

Using game-based learning to teach orthopaedics to perioperative nurses: A real game changer

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Abstract

Nursing shortages have been evident in perioperative nursing and healthcare organizations are adapting education to train more perioperative nurses in a timelier fashion. Many educators are blending online theory courses with hands-on learning, such as game-based learning (GBL) to combat this issue. Game-based learning can come in various forms, such as escape rooms, simulation games, and virtual reality, which accommodate the multi-generational, interprofessional culture of the perioperative setting. The use of GBL in the perioperative environment has been found to increase staff engagement, foster teamwork, enhance knowledge retention, and improve problem-solving and technical skills. This literature review explores the application of GBL techniques in the surgical specialty of orthopedics. Perioperative nursing in orthopedics presents unique challenges, such as complex instrumentation, high surgical demands, and low staff engagement. By incorporating GBL techniques into orthopedic perioperative education, perioperative nurses could improve their knowledge retention, enhance their technical skills, and improve teamwork.

Keywords:

Game-based learning (GBL) is an innovative pedagogical tool that utilizes games as the medium that facilitates education delivery and learning comprehension (Ward & Anderson, 2022). There are many examples of GBL that can be used, such as board games, game shows, escape rooms, virtual reality, or digital games (Nisbet, 2024). A systematic literature review by Tavares (2022) found that students liked GBL and it fostered teamwork, improved relationships, improved short-term knowledge, and was more enjoyable than traditional

teaching methods. Previously popular in education, GBL has been introduced in nursing education due to the younger generations of learners who thrive on learning with interactive modalities and new modern technologies (Anastasiadis et al., 2018).

Perioperative nursing encompasses nurses who work in the preoperative, intraoperative, and postoperative phases of a patient's surgical journey in a variety of surgical specialties, such as gastrointestinal, gynecologic and obstetric, cardiac, vascular, orthopedics, neurosurgery, ophthalmology, and plastics (ORNAC, 2023; Rothrock, 2019). Perioperative nursing education focuses on teaching basic perioperative foundations, such as sterile technique, and focuses on general surgery for students to master the basic foundations (Li & Conway, 2024). Many nurses are left to learn such surgical specialties as orthopedics in real-life scenarios, watching experienced scrub nurses, reading technique guides, or watching videos, which can create a lot of anxiety and stress for the new perioperative nurse (Bracq et al., 2021). According to Clarke et al. (2021), the most common surgical specialty for perioperative nurses to learn is general surgery (42%), followed by orthopedic surgery (20%).

The demand for orthopedic surgery is increasing, due to the growing Canadian population over the age of 65 requiring joint replacement and fracture management (Canadian Institute for Health Information [CIHI], 2024). Two of the three top inpatient surgeries performed in Canada are knee and hip replacements, which require perioperative nurses to have extensive orthopedic knowledge and technical skills (CIHI, 2024; Rothrock, 2019). Arthritis is the most prevalent chronic health condition in Canada, plaguing 6,000,000 people, and the Arthritis Society (2021) predicts this number will rise to 9,000,000 by 2040, indicating an increased demand for orthopedic surgical procedures.

Game-based learning has been utilized in perioperative nursing as an innovative strategy to increase staff engagement, promote teamwork, enhance knowledge retention, and improve

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problem-solving and technical skills. The perioperative specialty of orthopedics is a challenging field requiring mastery of high-demand procedures and complex instrumentation, which can lead to challenges of staff frustration, gaps in technical skills, and surgical inefficiencies. This literature review evaluates the effectiveness of game-based learning, specifically on enhancing knowledge, improving technical skills, and promoting teamwork in orthopedic perioperative nursing.

Background

Healthcare organizations have been tasked with developing alternative teaching strategies to educate perioperative nurses in a quicker manner to help overcome the shortages of perioperative nurses caused by an increased number of retirements, lack of perioperative exposure in nursing undergraduate programs, as well as growing surgical waitlists caused by the aging baby boomer population and the delays of the COVID-19 pandemic (Li & Conway, 2024; Vortman et al., 2019). Historically, perioperative nursing education was offered by college-based programs. However, these were offered at limited times per year, were costly, and produced fewer perioperative nurses. Thus, many healthcare organizations have shifted to standardized online perioperative programs, to save money and produce more perioperative nurses in a timelier fashion (Li & Conway, 2024; Vortman et al., 2019). Many perioperative educators have created blended learning programs that incorporate online theory courses with hands-on learning through simulation, role-playing, or educational games. These programs have benefits for both students and teachers, including improved student satisfaction, increased applicability to practice, more flexibility, and facilitation of teaching technical aspects involved in perioperative nursing (Li & Conway, 2024). Because it allows nurses to gain skills and build confidence in a safe, fun environment, GBL has increased in nursing education over time (Nasiri et al., 2019).

Theoretical background of game-based learning

Games have been an important part of society, engaging human beings, creating competition, developing critical thinking skills, building friendships, and providing a positive learning medium (Anastasiadis et al., 2018; Nisbet, 2024). A systematic review by Krath et al. (2021) revealed 118 different theories linked to GBL, with the two most popular being the self-determination theory that appeared in 82 studies and the experiential learning theory found in 40 studies.

The Self-Determination Theory and GBL

The self-determination theory is a motivation theory that states human beings have three key psychological needs that build their growth and development: autonomy, competence, and relatedness (University of Rochester Medical Center, n.d.). Game mechanics can be designed to address one's autonomy by creating puzzles that allow the learner to make choices on their

own behalf (Krath et al., 2021). Competence can be improved by providing the learners with challenges that include specific goals, with awards for achievements and providing encouraging feedback. Relatedness results from providing a means for participants to feel connected as they collaborate toward the end goal (Krath et al., 2021; University of Rochester Medical Center, n.d.). When the self-determination model's three key psychological needs are met, learner motivation is increased, ultimately leading to improved engagement and a desire to achieve more (Krath et al., 2021). Engaging learners with GBL can motivate them intrinsically, with the enjoyment and the goal of learning, and extrinsically, by offering points, prizes, or praise. This results in their continued motivation to participate in GBL in the future (Brull & Finlayson, 2016; Krath et al., 2021).

The Experiential Learning Theory and GBL

Experiential learning theory emphasizes that, instead of direct learning instruction, how one's knowledge is obtained through experiences and interactions: concrete experience, reflective observation, abstract conceptualization, and active experimentation (McCarthy, 2016). The concrete experience occurs as the learner takes initiative to participate in the game, followed by reflective observation as they reflect and debrief on their experiences and emotions (Ho et al., 2022). Abstract conceptualization occurs as the learner integrates new and old concepts creating a new idea, followed by the active experimentation stage where the learner uses these new ideas to progress to the final game goal (Ho et al., 2022).

The experiential learning theory demonstrates many of the mentioned GBL benefits, such as fostering teamwork, improving motivation, providing opportunity for reflection, and hands-on practice (The University of You, 2020). To improve team dynamics, games help teams apply their past experiences and newly acquired knowledge to real-world scenarios (Abraham et al., 2024). Games provide a safe place for learners to experiment with past experiences and reflect through new experiences as they navigate through game challenges (Cho, 2022).

Methodology

For this review, a literature search was conducted in January 2025 using Science Direct, ProQuest, and Google Scholar. The literature search criteria included peer-reviewed scholarly articles, in English, and published between 2005 and 2025. Search words utilized were "perioperative nursing", "operating room nursing" and "game-based learning". Articles were selected if they demonstrated the use of GBL methods to teach perioperative nurses or the interprofessional perioperative team. Articles that used GBL outside of the perioperative setting or with undergraduate nursing students were excluded.

Results

The literature search found 14 articles that analyzed GBL specifically in the perioperative setting and were found to support the premise that GBL is an innovative and effective educational strategy.

GBL Increases Staff Engagement

Game-based learning in healthcare education increased in popularity following the COVID-19 pandemic, as it was an effective supplement to online teaching that enhanced student engagement (Tavares, 2022). Employee engagement is multidimensional, consisting of three different types of engagement: cognitive, behavioural, and emotional. Cognitive engagement occurs when employees use new learning strategies, search for new ideas, are creative, and employ their skills and knowledge effectively (Smith, 2025; Sutton, 2021). Healthcare organizations can promote cognitive engagement by offering continuous learning opportunities, such as GBL, to encourage problem-solving skills and innovative thinking (Smith, 2025). Behavioural engagement includes the employee's participation, effort, persistence, and attention to detail, and can be encouraged by using GBL to define expectations and provide the learner with feedback on their performance outcomes (Smith, 2025; Sutton, 2021). A systematic review by Nasiri et al. (2019) found that GBL can improve the emotional engagement of learners, by enhancing their feelings, motivation, interest, and attitude. Employees who are engaged in the workplace produce better outcomes, showcase a passion and energy for the organization's goals, have positive workplace relationships, and change jobs less frequently (Chandani et al., 2016).

Traditional learning methods, such as lectures or reading manuals, can be unengaging for the learner, especially for repetitive topics, such as annual policy reviews (Brull & Finlayson, 2016). Researchers have observed staff using their smart phones for non-work-related activities during presentations and policy updates, resulting in educator frustration, learner distractions, missed critical knowledge, and learner disengagement (Crowley-Barnett et al., 2020). Educational games can be tailored to review mandatory policies to improve proficiency, encourage self-development, and promote best practices (Paim & Goldmeier, 2017). After playing a game show that reviewed annual laser safety, perioperative nurse evaluations highlighted that the game was an enthusiastic and an engaging way to review laser safety versus reading safety standards (Castelluccio, 2011). When reviewing mandatory education content, such as cardiopulmonary resuscitation, 98% of participants found escape rooms an engaging, interactive teaching tool for reinforcing emergency situations (Borck et al., 2022).

Game-based learning can employ pleasing game elements, such as music, visual effects, and a narrative story, that help keep the education topic fresh and new (Ward & Anderson,

2022). During development of the digital game "Playing with Tweezers," developers adjusted game aesthetics to add nurse avatars with different facial expressions, background music, and 3D images to appeal to the learning perioperative nurses (Paim & Goldmeier, 2017). Utilizing participants in different roles, such as judge, scorekeeper, or timekeeper, can help orchestrate an engaging environment when hosting a game show-style GBL event (Fawcett & Dodd, 2009). Educational escape rooms are multi-sensory and incorporate a variety of props, such as blacklights, various styles of locks, and mirrors, to keep learners engaged in the learning process (Frederick & Reed, 2021).

GBL Fosters Teamwork

The operating room is a fast-paced, complex environment that requires enhanced interprofessional teamwork to ensure safe, quality patient care (Paige et al., 2020; Rothrock, 2019). Game-based learning, such as escape rooms, is an innovative means to employ teamwork that encourages communication, while recognizing an individual's strengths and promoting collaborative decision making (Borck et al., 2022; Soares et al., 2023). Following participation in a perioperative escape room on emergency situations, 43.5% of participants indicated "teamwork" was the key learning experience from the interprofessional education session (Borck et al., 2022).

An educational interprofessional escape room developed to reinforce the safe surgical checklist was found to be a positive experience that offered an opportunity for the various professionals to collaborate, enhance communication skills, and problem solve as a team (Soares et al., 2023). Despite the safe surgical checklist being a well-known topic, the researchers found that utilizing an escape room raised the team's awareness of the weak points in the current process, and a debriefing offered opportunity for the team to identify strategies for improvement (Soares et al., 2023).

Kinlaw (2020) developed an escape room, versus traditional teaching methods, to teach perioperative nurses the principles of sterile technique. This GBL activity outlined specific rules, including "collaborate with your team" and "everyone must respect each person's contribution and ideas" (Kinlaw, 2020, p.494). Survey results revealed that 100% of perioperative nurses found this to be a fun learning activity that encouraged collaboration and teamwork (Kinlaw, 2020).

Educating perioperative nursing staff can be a challenging task with potentially four different generations in the team: from baby boomers to generation Z (Borck et al., 2022; Crowley-Barnett et al., 2020). Game-based learning encourages all generations to utilize their specific skills; for example, baby boomers' experiential knowledge or millennials' technology skills (Brull & Finlayson, 2016; Cho, 2022; Crowley-Barnett et al., 2020). Overall, this type of learning is an effective tool for younger nurses who thrive in a digital age and require

active engagement, reality, and entertainment to help them learn compared to traditional education modalities (Paim & Goldmeier, 2017).

GBL Increases Knowledge and Enhances Knowledge Retention

While analyzing the literature, GBL has been proven to improve a learner's knowledge, enhance cognitive performance, and promote knowledge retention (Abraham et al., 2024; Akbari et al., 2022; Clarke et al., 2021; Crowley-Barnett et al., 2020; Kinlaw, 2020; Khorammakan et al., 2023). Following playing a game show that reviewed surgical attire and sterile technique, 97% of perioperative nurses agreed that the game helped them learn the subject content (Crowley-Barnett et al., 2020). Kinlaw (2020) found similar survey results following an escape room on sterile technique, where 100% of participants agreed that the escape room increased their knowledge.

A study by Akbari et al. (2022) split participants into a lecture-training group or a virtual game-training group to learn general surgery instrumentation. Following theoretical tests on the first and last day of training, researchers found that the game-training group had higher theoretical mean scores and had fewer errors than the lecture-training group (Akbari et al., 2022). A randomized controlled trial by Clarke et al. (2021) found that perioperative nurses who played the digital simulation game, "Periop Sim", prior to exposure to real surgical instruments were 23% quicker with a 93% accuracy in instrument recognition compared to perioperative nurses who had an 80% accuracy playing the game after real instrument exposure.

Puzzle-based games, another form of GBL, have been proven to improve knowledge and cognitive performance (Hosseini et al., 2023; Khorammakan et al., 2023). A puzzle game was designed to teach learners coronary artery bypass graft surgery instruments and the stages of the surgery (Khorammakan et al., 2023). Following a two-week post-game test, researchers found that knowledge mean scores increased from 2.68 to 5.75 and cognitive functions increased from 2.00 to 6.31, proving these puzzle games improved participants' knowledge (Khorammakan et al., 2023).

GBL Improves Problem-Solving and Technical Skills

The perioperative setting has many practices and protocols that must be correctly mastered to ensure safe, quality patient care; one such is sterile technique (Rothrock, 2019). Game-based learning is an innovative strategy for encouraging the use of critical thinking skills while navigating through game challenges (Carifa & Goodin, 2011; Castelluccio, 2011). Escape rooms can enhance perioperative nurses' critical thinking skills as they solve puzzles related to such perioperative practices as sterile technique, wound closure, and patient safety (Frederick & Reed, 2021; Kinlaw, 2020).

Working in the operating room requires a high level of concentration, speed, and accuracy and well-developed skills in instrument identification, sterile field set-up, and patient positioning to ensure patient safety (Hosseini et al., 2023; Rothrock, 2019). Akbari et al. (2022) found that participants who played the virtual reality game, "PlaSurIn", had more accurate and efficient sterile instrumentation set-up times. Online puzzle games were also found to be an effective tool for enhancing problem-solving skills along with improved surgical instrument set-up times (Hosseini et al., 2023).

Discussion

Traditionally, perioperative nurses are educated through college-based programs or online perioperative programs. However, these programs primarily focus on teaching perioperative basics and general surgery (Li & Conway, 2024). This leaves the perioperative nurses to learn surgical specialties, such as orthopedics, in real clinical settings on real patients (Clarke et al., 2021). As healthcare continues to change constantly to meet new innovations and society strains, education training also needs to be flexible and innovative to meet healthcare demands and challenges (Brull & Finlayson, 2016). As we have seen with previous literature, GBL has been successful in perioperative education and could have benefits in teaching orthopedics to perioperative nurses.

Enhancing Orthopedic Knowledge

Orthopedic surgery is a complex surgical specialty requiring a vast knowledge of anatomy, physiology, orthopedic conditions, and surgical instrumentation (Rothrock, 2019). A learner's knowledge is improved when they can find relationships between different domains, e.g., anatomy and a surgical sequence, such as in the Khorammakan et al. (2023) study, where GBL was used to teach perioperative learners heart anatomy and surgical sequences in coronary artery graft bypass surgery. Game-based learning puzzles can link a perioperative nurse's knowledge together, e.g., connecting knowledge about orthopedic fractures, instrumentation, and orthopedic implants, to enhance knowledge comprehension.

Orthopedic equipment and instrumentation are ever-changing to keep up with the demands of society and as newer medical advances arise; thus, a perioperative nurse always must stay attentive to changing technology (Rothrock, 2019). Accordingly, perioperative educators need to use innovative learning approaches, such as GBL, to present new information and to stimulate critical thinking, especially in such stressful areas as orthopedic surgery (Paim & Goldmeier, 2017). Perioperative nurses can find orthopedic surgery a stressful environment due to there being multiple pans of complicated instruments that require the nurse to build specific cutting jigs and alignment guides, and assemble implants prior to surgeon use (Rothrock, 2019). When a nurse experiences anxiety,

learning can be difficult. However, if the learning is an enjoyable experience, the nurse is more likely to retain the new knowledge (Castelluccio, 2011). Using GBL to teach orthopedic instrumentation allows the nurse to learn through a hands-on experience in a safe, controlled environment that, ultimately, would decrease anxiety levels (Borck et al., 2022).

Some orthopedic education is mandatory and needs to be completed annually to ensure safe patient care, such as the use of power tools or mixing bone cement. However, annual in-services can be boring and unengaging (Brull & Finlayson, 2016). The use of GBL could reinforce current orthopedic knowledge on mandatory safety protocols to keep staff engaged, create a fun atmosphere, and instill positive competitive teamwork (Crowley-Barnett et al., 2020; Fawcett & Dodd, 2009).

Improving Technical Skills

The second most common Canadian inpatient surgery is the total knee arthroplasty, which is achieved through a specific surgical sequence using complex orthopedic instrumentation (CIHI, 2024; Rothrock, 2019). Historically, teaching often was done using the “see one, do one, teach one model in the clinical care setting” (Koo et al., 2022, p.3). However, using GBL has allowed participants to learn skills prior to coming to the operating room. Virtual reality games have been developed to teach joint arthroplasty principles to surgical residents and have proven successful for enhancing their knowledge retention of the surgical sequence, decision-making skills, and troubleshooting abilities (Sabri et al., 2010). Creating virtual reality games on orthopedic procedures could be used as a GBL strategy to enhance perioperative nurses’ technical skills with orthopedic instruments, prior to working in the operating room.

Incorporating more orthopedic surgeries in GBL could improve nurse’s instrumentation set-up time and other surgical efficiencies. The Hosseini et al., (2023) study was the only article found that utilized GBL in a variety of surgical specialties, including orthopedic surgery that analyzed open reduction internal fixation of fractures and dynamic hip screw fixation, where nurses had to set up surgical instrumentation (Hosseini et al., 2023). The study found that game-trained students could set up instrumentation in a shorter time than conventionally trained students, proving that developing more GBL on orthopedic procedures could improve surgical efficiencies (Hosseini et al., 2023). Canadian joint replacement waitlists continue to rise due to the aging population, staff shortages, and cancelled surgeries during the pandemic, so improving surgical efficiencies continues to be a priority for many healthcare organizations (CIHI, 2024). By improving perioperative nurses’ technical skills in instrumentation and sterile field set-up, surgical efficiencies could improve and, in turn, result in a reduction in surgical waitlists.

Promoting Teamwork

The literature has proven that GBL is an engaging teaching strategy that helps build teamwork. Orthopedic surgery requires the interprofessional team to work collaboratively to ensure safe patient care, as there are complex positioning equipment, various surgical positions, and complex instrumentation that can pose harm to patients and staff if not safely employed (Rothrock, 2019). For example, an entire interprofessional team is required to position and rotate a patient from a supine to prone position for posterior spine surgery, thus excellent teamwork is needed to execute the rotation in a safe manner (ORNAC, 2023). Surgical errors have negative consequences for patients, possibly causing longer hospital stays, higher complications, or mortality; thus, an interprofessional approach is used to prevent such errors (Santos & Jones, 2023). Game-based learning can provide a learning environment for teams to enhance their teamwork, communication skills, and decision making, which contribute to reducing potential errors (Borck et al., 2022; Soares et al., 2023).

Adverse surgical events, such as wrong-site surgery or a retained surgical item, unfortunately can occur, and most often during the intraoperative phase (Canadian Patient Safety Institute, [CPSI], 2016). The World Health Organization developed the Surgical Safety Checklist, which is utilized in more than 70% of countries worldwide, purposely to prevent adverse surgical events (Urban et al., 2021). This checklist is a low-cost tool that aims to improve communication and teamwork in the operating room. However, there is often a lack of training for medical professionals to engage together in practising its use (Urban et al., 2021). After developing an educational escape room to review the Surgical Safety Checklist, Soares et al. (2023) found the escape room provided a fun training environment for developing teamwork and communication between the various professionals. This same strategy could be applied specifically to orthopedic surgery, putting an emphasis on the Surgical Safety Checklist’s features for preventing wrong-site surgery or incorrect implant selection.

Effective teamwork is not just about patient safety. It is also about the safety of the surgical team. Orthopedic surgery involves the use of complex equipment, such as nitrogen power tools, bone saws, and high-speed drills that can cause harm to the surgical team if not handled properly (ORNAC, 2023). Effective operating room teamwork results in efficient work done in a safe and timely manner. Utilizing GBL to teach orthopedic surgery can be an effective way for teams to function and work together, with escape rooms particularly serving as a great means to improve teamwork and collaboration (Borck et al., 2022; Frederick & Reed, 2021; Kinlaw, 2020; Soares et al., 2023). Consider how creating an escape room with orthopedic-themed puzzles would encourage orthopedic perioperative teams to collaborate, gain trust, and cooperate toward the end goal.

Challenges to Implementing GBL to Orthopedic Perioperative Education

Game-based learning does come with challenges that must be considered. Games such as escape rooms can be very labour intensive to develop and expensive in terms of cost and educator wage. Yet, once developed, they can be reused or adjusted in the future (Borck et al., 2022; Carifa & Goodin, 2011). Some digital GBL relies on expensive equipment and programs; however, after games are purchased, they can be seen as a cost savings in staff education and can decrease the burden on educators (Clarke et al., 2021; Nasiri et al., 2021).

Another challenge to using GBL is that it does not appeal to all types of learners. Some learners get anxious working in a competitive nature or fear not knowing the correct answer in front of their peers (Borck et al., 2022). Some GBL that use various technologies may not work well for those people who are not as savvy about technology, and the gaming activity would create frustrations or anxiety (Crowley-Barnett et al., 2020).

A final challenge in using GBL to teach orthopedic surgery is to keep the game content up to date. Orthopedic surgical instrumentation is always advancing to higher quality products to deliver best standards of care (Rothrock, 2019). Healthcare organizations also change vendors of orthopedic instrumentation in accordance with provincial contracts (ORNAC, 2023); thus, educators would need to update their GBL on a regular basis to accommodate the changing of various vendors, instruments, and protocols.

Future research

This literature review analyzed how GBL has been implemented in perioperative nursing education; however, most of these articles and studies are on basic perioperative principles. Only one study by Hosseini et al. (2023), studied surgical instrumentation set-up in a variety of surgical specialties, including orthopedics. A virtual game “PlaSurIn” was developed to help teach novice perioperative nurses how to set up basic surgical instruments. Because of its success, researchers feel this game serves as a foundation for future game development in other surgical specialties (Nasiri et al., 2021). Crowley-Barnett et al. (2020) found 95% of nurses agreed they would like to see more GBL applied to a variety of perioperative topics.

A lack of confidence in a highly demanding environment, such as the operating room, can lead to nursing anxiety and stress regarding providing safe, competent patient care (Borck et al., 2022; Paim & Goldmeier, 2017). Exposure to GBL can increase nursing confidence and enhance skill levels, which could alleviate some of the anxiety and stress (Castelluccio, 2011). To date, there is no evidence of research conducted to analyze perioperative nursing anxiety and stress levels before or after

using GBL. Future long-term studies to analyze GBL’s impact on improving perioperative nurses’ confidence and decreasing their anxiety and stress levels would be beneficial.

Conclusion

Game-based learning is a valuable and increasingly popular education strategy in perioperative nursing education. This tool has proven effective for developing staff engagement, team collaboration, enhanced knowledge, and improved problem-solving skills. So far, the majority of GBL in the perioperative setting has focused on perioperative foundations, such as sterile technique and general surgery, without addressing the specific requirements of orthopedic surgery. However, the surgical specialty of orthopedics is growing in demand due to a combination of the aging baby boomer population and increasing rates of osteoarthritis. Now, orthopedic surgery is in high demand, yet it is a comprehensive specialty for perioperative nurses to master, due to complex instrumentation and equipment, which can cause anxiety and stress. This literature review has shown that GBL could be a valuable tool for teaching surgical specialties—orthopedics and others—to improve knowledge, foster teamwork, and advance technical skills.

About the author



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Over the past 10 years, she has managed the joint arthroplasty, arthroscopy, spine, and orthopedic trauma program and trained perioperative nurses

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Conflicts of interest

There are no conflicts of interest to be declared.

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