operating theatre per patient to ensure appropriate staffing for safety<sup>8</sup>. This standard is based upon the discussed evidence that demonstrates the hazards of staffing operating theatres with fewer nurses<sup>17,18</sup>. Additionally the research shows the importance of having staff available to complete non-clinical tasks and the importance of cross-

training nurses to deal with nursing shortages<sup>4</sup>.

Finally, perioperative nurse education and training has been discussed as an important concern related to staffing in this specialty field. Perioperative nursing is not part of core undergraduate nursing programs in all Australian universities; therefore, it is important to provide perioperative education and experience for novice perioperative nurses<sup>20,21</sup>. The evidence indicated a direct correlation between trained and experienced perioperative nurses and patient safety<sup>4</sup>. Research recommends the implementation of undergraduate perioperative experience<sup>20</sup> and specialist postgraduate training programs as well as on-the-job and didactic in-service education for staff<sup>3</sup>. Furthermore, managerial support for continuing professional development is seen as a motivating factor by perioperative nurses<sup>23</sup>.

## Limitations

A robust review of literature was undertaken which included processes to identify and examine suitability and limitations. The articles included in this review were of good standing and credibility within the nursing field. The inclusion of secondary research also strengthened the discussion. All authors cited no conflict of interest, and no biases were able to be identified throughout the literature. Current quantitative research was difficult to identify as the majority of research was qualitative or mixed methods aimed at exploring nurses' opinions and views. This gap in literature makes it difficult to draw irrefutable conclusions regarding the effects of staffing on patient safety. A lack of counter arguments was searched for but not noted in the literature. The articles were cohesive in their discussion and all research

identified throughout the review was supportive. A gap in the current literature is noted in the absence of recent statistically significant data to link fatigue, staffing shortages and patient outcomes.

Studies that had small sample sizes were identified as a limitation within this review. Additionally, all research contained within the review was related to perioperative nursing; however, some articles did not include only perioperative nurses as participants. This limited the relevance of these articles.

## Knowledge translation

1. All perioperative nurses should be aware of the signs and symptoms of fatigue and compassion fatigue, and work with their respective perioperative manager to mitigate and manage fatigue.
2. Perioperative nursing staff should be seen as assets to the perioperative department and therefore appropriate staffing levels, adhering to the ACORN Standards recommendations, should be budgeted for in the health service to allow for safe clinical care.
3. Adequate postgraduate training for perioperative nurses is a serious concern for staff and must be addressed. Also, the incorporation of perioperative nursing into undergraduate nursing core curricula for the acquisition of surgical knowledge, to promote perioperative nursing and to provide basic transferable perioperative nursing skills, is paramount to ensure future recruitment of skilled perioperative nurses.

## Conclusion

This literature review has revealed numerous perioperative concerns that effect the safety of vulnerable patients and the quality of care across perioperative departments in Australia. The main themes identified were fatigue, nurse-to-patient ratios, and nurse training and education. Qualitative, mixed methods and secondary research indicate that these themes must be managed appropriately in order to ensure patient safety. Inadequate staffing and education create a serious risk for patients undergoing invasive procedures. There was a lack of counter arguments against the assumption that education creates safer staffing within the perioperative environment. A recommendation of this review is to consider further research into the links between fatigue, adherence to staffing standards, education levels of perioperative nurses and patient outcomes.

The evidence suggests the importance of non-fatigued, well-educated perioperative nurses in operating suites that are staffed in accordance with the ACORN standards to ensure a high level of perioperative patient care. Perioperative nurses and our patients deserve nothing less.

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