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Multidisciplinary simulation training for perioperative teams: An integrative review

Abstract

Background

The perioperative environment is a high-risk and complex area and the provision of safe, high-quality surgical care requires a multifaceted approach provided by multidisciplinary health care teams. However, it is reported that the multidisciplinary nature of perioperative teams can present barriers to patient safety through ineffective teamwork, ineffective collaboration and/or ineffective communication. Multidisciplinary simulation training creates realistic situations in safe environments to allow perioperative teams to improve teamwork and communication alongside the technical skills needed to manage emergency situations. This integrative review critically examines and reports the effects of multidisciplinary simulation training on perioperative teams and highlights the actual and potential advantages and disadvantages of such training.

Method

A structured integrative literature review process was undertaken yielding 14 key articles that were critically appraised and examined for emergent 'themes'.

Results

Multidisciplinary simulation training improved communication, teamwork, teamwork behaviours and teamwork attitudes between multidisciplinary perioperative team members. Overall, improvements in communication and teamwork correlated with improvements in perioperative patient safety. Despite the numerous benefits of multidisciplinary simulation training there are notable barriers to the implementation of such training programs. Multidisciplinary simulation training can be costly to set up and time consuming to facilitate. However, overall increases in patient safety offset the cost of simulation training and time-based barriers can be reduced by running simulation training in conjunction with existing education programs.

Conclusion

Multidisciplinary simulation training improved communication and teamwork among perioperative teams and this method of training is recommended overall within perioperative units. However, there were notable gaps within the literature, and further research involving multidisciplinary perioperative teams within Australian perioperative units should be conducted to gain a greater insight into the presence of multidisciplinary simulation training and the effects of such training.

Keywords: simulation training, multidisciplinary, interprofessional, interdisciplinary, perioperative, operating room, theatre

Introduction

Perioperative services are an essential part of health care, providing optimal health outcomes for patients through surgical and diagnostic procedures^{1,2}. Perioperative care can be a high-risk and complex process and the provision of safe, high-quality surgical care requires a multifaceted approach provided by multidisciplinary health care teams^{3–5}. Multidisciplinary perioperative teams consist of nurses, surgeons, anaesthetists and, depending on patient needs, may involve other health care professionals^{3,6,7}. During all stages of perioperative care, multidisciplinary teams are expected to work interdependently and collaboratively to meet the needs of the patient³. However, the multidisciplinary nature of perioperative teams can present specific barriers to patient safety – mainly through ineffective teamwork, collaboration and/or communication⁸. In perioperative emergency situations ineffective teamwork, collaboration and communication increases the likelihood of adverse health outcomes for the perioperative patient^{9,10}. Multidisciplinary simulation training has been identified as a method of training which can improve teamwork and communication within perioperative teams^{4,11}. The origins of simulation training can be traced back to the aviation industry, for the same reasons that it has been adopted in health care, and it is interesting to note that anaesthetists were the early adopters of this method of training^{12,13}. Simulated scenarios, often based on perioperative emergencies, are widely needed to allow the multidisciplinary perioperative team to learn, practice and improve the technical and non-technical skill required to manage perioperative emergencies¹⁴. With this in mind, the aim of this paper is to explore the

effectiveness of simulation training for multidisciplinary perioperative teams and identify potential gaps in practice through undertaking an integrative review of the research literature examining multidisciplinary simulation training in the perioperative setting.

Background

Multidisciplinary teams

Multidisciplinary perioperative teams consist of professionals from multiple disciplines such as surgeons, anaesthetists, anaesthetic technicians, theatre technicians and nurses^{3,6}. Unfortunately, the multidisciplinary nature of perioperative teams can present barriers to safe patient care, as a result of disciplinary ‘silos’, hierarchy and professional rivalries^{4,7,15}. These barriers are confounded by differences in clinical expertise, individual experiences and differing priorities for care⁹. Additionally, individual team members are continually changing due to rostering and transient workforces^{6,9}. All of these factors combined reduce team effectiveness and perioperative patient safety⁹.

Multidisciplinary simulation training

Multidisciplinary simulation training is a teaching technique whereby scenarios are created to represent realistic clinical situations to allow professionals to practice, learn, test or evaluate human actions, physical systems and processes⁶. Simulated scenarios are developed from relatively uncommon emergency events allowing perioperative teams to learn how to manage these events without causing harm to patients^{4,14,16,17}. Simulation training may occur within the environment in which the perioperative team would normally work or be conducted

in dedicated simulation centres¹⁸. However, for learning to be effective the environment in which simulation training takes place needs to reflect the clinical environment to provide participants with realistic and dynamic feedback^{19–21}.

Non-technical and technical skills

Perioperative care requires the use of both non-technical and technical skills to facilitate safe patient care, and failures in either have been associated with sentinel events within health care¹¹. Non-technical skills encompass interpersonal and cognitive aspects such as teamwork, collaboration, situational awareness, decision-making, problem-solving, task management, leadership and communication^{7,10,17,22,23}. Technical skills relate to the physical motor skills required to perform specific clinical tasks, for example, performing a surgical procedure or inserting an endotracheal tube^{12,17}. Technical skills also refer to the clinical knowledge needed to perform specific tasks related to patient care^{12,17}. Simulation training provides a platform in which technical skills rarely used in clinical practice can be practiced without causing patient harm^{12,17}.

Teamwork and communication are the non-technical skills focused on predominantly during multidisciplinary simulation training²¹. Effective communication within perioperative multidisciplinary teams is essential for collaboration, task management, leadership and teamwork^{10,15,24,25}. Social dynamics, heightened emotions in stressful situations and unclear messages all cause ineffective communication within multidisciplinary perioperative teams^{7,26}. This can be confounded by differences in communication training between the different disciplines within health care^{10,27}. Teamwork requires multidisciplinary

perioperative team members to work dynamically, interdependently and collaboratively while undertaking specific roles to achieve shared goals^{7,22,28}. All non-technical skills are interrelated, and inadequate levels of non-technical skills within multidisciplinary perioperative teams pose a significant risk to patient safety^{1, 11}.

Methods

Integrative review

A systematic process was used to conduct a detailed search of databases to identify current research literature related to perioperative simulation training. The review was integrative in that it drew upon, compared and contrasted both qualitative and quantitative studies (no mixed method studies were reported) to provide insight into multidisciplinary simulation training through the identification, summary and critique of themes^{29,30}.

Databases

To conduct a critical appraisal of the literature, a systematic search of the following electronic databases was conducted^{30–32}. Databases were searched with a linear approach beginning with PubMed, EBSCOhost and lastly Ovid. EBSCOhost was used to search CINAHL, Academic Search Ultimate, Australian/New Zealand Reference Centre Plus, Health Source: Nursing/Academic Edition, Medline and Medline Complete. Ovid was used to search UTAS Journal@Ovid, Joanna Briggs Institute EBP Database, Embase, Ovid Emcare and Ovid Medline all.

Key terms

To ensure a focused search of the literature, key terms were drawn from the research topic using the University of Tasmania’s

Table 1: Concept table

Group One		Group Two		Group Three
simulation training	AND	multidisciplinary	AND	peri*operative
		OR		OR
		interdisciplinary		operating room
		OR		OR
		interprofessional		theatre

concept table template. The key terms ‘simulation training’, ‘multidisciplinary’, ‘interprofessional’, ‘interdisciplinary’, ‘perioperative’, ‘operating room’ and ‘theatre’ were divided into three groups (Table 1). The asterisk truncation symbol was applied to retrieve all variables of the key term ‘perioperative’³⁰. Additionally, the following Medical Subject Headings (MeSH) terms were exploded and combined with major concepts within PubMed and Ovid³⁰. ‘Interdisciplinary studies’, ‘simulation training’ and ‘operating rooms’ MeSH terms were exploded and combined with major concepts within PubMed. ‘Simulation training’, ‘high fidelity simulation training’, ‘patient simulation’ and ‘operating room’ were selected as MeSH terms

and major concepts within Ovid and exploded. Key terms and MeSH terms were combined within group one, two and three with the Boolean operator OR, and each group were combined with the Boolean operator AND³².

Inclusion and exclusion criteria

Inclusion and exclusion criteria (Table 2) were set to focus the search strategy, producing literature closely aligned to the key terms^{30,32}. Articles were accepted if they included simulation-based training for multidisciplinary perioperative teams consisting of nurses, anaesthetists, surgeons and/or students from any of those disciplines. The location of simulation training could occur

Table 2: Inclusion criteria

Inclusion criteria	Exclusion criteria
Simulation-based team training	Simulation training conducted in emergency departments and intensive care units
Multidisciplinary team members from anaesthetic, surgical and perioperative nursing professions	Simulation training involving animal models, virtual reality and actors
Simulation-based training facilitated in situ or off-site	Abstracts
Full-text articles	Literature, narrative and integrative reviews
Articles publish after 2010	Historical papers
Articles written in English	Editorials
Primary research articles

Figure 1: PRISMA flow diagram

in situ or be conducted off-site provided the training location emulated the perioperative setting. Articles were included if they were less than ten years old, were full text, written in English and primary research. Articles were excluded if they were abstracts only, literature, narrative and integrative reviews or were historical papers and editorials. Articles were excluded if simulation training involved animal models, virtual simulation or used actors as members of the multidisciplinary team.

Results

The search results are presented in a PRISMA flow diagram (Figure 1). A total of 1018 records were obtained and reduced to 582 when duplicate studies were removed. A further 241 records were removed because they were not full text, 93 records removed because they were older than ten years and two records removed because they were not in English. The titles and the abstracts of the remaining 246 records were assessed to ensure the papers included some measure of multidisciplinary simulation training within the perioperative setting. A further 215 records were excluded, and the remaining 31 articles read in full. One article was excluded because the interdisciplinary training was not simulation-based and nine articles were excluded because they were literature, narrative or integrative reviews. Four articles were excluded because they were editorials and historical perspectives and a further three articles excluded because they involved animal models, actors or virtual human technology.

Critical analysis

Quality appraisal

To enhance the quality of this integrative review, the 14

studies chosen were assessed for quality, trustworthiness and relevance^{31–33}. The JBI Checklist for quasi-experimental studies (non-randomised experimental studies)³⁴ was applied to the non-randomised quantitative and mixed-method studies (see supplemental material). The Joanna Briggs Institute (JBI) Checklist for qualitative research³⁵ was applied to qualitative studies (see supplemental material). To calculate the percentage for the 14 chosen studies, each question within the relevant JBI checklist^{34,35} was assigned a score of one. Scores were totalled, divided by the number of questions in each tool and multiplied by 100 to calculate the percentage. Studies were considered to be of an appropriate quality if they scored 70 per cent or greater using the JBI checklists.

Theme identification

Critical analysis of the 14 primary studies required the identification of recurring and important themes and subthemes. Themes and subthemes were identified through an iterative approach involving reading and re-reading the primary studies, identifying themes and subthemes and determining the frequency with which these

themes and subthemes appeared in the primary studies Checklist for quasi-experimental studies (non-randomised experimental studies)³⁶. The final list of recurrent and repetitive themes and subthemes are identified in Table 3. Each theme and subtheme are expanded on in the discussion to examine the effect of multidisciplinary simulation training on perioperative teams.

Discussion

Critical analysis of the studies included in this review identified five themes: communication, teamwork, simulation fidelity, clinical change and barriers to program implementation.

Communication

Effective communication between multidisciplinary perioperative team members during emergency events is vital for safe perioperative patient care^{9,25,37}. Breakdowns in communication can be driven by professional hierarchies and lack of assertiveness, and is confounded by fatigue, interruptions and stressful high-risk situations⁹. Weller³⁸ identified that too much noise in the operating theatre also has a negative impact during

Table 3: Themes and subthemes

Themes	Subthemes
Communication	Debriefing
	Hierarchy and assertiveness
Teamwork	Non-technical skills
Simulation fidelity	In situ simulation vs off-site simulation
	Fidelity
Clinical change	Patient safety
Barriers to program implementation	Cost
	Time

emergency events. The disruptive effect of noise was also present in simulation training as Sørensen³⁹ identified that talking and laughing during simulation training reduced effective learning. Excessive noise needs to be reduced in perioperative environments as it distracts focus away from critical tasks and prevents effective communication between multidisciplinary perioperative team members^{38,40,41}.

Overall communication between multidisciplinary perioperative team members increased following simulation training^{38,39,42–45}. Furthermore, after undertaking multidisciplinary simulation training, perioperative teams were able to identify specific strategies for improving communication during emergency events^{38,44,45}. These strategies included using a whiteboard, avoiding acronyms and using common language to improve communication during an emergency^{38,44,45}. Additionally, closed loop communication was identified as an effective communication strategy^{38,44–46}. Closed loop communication creates a shared mental model through a process of information sharing, understanding and timely feedback³⁷. Effective communication leads to effective teamwork as it enhances leadership and task management. All of which are important non-technical skills required by multidisciplinary perioperative teams to manage emergency events.

An additional strategy for improving communication between multidisciplinary perioperative teams was direct communication^{38,45}. Direct communication involves using names to communicate directly with individual team members^{38,45}. The Surgical Safety Checklist⁴⁷ requires perioperative team member's roles and names to be identified prior to the start of surgery.

However, multidisciplinary teams members may change throughout the surgical case and face masks reduce the ability to recognise team members^{48–50}. Furthermore, only 30 per cent of names are recalled after team members are initially introduced^{48,49}. Briefings at the beginning of the day have been identified as a method of increasing name recall⁴⁵. Despite the issues just noted, simulation training is identified as an ideal way to 'get to know' the team members within the multidisciplinary team^{39,45,50}. Multidisciplinary perioperative team members also highlighted their appreciation for the opportunity to work in set teams during simulation training as it increased familiarity between team members and would therefore make direct communication easier⁵⁰. Effective communication leads to effective teamwork as it enhances leadership and task management. These are important non-technical skills required by multidisciplinary perioperative teams to manage emergency events.

Debriefing

An important forum for communication following multidisciplinary simulation training is debriefing after the simulation^{7,11,12}. If multidisciplinary perioperative teams are to meet learning objectives through simulation training they must reflect on their experience and test their understanding of knowledge gained⁵¹. This process is undertaken during debriefing and leads to a higher level of retention of key learning objectives through reflection, analysis, discussion and feedback^{7,11,51}. Multidisciplinary perioperative teams identified debriefing as the most positive and important part of learning following simulation training^{39,52}. Debriefing facilitated identification of patient care issues and reinforced

learning gained during simulation training, resulting in the transfer of new knowledge to the clinical setting^{39,53}. Debriefing also provided multidisciplinary team members with the opportunity to destress following simulation training^{51,52,54}.

Given the multiple functions of debriefing it is imperative that debriefing is facilitated by trained and experience staff^{51,55}. Properly facilitated debriefing sessions enable simulation participants to feel comfortable with being open and honest⁵³. Furthermore, Shapiro⁴⁶ emphasised the need for debriefing to be facilitated by staff who are aware of accreditation requirements as they used simulation training to ensure their office-based plastic surgery clinic met accreditation standards. This highlights the potential for multidisciplinary simulation training to be used to implement organisational changes to meet national standards and guidelines. However, accessing appropriately trained debriefing staff can be difficult and costly, presenting a potential barrier to the implementation of multidisciplinary simulation training^{38,52}.

Hierarchies and assertiveness

Traditional hierarchies within perioperative teams prevent open communication and have negative impacts on patient outcomes^{14,56}. Multidisciplinary team members identified the need to improve communication and teamwork and reduce hierarchies within the perioperative environment⁴⁵. Comments made after the simulation, showed simulation training gave perioperative team members more confidence to 'speak up'^{44,45, 53}. Interestingly, nurses and anaesthetists were more likely to identify the need to speak up than surgeons, demonstrating the existence of traditional hierarchies

within perioperative units^{53,57}. Although simulation training enabled multidisciplinary perioperative team members to feel more able to 'speak up', simulation training has not provided strategies for reducing professional hierarchies. In fact, reversing hierarchies by placing junior medical staff in leadership roles during simulation training has a negative impact on the experience of multidisciplinary simulation training³⁹. Involving students who may pursue a career in the perioperative field has been identified as a potential way of reducing professional hierarchies^{43,55}.

Teamwork

Non-technical skills

Effective teamwork among multidisciplinary perioperative teams requires individuals to work dynamically, interdependently and collaboratively while undertaking specific roles to achieve shared goals^{7,22,28}. Overall, there were improvements in teamwork, teamwork behaviours and teamwork attitudes following multidisciplinary simulation training of perioperative teams^{42,50,55,58-60}.

A range of rating systems were used to measure improvements in teamwork. Rating systems such as Behavioural Marker Risk Index (BMRI), Non-Technical Skills II (NOTECHS II), Non-Technical Skills for Surgeons (NOTSS) and Anaesthetist's Non-Technical Skills (ANTS) were used within the literature^{38,42,50,58}. Each rating system indicated improvements in teamwork by assessing non-technical skills such as leadership, management, problem solving, teamwork, cooperation, decision making, situational awareness and task management^{50,58}. Further to this, information sharing, briefing, contingency management, inquiry, assertion, inter-disciplinary information sharing and vigilance

are assessed in the BMRI rating system^{38,42}.

Rochlen⁵⁰ demonstrated overall improvements in NOTECHS II following simulation training. There were also improvements in NOTSS, ANTS and BMRI scores^{38,42,58}. Rochlen⁵⁰ found leadership and management improved the most following multidisciplinary simulation training, and proposed that this occurred due to the focus on communication during the debriefing process. Interestingly, communication and information sharing were identified as the individual components of the BMRI score which improved significantly as a result of simulation training³⁸. Further to this, debriefing was pivotal for multidisciplinary perioperative team members to identify the importance of information sharing³⁸. It is apparent that improvements in teamwork overall are dependent on improvements in non-technical skills^{38,42,50,58}. This demonstrates that non-technical skills are closely interrelated – communication and teamwork are not individual factors – and for perioperative teams to engage in effective teamwork they need to become proficient in a range of non-technical skills.

Effective teamwork between multidisciplinary perioperative team members requires individual disciplines to cooperate, work interdependently and collaboratively^{7,22,28}. This is evident by improvements in NOTSS scores which correlated with improvements in ANTS score but only when the scenarios were related to surgical complications⁵⁸. When the scenario was based on a difficult airway there were improvements in ANTS scores only⁵⁸. The surgeons did not contribute as much to this scenario demonstrating that simulation training needs to be appropriate to participant roles for learning to be effective^{39,50}. However, only one

surgical speciality was represented, and further research would be needed to assess if different surgical specialities demonstrate increases in NOTSS during a difficult airway scenario⁵⁸. Additionally, NOTSS and ANTS scores are representative of only two disciplines which make up a perioperative team. Further research would be required to examine if lessons learnt during simulation training involving one or two disciplines would transfer to the perioperative team as a whole.

Traditionally, multidisciplinary simulation training has not been taught at an undergraduate level, and it has been assumed that medical and nursing students will develop competence in communication and teamwork without formal training⁶¹. Unfortunately, this leads to the development of professional 'silos' and differences in communication training which creates ineffective communication between multidisciplinary team members^{7,10,27}. Multidisciplinary simulation training is an effective method of instilling consistent and optimal teamwork behaviours and attitudes in perioperative undergraduate students, interns and registrars^{43,52,55,60}. Instilling teamwork earlier in the careers of these students reduces professional hierarchies, increases collaboration between multidisciplinary teams and improves the overall culture thus fostering better communication and teamwork within multidisciplinary perioperative teams^{43,52,55,60}.

Simulation fidelity

Simulation training uses scenarios based on real clinical situations to allow multidisciplinary perioperative teams to practice and improve the non-technical and technical skills required to manage emergency situations without causing patient harm¹⁶.

Fidelity

The fidelity of a simulated scenario refers to the realism of a scenario, that is, the degree to which the simulated scenario correctly represents clinical events²⁰.

Simulation fidelity is identified as an important aspect of multidisciplinary simulation training to gain active engagement from perioperative teams^{45,46,50}. Greater engagement and 'buy in' from multidisciplinary teams occur once the perioperative team members determine that the scenarios are realistic and reflective of their clinical experiences^{45,46,50}.

There are several factors which influence the fidelity of simulated scenarios. Although, Shapiro⁴⁶, Rochlen⁵⁰ and Long⁴⁵ highlight the impact functional and psychological fidelity have on perioperative team members engagement with simulation training, physical fidelity is also important. Sørensen³⁹ found if perioperative team members wore their normal uniforms and full-scale mannequins or actors were used as patients, simulation fidelity was increased. However, some efforts at creating realistic situations during simulation training can be detrimental. Multidisciplinary team members found lists of telephone numbers to be disruptive and negatively impacted on the simulation experience³⁹. Maintaining traditional roles during simulation training was also deemed important for simulation fidelity³⁹; however, this could be problematic when challenging traditional hierarchies while undertaking simulation-based training, especially if traditional hierarchies are tied to traditional roles.

In situ vs off-site simulation

A further aspect of fidelity for simulation training is the physical setting in which a simulated

scenario takes place. Simulation training can be in situ simulation (ISS), which is facilitated within the perioperative unit in which the multidisciplinary teams work, or off-site simulation (OSS), which is in dedicated simulation centres^{18,21}. Conducting simulation training within the perioperative unit in which multidisciplinary team members work is believed to increase the authenticity and fidelity of the simulation training^{39,45,46,50}. In a study conducted by Sørensen³⁹, multidisciplinary perioperative team members believed ISS training would increase fidelity, therefore resulting in increased participant engagement. However, other factors became more important in relation to simulation participants' 'buy in', for example, multidisciplinary team members deemed authentic roles and realistic teamwork to be more important than simulation location. Improvements in teamwork, communication and safety climate within the multidisciplinary perioperative teams did not differ between ISS and OSS even though ISS was seen to be more authentic and realistic than OSS⁵⁹.

Conducting ISS training provides the opportunity for perioperative teams to identify latent safety threats within their clinical settings and identify changes which need to be made within organisations^{45,46,59}. Shapiro⁴⁶ used simulation training within their office-based plastic surgery clinic to not only improve the non-technical and technical skills of the staff but also test system issues within the office-based surgery. Furthermore, Shapiro⁴⁶ used simulation training to ensure their office-based plastic surgery practice complied with the accreditation standards for office-based practices within the United States.

Organisational changes can also be identified through simulation training. Slightly more organisational changes

were identified by multidisciplinary perioperative team members undertaking ISS than those who undertook OSS training⁵⁹. However, perioperative team members undertaking OSS found the location of training provided other unique learning opportunities³⁹. Their ability to adapt was challenged during OSS and adaptation during emergency events was seen as an important skill to possess. Furthermore, participants found that they were able to examine their routines from 'the outside' giving them a new perspective on their practices. Despite this advantage, perioperative team members identified being unfamiliar with the simulation environment as a drawback. Their focus shifted from improving essential non-technical skills to physical activities, such as searching for drugs and equipment, which they did not consider to be a priority or effective for learning³⁹.

Clinical change

Patient safety

Safe perioperative patient care is closely associated with effective communication and teamwork^{15,62,63}. Hinde⁶⁰ was able to show an improvement in safety climate following multidisciplinary simulation training due to improved teamwork, but stated that it was difficult to demonstrate a correlation between effective teamwork and improved safety culture and improved patient outcomes⁶⁰. This is contrary to the findings presented by Weller³⁸ and Weller⁴² who reported that an improvement in BMRI scores of 20 per cent correlated with a 14–16 per cent decrease in the likelihood of adverse events in the post-operative surgical patient^{38,42}. Doumouras⁵⁸ demonstrated that effective non-technical skills reduced the time to crisis resolution during surgical and anaesthetic emergencies.

This highlights the importance for multidisciplinary perioperative teams to undertake simulation training to increase perioperative patient safety.

Patient safety can be further improved through multidisciplinary simulation training as multidisciplinary teams test organisational systems, identify latent safety threats and test clinical practices⁶⁴. Following simulation training, Shapiro et al.⁴⁶ increased their multidisciplinary staff members' awareness of safety issues and identified processes which needed to be changed to increase patient safety⁴⁶. Similar results were demonstrated by Sørensen³⁹ and Sørensen⁵⁹ who reported that multidisciplinary perioperative team members were able to identify changes which needed to be made within their organisation to improve patient safety^{39,59}.

Barriers to program implementation

Cost

The development and implementation of simulation-based training programs can be costly²⁵. Reported costs within the literature include \$50 000 NZD for models and further costs of \$4000 NZD a day excluding staff wages paid during simulation training³⁸. Paige⁴³ estimated their costs to be \$9400 USD in total for the simulation session but they concede their cost estimates are low. Lost operating time, instructor training and instructor fees are not included in the estimates⁴³. Given the substantial costs of simulation training, improvements in teamwork, communication and patient safety, such as those reported by Weller³⁸ and Weller⁴², need to be demonstrated to gain support and funding from senior management and health care organisations^{38,42,44,45}.

This provides evidence of improved patient outcomes which correlates with decreased health care costs, which can be used to gain support and possible funding from senior management and/or alternative funding sources^{38,43–45}.

Time

A further barrier to implementing multidisciplinary simulation training is lack of time for facilitators to set up and run simulation training, and the lack of time to dedicate an entire operating theatre to simulation training⁴⁵. Study participants reported they lacked the required time to set up simulation equipment and course material⁴⁵. Furthermore, finding time between busy lists to set aside an operating theatre, resourcing facilitators and getting all team members together is challenging^{44,45}. Wongsirimeetee⁵² provided the schedule for simulation training months in advance to ensure they could secure nonclinical time for staff to participate in multidisciplinary simulation training. In contrast, Rochlen⁵⁰ designed their simulation training so that it could be conducted within one hour, making it easier to fit in with pre-existing weekly education and having minimal impact on operating times within the theatres. Integrating the multidisciplinary simulation training within existing education programs provides a way of negating the time-based barriers to implementation^{45,50}.

Further research

Despite the impact negative hierarchies can have on the effective functioning of multidisciplinary perioperative teams, hierarchies are not discussed in detail within the literature and neither is assertiveness. Furthermore, the ability for lessons learnt to be transferred to the perioperative team as a whole when one or two disciplines undertook simulation

training should be explored further. The largest gap in the literature, is the absence of Australian studies examining multidisciplinary simulation training for perioperative teams. It is unclear if simulation training is conducted regularly in Australian perioperative units and if there are positive or negative impacts on perioperative patient care. Further research involving multidisciplinary perioperative teams from Australian perioperative units should be conducted to gain a greater insight into multidisciplinary simulation training and the effects of such training before recommendations for practice changes can be made.

Conclusion and recommendations

Multidisciplinary simulation training undertaken by perioperative teams led to improvements in technical skills, non-technical skills and recognition of organisational changes, all of which improved perioperative patient safety. Individual non-technical skills such as communication were improved and techniques to improve communication were identified. Likewise, teamwork was also improved following simulation training. A high level of simulation fidelity is important for perioperative team members to engage in multidisciplinary simulation training and, initially, ISS was thought to be more beneficial than OSS training. However, clinical and organisational changes were identified in both settings. Despite the numerous benefits of multidisciplinary simulation training, barriers to the implementation of such training programs exist. Multidisciplinary simulation training is costly to set up and time-consuming to conduct.

There were gaps identified within in the literature following this

integrative review. Professional hierarchies and the lack of assertiveness within perioperative teams were not discussed in detail. There is also a lack of guidance on the frequency of simulation training and types of scenarios which should be used during simulation training. Lastly, none of the 14 primary studies used in this integrative review involve research conducted in Australia.

The perioperative environment is a dynamic and high-risk environment and requires multidisciplinary perioperative teams to engage in effective teamwork and communication. Although costly and time-consuming, simulation training improves both technical and non-technical skills within multidisciplinary perioperative teams increasing effective teamwork, communication and collaboration, and therefore improving perioperative patient safety. However, further research is required to discern the effects of multidisciplinary simulation training on Australian perioperative teams before further recommendations for clinical practice change can be made in the Australian context.

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