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THE ROLE OF NURSE IN PROMOTING PATIENT SAFETY IN THE OPERATING ROOM DURING SURGERY

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ABSTRACT

Globally, patient safety is a crucial aspect of healthcare. Modern healthcare, with advancements in technology, surgical equipment, anaesthesia, and complex surgeries, improves the quality of life of many patients. However, patient harm is still a concern, even 25 years after the report by the Institute of Medicine. To err is human.

Therefore, this study's aim was to describe the role of nurses in promoting patient safety in the operating room during surgery. The research method used was a descriptive literature review. Additionally, thematic analysis was used to identify the study's main themes.

The study's findings revealed that nurses play a crucial role in preoperative preparation, which includes having a clear preoperative plan, correct patient identifications and well-functioning surgical equipment. In addition, effective communication and teamwork ensured a timely and effective surgical process limiting communication lapses which can lead to patient harm. Furthermore, following standardized hand washing techniques, using the correct skin disinfection agents and ensuring that the operating room environment is effectively prepared for the surgery, including having enough skilled and competent nurses. Similarly, pressure injury prevention and correct patient positioning can be achieved by using gel pads on areas and joints that are prone to injury and maintaining skin integrity. Also, advocating for the patients and ensuring that their dignity is maintained throughout the surgery are important roles of the nurse. Finally, reporting and documentation ensures that there is continuity of care and easy access to information when needed for better surgical outcomes.

By providing students with this fundamental knowledge, the study hopes to better prepare future nurses for the complexities of surgical care, so that they will be able to improve the safety of the patient. The study recommends future research on the role nurses play in the integration of technology for better patient outcome.

Keywords: intraoperative, nurse role, operating room, patient safety

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1 INTRODUCTION

The operating room is a complex surgical environment whereby the care of the surgical patient is aided by the coordination as well as the integration of many critical factors. The operating room handles a variety of different types of surgeries, from simple to complex. Emergency and scheduled surgeries are now possible because of technological advancement. This requires the multi-professional team working together to ensure the success of the surgery, and the goal being to promote the safety of the patient. (Smith et al. 2020, 92-93.)

Although there is advancement in technology in modern care, patient safety has improved. However, the advancement of technology has also introduced more risks and challenges because of the occurrence of adverse events, which requires the surgical team to consistently update their knowledge to meet the continuous advancement in technology. As a result, the World Health Organization has consistently highlighted surgery as a critical area of concern when addressing patient safety issues. (Aranaz-Ostáriz et al. 2022, 1-2.)

In 2009, the World Health Organization launched the Surgical Safety Checklist. The aim of the checklist was to reduce the cases of adverse events during surgery and promote communication and teamwork among the surgical team. Both the surgical team and the patients were intended to gain from these safety measures. However, despite the implementation of the checklist across the world, the operating room still faces challenges in ensuring a consistent and long-term implementation of the checklist. (Van Zyl et al. 2023.)

According to Michalak & Kaligna (2021, 1-2), approximately 234 million surgeries are carried out globally every year. Nearly 770 000 surgical patients continue to suffer because of avoidable surgical errors. This fact stressed the importance of strictly and consistently following the safety procedures, for example, the WHO surgical safety checklist, in lowering the risks to be able to protect the patient from harm. Smith et al. (2020, 5) highlighted that during surgery, patient's life is in the hands of the surgical team members and they depend on them, the systems and policies as well as the healthcare institutions to reduce these risks of adverse events, especially when the patients are under the anaesthesia and emphasized

the role of nurses in advocating for them when they cannot speak for themselves. Additionally, involving patients in deciding about their own care, ensuring that informed consent has been obtained and addressing the needs of the individual and respecting preferences build trust and enhance safety outcomes. (Smith et al. 2020, 5.) Michalak & Kaligna (2021, 1-2) added that every patient is entitled to receive healthcare services that align with the latest medical standards in a safe environment where their safety is safeguarded throughout their care.

Due to the dynamic as well as the multidisciplinary nature of the operation, collaboration of different healthcare professionals is needed, including surgeons, anesthesiologists, nurses and other specialized professionals. Each team member brings their own unique expertise and skills to ensure that the surgery is successful. However, errors, for example, wrong-site surgery, retained surgical instruments and surgical site infections persist, which emphasizes the need to carry out measures such as consistently following the implementation of surgical safety checklists, and adherence to infection control. (Smith et al. 2020, 93.)

Therefore, as key surgical team members, nurses play an essential role in promoting patient safety throughout the intraoperative phase of care. They oversee the surgical environment, maintain sterile techniques, and monitor patients' vitals while they are under anaesthesia. Their actions are integral in ensuring that errors are reduced, and patients' outcomes are improved. This thesis, therefore, seeks to fill that gap by describing the roles and strategies employed by nurses in promoting patient safety during intraoperative care.

Through a descriptive literature review, this thesis examines the existing research to be able to achieve the purpose of this study. Furthermore, this research integrates the findings to provide insights for nursing students, giving them a better understanding of how to ensure patient safety. The findings from this study can also be used as a learning material to help nursing students prepare for their roles in ensuring safety before they begin their surgical practice.

2 INTRAOPERATIVE PATIENT SAFETY

2.1 Intraoperative Patient Safety overview

Intraoperative patient safety is defined as to the measures, practices as well as protocols that can implemented to protect patients from harm that can happen either before, during or after the surgery (Ünver & Yeniğün 2020.) The intraoperative phase starts when the patient enters the operating room until the time the patient is being transferred to the postoperative unit (Potter et al. 2017, 1102).

The primary goal of intraoperative care is to prevent injuries and complications that are related to anaesthesia, positioning, infections, surgical errors as well as the equipment that are being used. Achieving this requires meticulous planning, precise execution as well as cooperative teamwork among the surgical team members. However, the dynamic and complex nature of the surgical environment comes with many challenges, such as the equipment's not functioning well, poor communication as well as the need to be able to adapt to unexpected situations. (Christman et al. 2024, 206- 207.)

The World Health Organization established standardized protocols, i.e. the surgical safety checklist, to be able to address these issues. These protocols put a strong emphasis on the importance of safety precautions, for example correctly identifying the patient, marking the surgical site and using sterile techniques. (Van Zyl et al. 2023.) Collaboration between surgical teams is further improved by efficient communication frameworks like the use of Situation, Background, Assessment, Recommendation method (SBAR). It has been suggested that SBAR be used, especially when patient handovers are taking place. (Ruhomauly et al. 2019.)

Furthermore, using digital health technologies, such as electronic medication administration records (eMAR) and computerized physician order entry (CPOE) systems, can improve patient safety and lower medication errors. Dispensing medication in the operation room lacks standards and routine safety checks unlike in a typical setting where a doctor prescribes, the pharmacy prepares, and a nurse and a second nurse confirm and administer. Real-time information is required to

be able to facilitate fast decision-making also in the administering of medications, and the eMar can assist in making an informed decision regarding the patient's care. By lowering medication errors, enhancing communication between medical professionals as well as offering real-time decision support, digital tools have the potential to transform medication safety completely. (Ye, 2023.)

In addition, maintaining a culture of safety by frequently carrying out audits, incident reporting as well as surgical outcome analysis gives the important information needed for improving procedures and enables averting the mistakes in the future. Healthcare teams can provide exceptional care and guarantee the best results for patients who are undergoing surgery by putting safety first at every stage. (Habahbeh & Alkhalaileh 2020, 222.)

2.2 Surgical site infection

According to Smith et al. (2020, 65-67) surgical site infections are infections that are associated with surgical procedures which happen at or near the incision site within 30 or 90 days after surgery, if for example an implant has been left in the place. They are the most common complications and increase the mortality risk by 2-11 times and the report shows that 40-60 % of these infections can be prevented. (Smith et al. 2020, 65-67.) Michalak & Kotomska (2021, 3-4) added that they have a major negative impact on the patients. They cause pain, prolonged hospital stays, suffering, increases the cost of medical care and frequently patients undergo reoperation.

Surgical site infections make up 22 % of readmission. This is reported in 38% of patients who have undergone surgery. (Michalak & Kotomska 2021, 3-4.) Simone et al. (2020) highlighted that emergency surgery is associated with higher risks of surgical site infections. This is because of the presence of significant risk factors such as contaminated and dirty wounds as well as a long duration of surgery. Surgical site infections may also be associated with the patient’s risk factors such as age, obesity or malnutrition.

Numerous interventions have been suggested and implemented over the years to prevent surgical site infections. These measures include protocols for skin

cleansing, methods for hair removal, maintaining intraoperative normothermia, administering antimicrobial prophylaxis before surgery, using plastic adhesive skin barriers, providing high-flow oxygen supplementation, protecting the wound, ensuring instrument sterility, preparing the bowel, managing incision length, and adopting delayed primary closure of incisions. (Simone et al. 2020.)

2.3 Retained surgical objects

Retained surgical objects are surgical items that are left inside the patient unintentionally during surgery, such objects include, for example, surgical swaps, gauze and needles. According to research, human factors are the most common cause of retained surgical objects. Insufficient written, oral and electronic communications, lack of compliance with the protocols and fatigue can lead to retained surgical objects. (Osborne et al. 2022, e49-e50.) Additionally, inadequate counting protocols and not following the entire established safety checklists can lead to having foreign objects being retained in the surgical site. Furthermore, environmental factors, such as poor lighting or chaotic operating room conditions, further increase the risk (Weprin et al. 2021).

Even though there is risk of retained surgical objects in all the surgeries, Snape et al. (2022, e10 - e12), highlighted that there is a higher risk when it comes to emergency surgery, patients having high BMI >30kg/m2 as well surgeries that last longer. Additionally, in cases where there is intraoperative bleeding or there are unexpected events. The consequences of retained surgical objects are infections, reoperation or even death. According to the research, the death rate is approximated to be as high as 35%. Furthermore, there is also a huge expense that is related to retaining surgical objects and resolving the inconsistencies of the surgical count. This entails additional operating room time or using more resources, for example radiography. (Snape et al. 2022, e11 - e12.)

Surgical environments have put in place several preventive measures, such as standardized counting systems and technological solutions, to address these risks. Despite being widely used, manual instruments and needle counting are prone to human error. To improve tracking accuracy, modern technologies like barcoding systems as well as radiofrequency identification retained surgical objects are also being used more and more. Furthermore, reducing risk requires developing a

strong safety culture that prioritise cooperation, communication and following surgical safety protocols (Weprin et al. 2021).

2.4 Wrong site surgery

Wrong-site surgery is a serious but preventable surgical error that has a far-reaching consequence for patient safety as well as the healthcare systems. A recent study emphasized that the errors in surgical consent and procedural scheduling are major contributors, with side-specific misidentifications, for example, the use of right versus left, which accounted for 69% of the cases that were reported. (Taylor & Yonash, 2024.) Consistent adherence is still a problem even after standardized protocols like the Universal Protocol have been adopted. This is especially true for complex procedures like spine surgeries, where strict preoperative checks are not always enough to prevent wrong level errors (Devine et al. 2020).

The use of modern technologies and other creative approaches has been shown to lower these risks. For instance, in a trial of 487 surgeries, the StartBox Patient Safety System successfully detected 17 near-miss events, which has guaranteed that there were no surgeries that were performed at the incorrect site (Gloystein et al. 2020). Artificial intelligence continues to develop as a transformative tool for preventing wrong-site surgeries. Recent research showed a deep learning system that can differentiate between left and right upper limbs with 98% accuracy. This reduces the likelihood of side-specific errors during surgical planning. (Wu et al. 2023)

Moreover, it has been shown that systemic adjustments, such as improving communication between operating team members and using proactive risk assessment models, are essential to improving patient outcomes. These developments emphasized how crucial it is to use technology, communicate, and adhere to stringent protocols to prevent avoidable mistakes. (Zil-E-Ali et al. 2023).

3 STRATEGIES NURSES EMPLOY DURING INTRAOPERATIVE

3.1 Surgical safety checklist implementation

A checklist removes the barriers between responsibilities, and it allows every member of the operating team to have a voice while they are working together in caring for the patients. In addition, the surgical checklist is adaptable and can be modified to suit the needs of the region or the hospital implementing it. Furthermore, when the checklist is used appropriately, as shown in Figure 1 below, i.e. implementing "sign-in", "time-out", and “sign-out”, it decreases the infections, complications after surgery and the mortality rate. (Moyal-Smith et al. 2022,342.)

According to Van Zyl et al. (2023), the "sign-in" stage focuses on identifying the patient and the procedure to be performed while addressing any concerns that are related to anaesthesia before administration is started. During this phase, nurses verify the identity of the patient as well as the details of the procedure. They also communicate with the anesthetists to make sure that any risks are discussed, and solutions are reached. The "time-out" stage takes place just before the incision begins, in this stage the surgical team reviews and verifies that all the important information including the patient's identity, the surgical site and any possible risks. (Van Zyl et al. 2023.) This phase emphasizes collaborative engagement, requiring all the team members, i.e. the nurses, surgeons and anesthetists to honestly communicate and confirm that all the necessary equipment is functional and available. To make sure the team is ready to move forward safely, nurses actively check that the instruments have been sterilized and that the results of diagnostic tests are ready. (Rodgers et al. 2020)

The "sign-out" phase takes place after the incision has been done, which ensures that all the surgical instruments, as well as the materials, are accounted for and verified. Important observations during the surgery are documented as well as being communicated. Surgical counts are meticulously done and confirmed that no instruments, sponges or other materials are left inside the patient’s body. Additionally, nurses inform the receiving team of significant surgical results and if

there are any urgent postoperative concerns, which also aid in the seamless transition to the postoperative unit. (Van Zyl et al. 2023.)

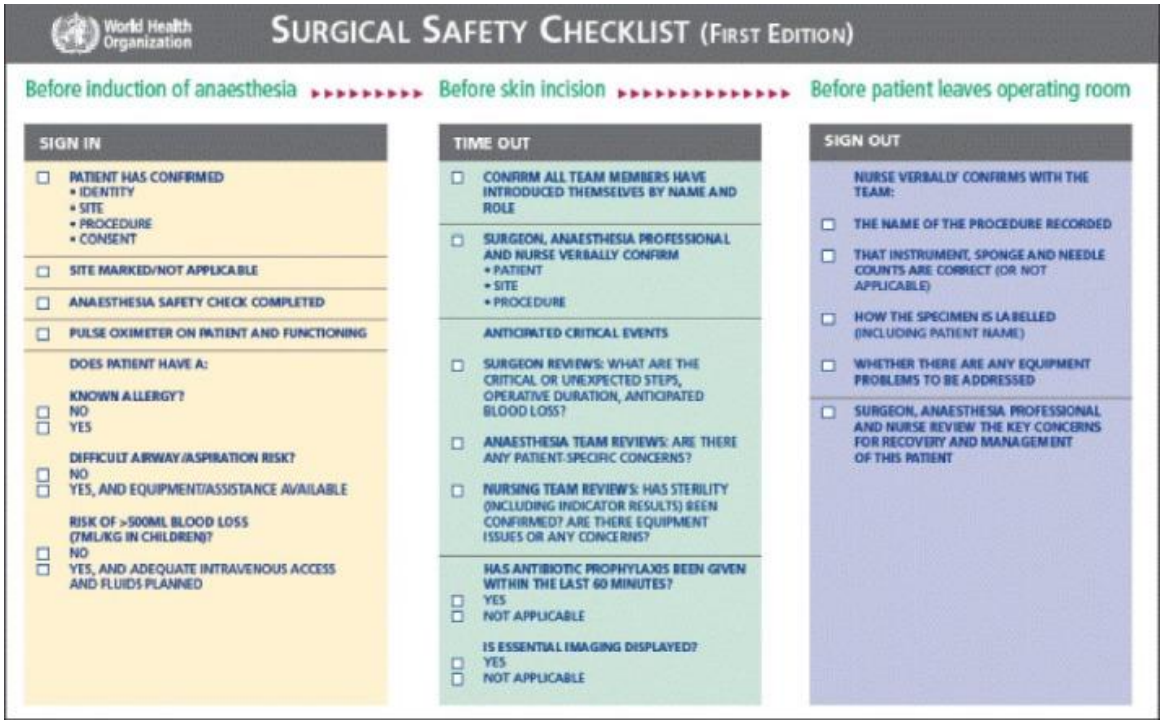

Figure 1 Surgical Safety Checklist (Smith et al. 2020, 99)

3.2 Infection control

Nurses play a crucial role in preventing infection during intraoperative care by ensuring that they use the evidence-based practice and following the aseptic measures, for example maintaining the sterile field i.e. properly washing hands, performing the surgical scrubbing and correct donning and the use of sterile gloves as well as gowns. Furthermore, nurses continuously monitor the surgical environment to make sure that there are no violations when it comes to sterility and also intervene immediately for instance if there are any contamination risks or concerns. (Wang et al. 2024.)

Nurses are also in charge of handling the surgical instruments and ensuring that they have been sterilized correctly. This, for example, entails confirming that the instruments are being stored as well as transported to the operating room without being contaminated. In addition, nurses prepare the surgical site by using antiseptic solutions so that they can reduce the microbial load that are present on

the skin and also ensure that it's applied properly and that the skin is dry enough from the solution before incision is made. They also monitor and give preventative antibiotics by following the guidelines. (Smith et al. 2020, 100-102.) Qvistgaard et al. (2019) added that the bacterial load in the surgical environment can be reduced by following established protocols that lower the risk of these infections during surgery. This entails, for example, operating team members following hygiene standards and thoroughly cleaning the operating room between the operations.

3.3 Patient psychological support and advocacy

During intraoperative care, each patient goes through intense emotions related to the fear of not knowing what will happen during the surgery and the care provided by the third party, i.e., the operating team members. In addition, with the fear of pain and the possibility of being rendered disabled and the stress of unpredictability. (Michalak & Kotomska 2021, 2). According to Smith et al. (2020, 11), it is critical for all patients undergoing surgery to remain calm and relaxed, regardless of the type of procedure they will have. Anxiety and fear, whether caused by uncertainty or any concerns about the possibilities of surgical complications, are common in cases that involve life-threatening conditions or operations. Nurses reassure the patient, for example through empathetic communication and by staying calm at the patient's side until after the anesthesia. For example, nurses offer a hand to hold to show empathy and comfort if, for instance, the patient is conscious during surgery. (Smith et al. 2020, 11.)

Patient advocacy means protecting the dignity of the patient, comforting as well as respecting their rights during the whole intraoperative process. Nurses act as the patient's voice by speaking on behalf of the patients by making sure that their rights as well as their wishes are being respected while they are under anaesthesia. They also keep in close contact with the patient's family or the person the patient appointed and provide them with necessary details or updates about the surgical procedure. Nurses also ensure that the patient's pain is effectively managed or any other discomfort that the patient feels is addressed by working closely with the anaesthesia doctor and rest of the surgical team. (Christman et al. 2024, 211).

3.4 Positioning and prevention of pressure ulcers

During the surgery patients face numerous risks that are associated with the complications, for example, because of the position the patients are placed in. This however varies depending on the kind of surgery that is being carried out. When positioning the patient nurses ensure that the patient is both comfortable as well as safely positioned on the surgical table. This ensures that complications are prevented, for example nerve injuries, soft tissue damage and pressure ulcers that can happen because of prolonged positions. (Perrenoud et al. 2022.) Nurses work together as a team to make sure that the appropriate position is achieved as well as maintained throughout the surgery. This may include, for example, applying strategies, like using stirrups, gel cushions or placing the patient in a position that is suitable to expose the surgical site that is being performed while also paying attention in prioritizing the safety of the patient. (Christman et al. 2024, 211.)

According to Michalak & Kotomska (2021, 3), preoperative preparation is essential because it supports the safe positioning of the patient. This entails inspecting and preparing the operating table equipment to suit the patient's needs, considering factors such as musculoskeletal conditions or body deformities. It is also important to prevent direct contact between delicate body parts away from hard surfaces so that it can reduce the risk of pressure-related injuries. Supportive devices such as pads, gel cushions and rollers should be used in areas that are risky like heels and other pressure prone zones. These preventative actions guarantee patient safety both during and after the procedure. (Michalak & Kotomska 2021, 3)

3.5 Communication with the surgical team

Nurses are in constant communication with the anaesthesiologist, surgeon and other team members to keep all members updated about the status of the patient. They also communicate with the surgical team to make sure that the incision is properly closed and that the drains are functioning well. They carefully monitor the surgical wound site to make sure that there are no possible signs of complications and if for instances signs of complications appear they intervene

immediately by updating the surgeons and ensure that they are effectively managed. (Christman et al. 2024, 214.)

Salazar Maya (2022) stated that the lack of comprehension of roles and responsibilities among operating room nurses makes room for errors impacting patient safety. Operating room nurses must understand their roles and responsibilities, especially in the complex setting of the operating room where the patient is in a vulnerable state, mainly when they are under anaesthesia and cannot speak for themselves. Communication is essential for managing the varied and changing nature of the operating room. Effective communication facilitates a better understanding of every team member´s roles and responsibilities, which is essential for maintaining workflow efficiency and avoiding any misunderstandings. Lapses and slips in communication among the surgical team members cause a risk of errors that could compromise the safety of the patient and the surgical outcomes. (Göras et al. 2020, 3.)

According to Yates and Foran (2022 e33-e35), the use of Closed-loop communication helps prevent communication breakdowns. It involves the sender sharing information with a specific recipient, the recipient acknowledging and restating their understanding of the information and the sender confirming that they have understood by repeating the information back. This reduces uncertainty and improves patient safety. (Yates & Foran 2022 e33-e35).

4 SPECIFIC ROLES OF NURSES DURING SURGERY

4.1 Scrub nurse

Scrub nurses, also called instrumental nurses, are responsible for maintaining the sterile field, preparing surgical instruments, and setting up sterile supplies and trolleys. Scrub nurses also help with the procedure by passing surgical instruments to the surgeon and preparing drugs and supplies in the sterile field. Scrub nurses with years of experience can anticipate the surgeon's needs without the surgeon speaking to them directly. They also help the surgeon stay focused and avoid misunderstandings and cross-infections. The instrumental nurse monitors all

surgical instruments and supplies, including sponges and needles, to prevent surgical item retention by performing surgical counts before and after surgery and the circulating nurse confirming and recording the count. This reduces the possibility of contamination, retaining foreign bodies and increases surgical efficiency. (Christman et al. 2024, 209.) Patient safety may be impacted by surgical team delays, inefficiencies, and tension brought on by communication errors and slips involving surgical instruments. (Criscitelli 2014.)

4.2 Anaesthetic nurse

The role of an anaesthetic nurse is dual, entailing the role of a nurse and an assistant to the anesthesiologist. The anaesthetic nurse works with the anaesthesiologist to ensure that a patient transitions smoothly to the required state of anaesthesia. The anaesthetic nurse prepares the equipment for administering anaesthesia (Criscitelli 2014). Anaesthesia practice includes general anaesthesia, local anaesthesia, airway management, perioperative medications, pain management, resuscitation crisis management, and safety, which the anaesthetic nurse should be knowledgeable about and competent in. Good assessment skills are required for monitoring the level of anaesthesia, maintaining the patient´s normothermia and ensuring patient safety during surgery. (Ireland & Osborne, 2016)

The anaesthetic nurse is usually the last person to be with the patient before sedation and mainly deals with the high level of emotions of the patient. Therefore, it is crucial that the nurse possesses a high command of non-technical skills and can establish a rapport with the patient. Good communication skills and the ability to communicate relevant information to the surgical team are necessary for this role (Ireland & Osborne, 2016). In addition, the nurse should be aware of the risk of intraoperative awareness, which is a severe complication, although rare, that is associated with general anesthesia. The anaesthetic nurse is responsible for advocating for the patient and should be able to utilize the knowledge and skills to identify patients who are at high risk of intra-operative awareness and communicate this information to the anaesthesiologist and the entire intraoperative team (Bull & Foran, 2022).

4.3 Circulating nurse

The circulating nurse serves as the coordinator of the operating room. They are not part of the sterile field. However, they play an important role in resource management and ensuring effective communication between surgical team members and external departments. This entails delivering additional instruments and adjusting the environment, such as lighting and temperature. (Christman et al. 2024, 209.) Additionally, they are responsible for preparing the patient and the surgical room before the start of the operation. Assisting in patient positioning and the anaesthesiologist during airway management. Furthermore, they complete the nursing documentation and retrieve the requested items during a surgical procedure. (Criscitelli 2014) The circulating nurse is also a patient advocate, ensuring that positioning, safety measures, and care standards are consistently met (Smith et al. 2020, 11).

5 PURPOSE, GOAL AND RESEARCH QUESTION

The purpose of this thesis is to describe the role and strategies of nurses in promoting patient safety during intraoperative care. The goal is to develop learning material for nursing students to help them understand nurses' roles and strategies to promote patient safety before they start their surgical practice. The research question guiding this thesis is: What is the role of nurses in promoting patient safety in the operating room during surgery?

6 RESEARCH METHOD

6.1 Descriptive literature review

This thesis applied a descriptive literature review as a research method. Researchers chose this method because a descriptive literature review seeks to determine if a set of information in a particular field of study or topic shows any clear patterns or themes connected to existing ideas, theories, methodologies, or results. Furthermore, its flexibility enables the inclusion of a wide range of studies regardless of their design. Therefore, this thesis identifies patterns or themes that

emerge from the existing literature, making this method suitable. (Hawkins et al., 2019.)

A preliminary search was conducted in the databases approved by the university to help identify whether enough information on the chosen topic is available. In the beginning of the process, it helped in clarifying the research topic and in formulating the research question. Initially, the focus was perioperative patient safety, which included preoperative, intraoperative and postoperative nursing. The number of research articles was vast, and after skimming through some articles, researchers decided to focus on the intraoperative period, and the issue of role clarity was apparent hence, researchers were able to formulate the research question `What are the role of nurses in promoting patient safety in the operating room during surgery.

6.2 Data collection

The search for relevant data was conducted using specific inclusion and exclusion criteria as shown in Table 1. The inclusion criteria required sources to be in English, peer-reviewed, and published within the last six years i.e. (2019-2025) in academic journals, and freely accessible as full-text. Exclusion criteria excluded publications in other languages apart from the English language, not peer-reviewed, older than six years, not from academic journals and paid access journals.

The search was performed across PUBMED and CINAHL databases. The search terms used were for example in PUBMED searches included terms like “Intraoperative” AND “Nursing responsibilities,” “Nurse role AND intraoperative infection control,” and “Operating room nurses AND patient safety,” while CINAHL used terms like “Patient advocacy AND safety culture.”

The process initially yielded the following after applying the inclusion criteria. PUBMED returned 9, 1, and 15 sources from three separate searches, respectively, while CINAHL yielded 2 sources from a targeted search. After reviewing the results, PUBMED yielded 9 articles in total, with 2, 1, and 5 articles selected for inclusion across the three searches, respectively. CINAHL yielded 2

articles, with 1 article ultimately included for study. In total, the search across both databases identified 27 articles, of which 9 were regarded as relevant and included for analysis.

Table 1 Inclusion and Exclusion

Inclusion criteria	**Exclusion criteria**
English language	Other languages
Peer reviewed	Not peer reviewed
Up-to 6 years	Older than 6 years
Free full text academic journal	Not free full academic journals
Journals discussing intraoperative phase and patient safety	Journals not related to intraoperative and patient safety

6.3 Data analysis and synthesis

Thematic analysis was used to analyze data to be able to identify and examine the key themes in the selected studies. Thematic analysis is a research method that identifies and assesses patterns or themes in a data set, mostly leading to the generation of new ideas as well as an understanding. The researchers chose this method because of its flexibility and a systematic approach. The stages provide a complete guide for the researcher to carefully examine qualitative data, thereby enhancing the integrity of the study process and the depth of the findings. (Naeem et al. 2023.)

The process of thematic analysis follows 6 steps as shown below in Figure 2. In the first step, researchers read the data many times and thoroughly to be able to get familiar with the content of the data. Researchers made notes and wrote down any initial thoughts or ideas about the data. In the second step, researchers began to identify information by coding segments of the data that are relevant to answering the research question. In the third step, researchers grouped the codes into possible themes. In the fourth step, researchers refine the themes by checking

that the themes make sense in relation to the coded extract as well as the whole data set. In the fifth stage, the researchers review the themes and finally, discuss the finding of the study. (Naeem et al. 2023.)

The research and analysis tables were used to be able to organize, record, and analyze data from 9 different selected studies. In the Research Table (Appendix 2), each study's aim, method and results were documented to summarize key findings. In the Analysis Table (Appendix 3), codes from each study were grouped into themes and sub-themes, allowing for a comparison of findings. By grouping similar data and finding the connections, the tables helped the researchers to be able to identify the recurring themes. This process guided the discussion and made it easier to draw conclusions. It also ensured that the findings were organized, clear as well as consistent across all the studies.

7 RESULTS

The researchers organised the data and compared 9 different selected studies and through this process six key themes were identified as seen in Appendix 4. These themes were: prevention of infection, with sub-themes focusing on hand hygiene and skin disinfection, operating room environment and preparation. Additional themes included patient advocacy, pressure injury and positioning. Communication and teamwork, preoperative preparation, with sub-themes and patient identification and planning and finally reporting and documentation.

7.1 Prevention of infection

7.1.1 Hand Hygiene

Findings of Wistrand et al. (2022) showed that nurses have the role of making sure that proper hand hygiene measures are being followed before as well as after any interaction with the patient. This includes, for example, washing hands by using soap and water or using alcohol-based hand sanitizer. These measures are in agreement with Christman et al. (2024, 211) who highlighted the importance of meticulously following infection control measures. These include thoroughly

washing hands, and hand sanitizing when, for example, setting up the sterile field to reduce the risk of surgical site infection.

However, the findings by Singh and Arulappan (2023) highlighted that despite the emphasis of following hand hygiene, barriers such as lack of time and nurses' workloads showed to interfere with consistency in following the measures. Nurses in the study reported that there were instances where hand hygiene was compromised because they were in a hurry due to emergency cases, and in other situations because they had lacked enough workforce. (Singh and Arulappan 2023.)

7.1.2 Skin Disinfection

The findings indicated that adherence to skin disinfection protocols were generally high. The skin serves as the body's first way or line of defending against the pathogens. By doing the disinfection before the surgery starts, it helps in reducing the microbial load that are on the surgical site, which in turn helps in reducing the risk of infection (Wistrand et al. 2022). The nurses are responsible for making sure that the appropriate antiseptic agents for example chlorhexidine or iodine-based solutions, are being used to disinfect the patient's skin. Singh and Arulappan (2023) found that nurses who adhere to evidence-based measure of skin disinfection significantly reduce the chances or any possibilities for having infection at the surgical site.

In contrast, Swenne et al. (2019) noted that the inconsistencies mainly happen when there is a lack of proper training or understanding of the reason behind why specific disinfections are important. In some instances, nurses reported that the use of ineffective skin disinfectants or improper application of the disinfectants was due to the pressure of not having enough time or adequate training. (Swenne et al. 2019.) This highlights a key point that nurses should not only follow protocol but also understand the reasoning behind why specific practices are being done. This is because lack of understanding can lead to errors, highlighting the need for ongoing education to reinforce or ensure the critical nature of skin disinfection.

7.1.3 Operating Room Environment and Preparation

The operating room environment and preparation refer to a wide range of practices that includes maintaining of the sterile environment, handling of instruments properly, and controlling the environmental factors for example temperature, the humidity as well as the quality of the air. The research revealed that nurses are actively involved in confirming the sterility of all surgical tools and the cleanliness of the operating room environment. However, as noted by Singh and Arulappan (2023), operating room preparation is sometimes compromised because of the shortage of staff members as well as not having enough resources. In some cases, the operating room environment was not thoroughly prepared since surgical schedules were done at the last minute or due to a large number of procedures, which placed strain on the nursing staff available in the shift. (Singh and Arulappan 2023.) Wistrand et al. (2022) also found that when there was a lot of pressure, nurses did not have enough time to properly clean surfaces, prepare the instruments, or even verify the sterility of the equipment.

Furthermore, according to Christman et al. (2024, 209), proper preparation of the operating room and adherence to the infection control guidelines helps in reducing the possibility of contamination and the occurrences of surgical site infections. It is further emphasized that it is the nurse´s role to ensure that the sterile field is maintained and that all the instruments are properly sterilized before they are being used, also that the operating room environment meets the necessary standards for infection control.

7.2 Patient advocacy

The findings of this study revealed that nurses play a critical role when it comes to advocating for the rights of their patients as well as their well-being when they are not able to voice their wishes, also when they are nervous of the whole process. The study revealed that nurses perceived that it is their responsibility to ensure that their patients' wishes are being respected, their emotional needs are addressed, and the informed consent is obtained. (Shoemark & Foran, 2021.) These are in-line with the literature which emphasized the need for nurses to ensure that the

patients' rights, wishes and informed consent is obtained as well as communicate with the patient as well as their families (Christman et al. 2024).

Similarly, Singh and Arulappan's (2023) findings highlighted that nurses are obligated to speak up for the patient whenever the decision made poses a threat to the safety of the patient. Furthermore, the findings showed that hierarchical barriers are a challenge within the operating room and that it limits nurses from carrying out there duties effectively. Nurses reported that they felt intimidated or reluctant to challenge the decision of the surgeon especially when patient safety was at risk. Nurses expressed their concerns that they are afraid of being blamed and thus made them not wanting to voice safety concerns. Singh and Arulappan (2023) also discovered that many nurses would rather maintain their working relationships with the surgeons than voice concerns about patient safety for fear of causing any unfavourable reaction. This contradicts a study by Smith et al. (2020, 11), which stressed that the nurse must speak for the patient, particularly when the patient is anaesthesia.

7.3 Pressure injury and positioning

Pressure injuries remain a significant risk in the operating room because of the prolonged duration of immobility, and nurses play a crucial role in ensuring that these injuries don't occur. The results showed that the nurses are proactively involved in making sure that the patients are placed correctly by using the right equipment, such as foam pads, as well as the gel cushions to be able to prevent pressure sores (Savcı et al. 2024). Similarly, Michalak and Kotomska (2021) emphasize that proper positioning and the use of pressure relieving devices are of crucial importance

The study by Smith et al. (2020) established that nurses also ensured that there was frequent observation of the patient's skin during surgery, in their study, they advised that pressure buildup should be identified at an early stage to avoid injuries. In addition, a study of Michalak and Kotomska (2021) showed the importance of preoperative preparation, which comprises identifying the needs of

the patient and making sure that the correct positioning devices are obtained and applied.

Additionally, Michalak and Kotomska (2021) unveiled that sufficient staffing and proper infrastructure were necessary to be able to provide appropriate positioning protocols to be adhered to. Similarly, Perrenoud et al. (2022) who emphasised that an adequately resourced and manned operating room is a prerequisite for the proper execution of patient safety measures. The outcomes indicate that institutions need to prioritize in enhancing resources, staff education as well as retraining for the nurses to be competent in preventing pressure injuries during surgery.

7.4 Communication and teamwork

Nurses have a responsibility to communicate with the patients and the surgical team. Communication involves the use of verbal and non-verbal cues. Communication with the patient, especially during the perioperative period, has been shown by research to relieve the stress and anxiety of the patient. Studies indicate that operating room nurses were eager to meet and greet the patients before surgery and assure them that the operating team would do their best for them (Nyberg et al. 2021). The intraoperative period is a high-stress period, and the emotions of the patients are particularly high given the nature of unpredictability and uncertainty of surgery. Therefore, nurses pay attention to the patient and if they show signs of distress, find the time to address this by creating a rapport with the patient and by being empathetic. Establishing a rapport may be challenging, given the short period before anaesthesia (Singh & Arulappan 2023).

Nurses also have the responsibility to communicate with the surgical team. Research shows that standardized processes such as the World Health Organization surgical safety checklists, improve communication and teamwork in the operating room. The checklist also confirms an increase in the safety climate leading to reduced cases of post-operative morbidity and mortality. However, there are setbacks to the implementation of the checklist. Additionally, the study shows that the checklist was often performed when the operating room nurses were

engaged in the final preparations, and that the use of the checklist varies from surgeon to surgeon. (Nyberg et al. 2021.)

The operating room environment uses technological and information technology systems during surgeries. According to research, digital tools in the operating room improve communication by making information accessible during surgery, promoting clear communication since there is no bad handwriting, and facilitating contact with other personnel when needed, improving patient safety. However, findings reveal that mobile cell phone use in the operating room draws the focus of the nurses and surgeons. This impacts patient safety. In addition, nurse anaesthetists are required to enter real-time information during anaesthesia on the digital systems, influencing their awareness of the patient, which may lead to patient harm. (Leonardsten et al. 2024.)

The surgical team is usually made up of surgeons, anaesthetists, operating room nurses and nurse anaesthetists. Teamwork in the operating room plays a crucial role in safe surgery and manifests when members of the surgical team support each other. Teaching, supervising, and providing emotional and physical support during distress in the operating room is important to maintaining mutual understanding and respect between team members, promoting patient safety. (Sirevag et al. 2021). In the prevention of adverse events in the operating room, teamwork and collaboration between the surgical team members is crucial. (Nyberg et al. 2021.)

7.5 Preoperative preparation

7.5.1 Patient identification

Studies indicate that the verification of the patient's identity when entering the operating room is one of the responsibilities of nurses (Nyberg et al. 2021). Nurses also check that the patients at high risk of blood loss, issues with the airway or anaesthesia and, a history of allergies are correctly identified. In addition, confirming the operating site and ensuring its consistency with the plan and with X-rays. The World Health Organization surgical checklist is a standardized protocol

that ensures that the process is followed. However, nurses note a difference in the implementation of the checklist between surgeons. Research shows that the checklist alone cannot counteract all errors (Singh & Arulappan 2023).

7.5.2 Planning

Findings reveal that having a reliable preoperative plan ensures safety during intraoperative care from the operating room nurse's perspective (Nyberg et al. 2021). Nurses are accountable for planning the patient's care and working together with the surgical team and other healthcare providers to ensure continuity and safety of care. Planning also ensures that there are instruments, sutures and drugs available, which in turn reduces the waiting time and overall, the time of the surgery. In addition, proper scheduling of procedures has the potential to improve patient safety (Singh & Arulappan 2023).

Nurses reported that having enough time to do things the way they should be done impacts patient safety. Otherwise, the time constraints mean that nurses work under pressure, increasing the stress of nurses and compromising the safety of the patient (Nyberg et al. 2024). Time management is essential in the operating room, however, factors such as understaffing and increased workload have safety implications. Having adequate resources to ensure that the patient's needs and nursing competencies are matched shows improved patient outcomes (Singh & Arulappan 2023).

7.6 Reporting and Documentation

Research indicates that nurses document perioperative care in paper form and computerised systems. Nurses consider the double documentation time-consuming and pose a risk to patient safety. Handovers during surgery were deemed risky, and nurses tried to maintain the same personnel throughout the surgery. However, for surgeries lasting the whole day, shift changes were inevitable, and reporting to a colleague while simultaneously concentrating on the surgery was perceived by scrub nurses as a safety risk. Nurses considered reporting during surgery as a challenge since it was difficult to recall every single

detail and sometimes had to call back to the operating room to fill in missing parts in their report. (Nyberg et al. 2021)

8 REFLECTION

8.1 Reflection of results

The aim of this study was to describe the roles and strategies of nurses in promoting patient safety in the operating room. Findings from the research show that nurses act as patient advocates, prevent infection, communicate and collaborate with other healthcare professionals, prevent injuries and report and document the intraoperative process. Operating room nurses' roles entail instrumental nurses whose main role is to maintain the sterile field throughout the surgery and to provide surgical instruments in a timely manner to the surgeon. The circulating nurse is responsible for the patient and protects the patient's dignity. Prevention of injuries by ensuring correct positioning of the patient by use of gel pads to prevent nerve damage and pressure injuries is also done by a circulating nurse. In addition, circulating nurses retrieve additional instruments needed during surgery as requested by the scrub nurses and surgeon (Sirevåg et al. 2024). Similarly, Cristelli 2014 highlighted the roles of operating room nurses, which include circulating, instrumental and anaesthetic nurses.

Literature shows that nurses play an important role in promoting patient safety and preventing injuries, which is their main role and responsibility. Nurses act as patients' advocates during surgery when the patient cannot speak for himself/herself (Singh & Arulappan 2023). This is consistent with previous studies that nurses act ethically by speaking up for the patient and when there is a safety concern, such as an incorrect surgical count, they voice up and ensure that patient safety is maintained, and the surgical count is consistent before and after a surgery.

Singh and Arulappan (2023) emphasize that nurses' communication and teamwork improve patient safety. Salazar Maya (2022) states that communication errors are

still being identified in nursing care in the operating room especially due to high stress, multitasking and lack of role clarity. This identifies role clarity as an important aspect of patient safety. In addition, delivering high-value information timely to peers supports patient safety. The surgical safety checklist aims to improve teamwork and communication. However, findings show that the checklist is implemented differently or sometimes not used, so the checklist alone cannot prevent patient harm. Moreover, studies by Göras et al. (2020) show that the use of a systems approach which involves interaction between people, equipment, and procedures is important to address the complexity in the operating room and bring about the adaptive capacity of the surgical team.

Documentation and reporting are essential aspects of intraoperative care. They ensure patients' continuity of care between different healthcare professionals. Documentation also ensures that no important steps of care are missed, which may impact patient safety (Akbari et al. 2023). This is consistent with the findings of this study by Nyberg et al. (2021), which emphasizes the importance of handover and documentation in patient safety. Digital tools play a crucial role in ensuring timely accessibility of data; however, they are also a distraction, which can take the focus of nurses from the patient, impacting patient safety. It is therefore important for nurses to find a balance with using digital tools so as not to affect the workflow processes and patient safety.

Moreover, Singh and Arulappan (2023) emphasize infection control as an important aspect of intraoperative nursing. This includes basic techniques such as handwashing and disinfection, and disinfection of the surgical sites and the surgical environment. Infection control is important in the prevention of surgical site infections, which is a major cause of long hospital stays, and increased hospital costs. This is consistent with previous studies. In addition, studies by Nyberg et al. 2024 emphasize preoperative preparation, such as having the necessary equipment before surgery, can be challenging at times due to the turnaround time set by the organization. Nurses state that having enough time to do what they must do is a factor that impacts patients' safety.

8.2 Ethical consideration and reliability and validity

The study conducted secondary research and hence there were no issues of concern when it came to ethical issues. However, the challenge was that the study used recent studies that were published within the past six years, i.e. from the year 2019 to 2025. This exclusion decision may have removed the older studies that might have been valuable sources for the research of this study (Hawkins et al. 2019.) Additionally, the use of thematic as an analysis method came with its challenges due to its nature of flexibility. Therefore, thematic analysis could have led to a lack of consistency when creating or generating themes (Naeem et al. 2023). However, researchers conducted member checks among themselves to ensured that there was a transparency in the data analysis process as well as to guarantee the accuracy and reliability of the findings of the study.

9 CONCLUSION AND RECOMMENDATION

The surgical environment is a complex field because of its ability to handle different types of surgeries, whether planned or emergency cases, simple or complex and is still prone to adverse events. However, most of the adverse events are preventable and the World Health Organization launched the surgical Safety Checklist which showed that when correctly implemented it can reduce those adverse events and promote teamwork and communication among the surgical professionals. The purpose of this thesis was to describe the role and strategies of nurses in promoting patient safety during intraoperative care. The goal was to develop learning material for nursing students to help them understand nurses' roles and strategies to promote patient safety before they start their surgical practice.

The results revealed that nurses play a critical role in promoting the safety of the patient. Nurses play a critical role in preventing infection right from preparing the operating room and handling the patient, i.e. during skin disinfection. Nurses ensure that the surgical team follow the infection control measures during the entire process. Nurses also act as advocates for the patient when they are unable to

speak for themselves. Nurses ensure that the patient is free from pressure injury by ensuring that the position is safe and using, for example, gel cushions to prevent pressure ulcers. Communication and teamwork among the surgical team was also identified as the nurse's role. Preoperative preparation by making sure the patient is identified by using the surgical safety checklist, planning patient care and finally reporting and documenting the whole care process by nurses, which is important for the continuity of patient care.

The study identified key themes. However, it was limited by the selection of the studies that were included as well as the differences between the methods in the studies. These themes may be explored more in future studies by conducting primary data collection or conducting a larger sample of studies. Additionally, future research could explore how nurses promote the use of technology during intraoperative care.

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Table 2. Search table

Database	Search Terms	Filters	Results	Included for study
PUBMED	(Title) “Intraoperative ” AND “Nursing responsibilities ”	Free full text, last 5 years, English language and Abstract	9	2
PUBMED	(Title) “Nurse role AND intraoperative infection control”	Free full text, last 5 years, English language and Abstract	1	1
CINAHL	(Title) “patient advocacy AND safety culture”	Full text, Past 5 years, English, peer reviewed	2	1
PUBMED	(operating room nurses [Title]) AND (patient safety)	Free full text, last 5 years, English language and Abstract	15	5

Table 3 Research Table

Bibliography	Aim/Purpose	Method	Results
Leonardsen, A. L., Nystrøm, V., Trollnes, A. K. H., Renate Slang, R., & Olsen, E. 2024.	Explore operating room (OR) nurses' and Nurse Anesthetists' (NAs) experiences with digitalization in the operating theatre	Qualitative design, using individual interviews with Operating room nurses and Nurse anesthetist.	Two themes identified: impacting the work processes, and implications for patient safety.
Nyberg, A., Olofsson, B., Fagerdahl, A., Haney, M., & Otten, V. 2021	Explore operating room nurses' safety attitudes and their views on how to improve patient safety in operating rooms	A cross-sectional study using the Swedish-translated version of the Safety Attitudes Questionnaire Data collection using an online survey platform.	The respondents' most recurring recommendations for improving patient safety were Having better and clearer communication' followed by 'Having enough time to do things the way they should be done'.
Nyberg, A., Olofsson, B., Otten, V. Haney, M., & Fagerdahl, A., 2024	Explore aspects of patient safety practice during joint replacement surgery through assessment of operating room nurse experiences	A qualitative design using semi structured interviews and Inductive qualitative content analysis.	The operating room nurses described experiences with patient safety hazards on an organizational, team, and individual level. Teamwork and collaboration were described as crucial at the team level, including being respected as valuable and having shared goals and common expectations. On the individual level, professional knowledge, skills and experience were

			needed to make corrective steps.
Savcı A, Karacabay K & Aydın E. 2024	To identify the frequency and contributing risk factors that are associated with pressure injuries developed in the operating room.	Descriptive cross-sectional study and statistical analysis using SPSS	5.8% of the patients developed pressure injuries in the operating room. Additionally, 54.4% of patients had medical devices, with 4.2% experiencing device-related pressure injuries. Factors influencing the development of operating room-acquired PI included patient age, hemodynamic status, albumin levels, and the length of surgery.
Shoemark, T. & Foran, P. 2021	to identify barriers to patient advocacy and explore strategies to enhance patient safety.	An integrative review and Thematic analysis	The perioperative hierarchy in the surgical setting and the fear of blame.
Singh, B.C. & Arulappaan, J. 2023	Explore the understanding of OR nurses regarding their roles and responsibilities for patient care and safety measures in the intraoperative practice	Qualitative, descriptive, exploration research design and Colaizzi's seven-step strategy.	Seven themes were identified: patient safety, preoperative preparation, standardization of practice, time management, staffing appropriateness, staff education and communication, and support to the patient in the operating room
Sirevåg, I., Hansen, B. S.,	Establish face and content validity of	A two round, Delphi panel with	The Non-Technical Skills of Operating Room Nurses

Tjoflåt, I., & Gillespie, B. M. 2024.	the Non-Technical Skills for Operating Room Nurses behavioural marker system.	international experts in operating room nursing. Online survey	behavioural marker system is a nuanced tool with a myriad of non-technical skills operating room nurses need to undertake their work safely.
Swenne, C. L., Gustafsson, B. Å., & Brynhildsen, K. F. 2019.	To examine the competence of specialist operating theatre nurses in relation to the six core competencies and their impact on patient safety.	A Discursive Paper and deductive analysis	All healthcare professionals are expected to possess the general core competencies, regardless of their field. However, the specific application of these competencies varies by discipline. Specialized operating theatre nurses are uniquely qualified to oversee asepsis, manage instrumentation, control infections and complications, and handle biological specimens during surgical procedures. No other healthcare profession is equipped with the formal education, expertise, or skills required to provide operating theatre nursing care during surgery. As such, the competence of operating theatre nurses is essential for ensuring patient safety in the surgical setting.
Wistrand, C., Falk-Brynhildsen,	to investigate the interventions that Swedish operating	A web-based cross-sectional survey, summative	The nurses highlighted the following as important in inhibiting bacterial contamination

K., & Sundqvist, A. 2022.	room nurses identified as important for preventing bacterial contamination and surgical site infection.	content analysis and descriptive statistics.	and SSI: “skin disinfection 25.9%, the operating environment 18.2%, aseptic technique 16.4%, OR clothes 13.4%, draping 9.8%, preparation 6.1%, dressing 3.6%, basic hygiene 3.4%, normothermia 2.1%, communication.”

Appendix 3

Table 4 Analysis Table

Study	Initial codes	Themes	Sub-themes	Supporting information
Leonardsen, A. L., Nystrøm, V., Trollnes, A. K. H., Renate Slang, R. & Olsen, E. 2024.	Digitalisation Patient safety Nurse Anesthetist Operating room nurses	Reporting and Documentation		"Both the OR nurses and the Nurse anesthetists' (Nas) perceived those digital tools were both facilitators and barriers to ensure patient safety" "Make information more accessible", "avoid misunderstandings due to bad handwriting", "make it easier to get in touch with other personnel", or "ensuring registration in real-time"
Nyberg, A., Olofsson, B., Fagerdahl, A., Haney, M. & Otten, V. 2024	Safety culture Safety climate Staffing levels Workload Patient positioning Skin disinfection, Sterile draping Instruments and implants availability	Communication, Teamwork Preoperative preparation		"Having better and clearer communication" "Having enough time to do things the way they should be done" "Developing teamwork and team performance" "Retaining experienced nurses is crucial in maintaining specialist expertise in emergency and critical care settings to ensure safe care for patients" "Importance of adequate staffing levels with competent, experienced and permanent staff, as well as a permissive working environment, improving safety" "Familiarity with team members and stability in teams was found to promote safety by combining team members' different skills in long- term planning"
Nyberg, A., Olofsson, B., Fagerdahl, A., Haney, M. & Otten, V. 2024	Patient safety Operating room asepsis Maintaining the sterile field	Instrumentation Patient positing Prevention of infection Teamwork and communication Documentation And reporting		Operating Room Nurses are responsible for preparing instruments and implants for the operation, patient positioning and OR asepsis. Reporting and documentation practices threatened the continuity of patient care.

		Preoperative planning Patient advocacy		
Savcı A, Karacabay K & Aydın E. 2024	Pressure injury, patient positioning, Tissue oxygenation	Pressure injury and positioning	Prevention of pressure injury Positioning assessment	"It is important that nurses not overlook physical signs characteristic of stage 1 pressure injury. The risk of operating room–acquired pressure injury was higher in patients who underwent orthopedic and neurosurgical interventions, and medical devices were associated with increased rate of PI" "Nurses to determine existing and potential preoperative, intraoperative, and postoperative risks that impair skin integrity and affect tissue oxygenation."
Shoemark, T. & Foran, P. 2021	Patient safety, nurse advocacy Hierarchy, fear and blame	Patient advocacy	Overcoming hierarchy Fear and blame barriers	"Overarching theme to emerge linking perioperative patient advocacy and safety culture, was 'perioperative nurse role in patient advocacy" 'Hierarchy in the perioperative environment and fear of blame" "Hierarchy in the perioperative environment and fear of blame
Singh, B.C. & Arulapaan, J. 2023	Patient's advocates, Prevention of infection, preoperative preparation, patient identification, Uniformity of care, Time management, Staffing appropriateness, staff education, proper communication	Patient advocacy Communication, Infection control Standardized care		"Nurses are the patient's advocates, and they must speak up for the patients" "Hand hygiene is the fundamental concept in the prevention of infection and in promoting patient safety" The preoperative assessment should be done thoroughly to prevent complications during the intraoperative period. "The staff from different backgrounds should be trained to provide uniform care" "Time management should be done without compromising patient safety and staff injury" "Understaffing and rushing to accomplish tasks with the available staff can place the staff at risk of injuries" "Staff training and education can make the nurses more knowledge able and enhance their performance"

				"Verbal and non-verbal communication as it relieves stress and anxiety".
Sirevåg, I., Hansen, B. S., Tjoflåt, I. & Gillespie, B. M. 2024.	Non-technical skills	Prevention of infection Instrumentation Prevention of Injuries Teamwork and Communication		Operating room nurses have dual roles: the instrument nurse monitors and maintains asepsis throughout surgery and provide appropriate and timely instrumentation, while the circulating nurse manages the operating room, prevents patient positioning related nerve and/or pressure injuries, and is responsible for the well-being of the patient while protecting their dignity
Swenne, C. L., Gustafsson, B. Å. & Brynhildsen, K. F. 2019.	Asepsis, instrumentation, infection and complication control management of specimen	Prevention of infection Management of instruments		"The specialized operating theatre nurse is the only healthcare professional having the competence to be responsible for asepsis, instrumentation, infection and complication, control and management of biological specimens during the surgical procedure."
Wistrand, C., Falk-Brynhildsen, K. & Sundqvist, A. 2022.	skin disinfection, OR environment, aseptic technique, OR clothes, draping, preparation, dressing, basic hygiene, normothermia, communication	Prevention of infection control Communication	Operating environment Operating room preparation Operating clothing and draping Skin disinfection,	"The nurses described twelve important interventions to prevent bacterial contamination and SSI: skin disinfection (25.9%), the OR environment (18.2%), aseptic technique (16.4%), OR clothes (13.4%), draping (9.8%), preparation (6.1%), dressing (3.6%), basic hygiene (3.4%), normothermia (2.1%), communication (0.7%), knowledge (0.3%), and work strategies (0.2%)."

Table 5. Reviewed themes and sub-themes

Themes	Sub-themes
1. Communication and teamwork	
2. Preoperative preparation	Patient identification Planning
3. Prevention of infection	Hand hygiene Skin disinfection Operating room environment and preparation
4. Patient Advocacy	
5. Pressure injury and positioning	
6. Reporting and Documentation	