SOCIAL SCIENCE REVIEW ARCHIVES
ISSN Online: 3006-4708
ISSN Print: 3006-4694
https://policyjournalofms.com

Knowledge, Attitude and Practices of Undergraduate Nursing Students Regarding Surgical Site Infections

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Abstract

Surgical site infections (SSI) are a critical healthcare issue, leading to increased patient morbidity, mortality, and healthcare costs. Nursing students, as future healthcare professionals, play a pivotal role in preventing SSI. However, there is limited understanding of their knowledge, attitude, and practices (KAP) regarding SSI prevention. This study utilized a literature review design to evaluate the knowledge, attitudes, and practices (KAP) of undergraduate nursing students regarding surgical site infection (SSI) prevention. A comprehensive literature search was performed using electronic databases including CINAHL, PubMed, ResearchGate, Google Scholar, Pak Medi Net, and BioMed Central. Initial searches identified relevant index terms related to nursing students and SSI prevention, which guided a more in-depth search. Studies were included based on their relevance to nursing students' KAP towards SSI prevention, with a focus on factors affecting adherence to infection control guidelines. Articles from various geographical locations were reviewed to compare findings across different educational and healthcare settings. The review found significant knowledge gaps and low adherence to SSI prevention protocols among nursing students in countries such as Turkey, Saudi Arabia, and Italy. Contributing factors included insufficient hands-on experience, limited educational content on SSI prevention, and institutional culture. Simulation-based education and targeted interventions were shown to enhance both knowledge and compliance with infection control measures, underscoring the need for such methods in nursing curricula. This review identifies critical areas in nursing education where interventions are needed to strengthen students' understanding and practice of SSI prevention. By addressing these gaps, targeted educational programs can be developed to improve preparedness, enhancing both student competence and patient safety. The findings contribute to the broader field of infection prevention and control, offering insights that may inform curriculum design and policy to support improved infection control practices in healthcare settings.

Keywords: surgical site infections, nursing students infection control, knowledge, attitude, practices, SSI prevention, cross-sectional study.

Introduction

Surgical site infections (SSI) are infections that may develop within 30 days following surgery, particularly in cases where no implant is used (Feng et al., 2022)SSIs represent a serious health

risk, increasing patient morbidity, healthcare costs, and the overall burden on healthcare systems. Nurses play a vital role in SSI prevention through the application of evidence-based care, and their knowledge, attitudes, and practices directly influence patient outcomes (Lin et al., 2019)By implementing current knowledge and techniques, nurses can prevent SSIs, and reducing associated costs, and enhance patients' quality of life (Sadaf et al., 2018a). However, several studies have identified that nurses, especially those in surgical wards, often lack the necessary knowledge, experience, or compliance with SSI prevention protocols (Mohsen et al., 2020)Nursing students represent a significant proportion of the healthcare workforce, and therefore, their understanding of infection control and prevention (ICP) is crucial for the success of hospital infection control programs (Olorunfemi et al., 2020)Zimmerman's findings highlighted that while first-year nursing students often possess adequate theoretical knowledge, this knowledge may decline in second-and third-year students, indicating a need for continuous reinforcement throughout their education (Bouchoucha et al., 2021). Research from various countries has shown that many nurses, including students, lack an adequate understanding of SSI prevention based on evidence-based standards and guidelines (Woldegioris et al., 2019)A recent qualitative study found that limited knowledge and proficiency in aseptic techniques were significant barriers to nurses' adherence to SSI prevention protocols (Feng et al., 2022). SSIs cause considerable patient suffering and impose high societal costs(Qvistgaard et al., 2019). An observational study on surgical wound care practices reported that up to 20% of nurses either failed to wear gloves when dressing surgical wounds or wore the incorrect type, demonstrating inadequate adherence to aseptic technique (Lin et al., 2019). This study aims to address these issues by assessing the knowledge, attitudes, and practices of nursing students in SSI prevention, highlighting areas where educational interventions may enhance their preparedness for infection control in clinical settings.

Problem statement

Surgical site infections or SSIs, are serious side effects that can raise healthcare expenses, lengthen hospital stays, and increase morbidity. SSI rates can be particularly high in underdeveloped nations like Pakistan, frequently reaching from 8% to 30% of surgical procedures. Many of these infections can be avoided by following established protocols and guidelines(Sadaf et al., 2018b). Infections at the surgical site are a serious problem in medical settings because they raise morbidity, lengthen hospital stays, and increase medical expenses. Studies show that nurses' knowledge and adherence to optimal practices are frequently insufficient, despite the crucial role they play in avoiding SSIs. Poor practice standards and limited nursing knowledge have been linked to increased infection rates, according to research.**(Woldegioris et al., 2019)**

Study objectives

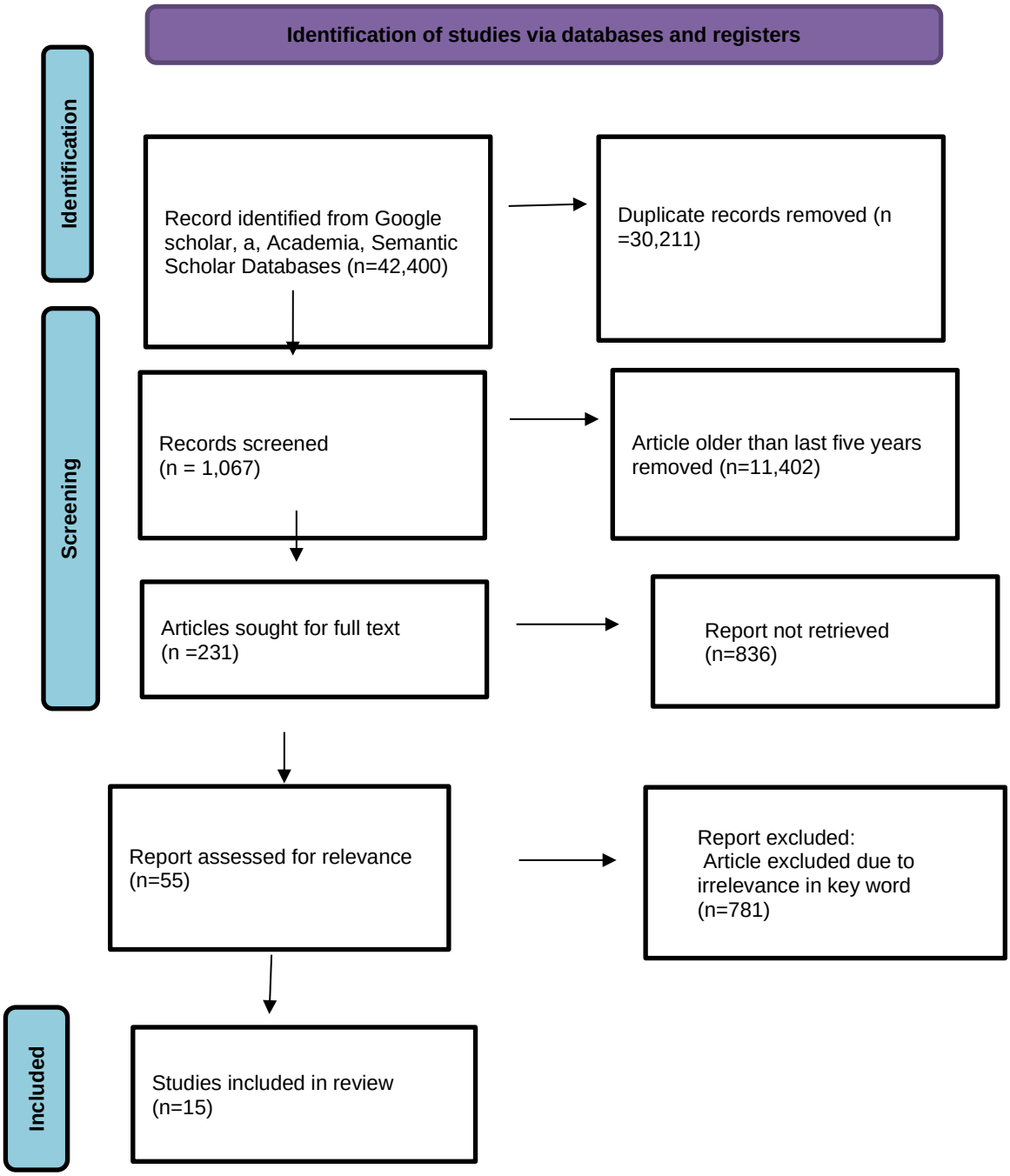
1. To explore third- and fourth-year undergraduate nursing students' perceptions of surgical site infections (SSIs) and their understanding of their role in SSI prevention.
2. To assess the SSI prevention strategies implemented by third- and fourth-year undergraduate nursing students during clinical rotations, specifically focusing on adherence to standard protocols.

Study Rational

Surgical site infections (SSI) continue to be a major health concern due to their high occurrence, which raises morbidity, mortality, and medical expenses. When it comes to putting infection prevention strategies into practice and lowering SSI rates, nursing students are essential. Regarding their level of awareness, attitude, and adherence to accepted SSI preventive guidelines, there is uncertainty, nonetheless.(Woldegioris et al., 2019) By evaluating undergraduate nursing students' comprehension of SSI causes, risk factors, and preventive measures, this study seeks to close the knowledge gap. According to research, nurses frequently do not follow SSI prevention protocols

to the best of their abilities. According to a study done in Egypt, nurses' mean compliance score was very low, and many of them reported having little understanding of and using inadequate SSI prevention practices. The issue is further made worse by research from other areas, such as Bangladesh and Australia, which shows that a sizable portion of nurses are ignorant of evidence-based guidelines for SSI prevention.(Mohsen et al., 2020)

PRISMA Chart:



Literature Review

A Descriptive Cross-sectional Study was conducted in Turkey. In Turkey, student nurses are subjected to hazards related to occupational health and safety (OHS) difficulties. Further investigation is necessary to better understand these issues in the clinical context and to enhance

the health and safety of student nurses. In terms of OHS, the clinical practice areas are restricted. Students are at risk of developing burnout syndrome and are exposed to psychological, chemical, and physical risks related to OHS. They are also most psychologically affected by feeling anxious and irritable in addition to physiologically experiencing symptoms resembling burnout(Eyi and Eyi, 2020). Another descriptive cross-sectional study was conducted in Saudi Arabia. This study looked at how nursing students' adherence to conventional precautions throughout clinical training was affected by the infection prevention environment of the training institution. Since organizational culture is known to have an impact on healthcare workers' adherence to infection prevention and control procedures, the idea of an infection prevention environment has emerged in healthcare institutions This study emphasized the need to preserve a high standard of infection prevention in training facilities since it affects nursing students' acquisition of infection prevention and control competencies. (Cruz, 2019). A pretest and posttest design was used to compare the effects of simulation using. Initially released by the Centers for Disease Control and Prevention (CDC) in 1996, standard precaution is the most fundamental management action to prevent illness In response to the introduction of novel infections including Severe Acute Respiratory Syndrome and numerous outbreaks of blood-borne viruses (BBVs) brought on by injection practices, a revised version was released in 2007. A field-reproducible educational approach that mimics the real clinical setting is called simulation-based education. As anticipated, it permits safe and efficient recurrent learning. (Kim et al., 2021). Furthermore, a retrospective study was conducted between 2012 to 2016 to evaluate all surgical site infections following lower extremity revascularization procedures. In January 2015, a quality improvement protocol was started. Secondary outcomes included management results, perioperative antibiotic coverage, closure technique, and patient demographics. Following the approach resulted in a 6.4% reduction in surgical site infection rates to 1.6% (p¼0.0137).(Parizh et al., 2018) Moreover descriptive correlational study was conducted in Lahore in two public hospitals to assess the knowledge and attitude of nurses. Surgical Site Infection (SSI) is a prevalent infection linked to healthcare that significantly compromises patient safety. Nurses' actions and knowledge are crucial in halting the spread of infection. To deliver high-quality care, nurses must possess strong knowledge and practice regarding SSI prevention. The majority of the participants, according to the data, were between the ages of 20 and 30 and had between one and five years of work experience. They also held general nursing and midwifery diplomas. The majority of nurses had low levels of expertise, although there were good levels of surgery site infection prevention procedures. The knowledge and practice of nurses were found to be strongly negatively correlated. The results of the current study showed a lack of knowledge, indicating the urgent need for educational and awareness programs to increase nurses' understanding of surgical site infection prevention. (Shaheen and Hawash, 2021). A nationwide cross-sectional survey was carried out for this study between June and November of 2017 in Italy. Thirty nurses were chosen at random from each hospital who expressed interest in taking part. The purpose of the questionnaire was to investigate knowledge, attitudes, and reported practices on evidence-based strategies for SSI prevention, as well as sociodemographic and practice factors. In terms of knowledge, only 53.8% of the sample was aware that preoperative hair removal should occur as soon as possible before surgery, if necessary, and 28.9% were unaware of the correct meaning of the term "bundle." Nine percent of participants thought that wearing gloves during this procedure would be enough to avoid SSI, while more than seventy-five percent said they always undertake hand antisepsis before and after biological sample collection. Moreover, hand antisepsis was consistently carried out by 91% of nurses both before and following invasive procedures. (Zucco et al., 2019). Another cross-sectional study centered at an institution was carried out in the hospitals of Bahir Dar From January 5–15, 2017. A self-administered structured questionnaire was utilized to gather data from nurses using the systematic random sampling technique. Multiple-choice questionnaires covering the nurse's knowledge and

practices were used to assess the amount of knowledge and practice about SSI. To evaluate the relationship between the dependent and explanatory variables, logistic regression was used. The nurses received scores of 74.5% and 45.1%, respectively, for their knowledge and practice of SSI prevention. The practice of nursing concerning SSI prevention is inadequate. To increase knowledge and practice changes regarding the prevention of SSI, educational and awareness programs are desperately needed, as is the necessity to put nurses' knowledge into practice.(Woldegioris et al., 2019)

Moreover, a descriptive study was conducted in Turkey in May 2016 on undergraduate nursing students from the university. The nursing students' mean score on hand hygiene knowledge was 16.05 ± 4.48, their mean score on surgical site infection prevention was 5.53 ± 2.42, and their mean score on prevention of healthcare-associated infections was 54.28 ± 11.16. The third-grade students' mean score (56.29) was found to be higher than the other averages ($p < .05$), as indicated by the factors affecting the mean scores for the students' knowledge of the prevention of nosocomial infections. The average knowledge scores of the student nurses on surgical site infections were found to be low, while their mean scores on preventing infections related to healthcare were found to be moderate. (Yıldız and Dal Yılmaz). Additionally, From March 1 to March 30, 2018, a cross-sectional study centered on an institution was conducted. A self-administered, modified, and pretested questionnaire was used to gather data. The number of hospitals was taken into consideration as strata while using a stratified random sample technique. About 50% of the participants don't practice enough to prevent surgical site infections. It is advised to train nurses, make surgical site infection control guidelines easily accessible, and make sure the knowledge nurses already possess is sufficient and capable of being translated into desired behaviors.(Mengesha et al., 2020). In a quantitative study conducted on nursing students in their last semester of study, undergraduate nurses took a knowledge test on pre- and postoperative surgical nursing. Since a nurse's first year of practice is a time of great learning, participants in the Graduate Nurse Program/Preceptorship were retested following their year of program. The results of the participants were compared to the operating room education model they had followed to see if there was any correlation between the kind of theatre education they had received and their proficiency with surgical ward nursing. According to the research, guided operating room experience helps student nurses learn more about surgical ward nursing than does surgical ward experience on its own. (Foran, 2016)

Furthermore, In 2019, a cross-sectional study was carried out on student nurses assigned to the University of Benin Teaching Hospital's Burns and Medical-Surgical Unit in Nigeria. Nursing students' mean scores were 15.38 (3.32) and 14.17 (2.80), respectively, indicating low understanding and lack of infection prevention practice. With a $P < 0.001$ Spearman's correlation coefficient, the results also showed a significant association between KPIC among nursing students. We therefore advise nursing students to undergo extensive training on infection control measures before clinical posting, as the level of KPIC measures was low and those who are aware of infection control also had high compliance to infection control.(Olorunfemi et al., 2020). However, in a cross-sectional study conducted in Faisalabad Pakistan, according to the study, nurses' knowledge and experience with preventing surgical site infections was lacking. Knowledge and practice had a substantial, positive association with one another. This suggests that the nurses employed in surgically linked wards are not very knowledgeable about preventing surgical site infections(Sadaf et al., 2018b). Another cross-sectional study was conducted in South Africa on nurses' knowledge, attitudes, and practices in the prevention of infection. A total of 301 Western Cape-based postsecondary students in their second, third, and final years of education were invited to take part The study's findings suggest that more rigorous kinds of evaluations concentrating on infection prevention and control during clinical training be used in conjunction with interactive courses on infection control that foster critical thinking at the undergraduate level.(Rahiman et al.,

2018). Additionally, a quasi-experimental pretest-posttest single-group study was conducted in Egypt in 2018 by Elsharkawy. Four weeks following educational sessions, the study's results showed a considerable improvement in all participants' knowledge and practices, with mean scores of (23.06±.86 & 121.78±2.79, respectively). Furthermore, a favorable association was observed between the age of the participants and their experience, knowledge, and practice. An encouraging outcome was an educational package on preventing surgical site infections following cesarean sections. To increase nurses' competency, it is advised to apply such a module in a variety of environments and with an adequate sample size. (Elsharkawy et al., 2019)

Another descriptive cross-sectional study was conducted in Egypt on ICU nursing staff. With a mean score of 13.01, nurses' compliance was low. Most nurses lack knowledge and practice regarding surgical site infections. The main obstacles to nurses' adherence to surgical site infection prevention guidelines were a lack of a professional model, a lack of time, and the fact that some surgical site infection prevention measures were outside of nurses' purview. The surgical site infection prevention recommendations were not well understood, practiced, or followed by the nurses in the surgery-related wards. According to nurses, the biggest obstacles to following surgical site infection prevention standards were a lack of a professional model, a lack of time, and the fact that some surgical site infection control procedures are outside of their purview. To raise the standard of care, it's critical to assess how nurses and hospitals are following the recommendations. Evidence-based practice should be used in education and training programs to enhance nurses' expertise in certain areas.(Mohsen et al., 2020)

Methodology

Study Design

This study employed a literature review methodology to assess the knowledge, attitudes, and practices (KAP) of undergraduate nursing students regarding surgical site infection (SSI) prevention. Given the critical role that nursing students will play in infection control as future healthcare professionals, understanding their KAPs towards SSI prevention is essential for improving clinical outcomes. The review framework was informed by the World Health Organization's Guide to Developing Knowledge, Attitude, and Practice Surveys, providing structure for analyzing students' understanding and adherence to infection control measures.

A comprehensive literature search was conducted in relevant databases, including PubMed, Google Scholar, Pak Medi Net, Cumulated Index to Nursing and Allied Health Literature (CINAHL), and BioMed Central to identify studies that examined nursing students' KAPs related to SSI prevention. Keywords included combinations of terms such as "surgical site infections," "nursing students," "infection control," "knowledge," "attitudes," and "practices." The initial search results were further filtered using specific index terms, ensuring a focused selection of studies. The search strategy involved a combination of keywords and Boolean operators, specifically ("surgical site infection" OR "SSI") AND ("nursing students" OR "undergraduate nursing") AND ("infection control" OR "knowledge" OR "attitude" OR "practices"). This search was designed to retrieve studies that directly focused on nursing students' awareness, perceptions, and infection prevention actions related to SSIs.

Initial results yielded a total of 42,400 articles identified from Google Scholar, Academia, and Semantic Scholar databases. Following this, articles were sought for full text, resulting in 231 articles. The screening process revealed 781 articles that were excluded due to irrelevance based on the keywords used. Ultimately, 15 studies met the inclusion criteria and were included in this review. The selection process was thorough, ensuring that only studies providing significant insights into nursing students' KAPs toward SSI prevention were considered.

Results:

The reviewed studies on nursing students and staff nurses' knowledge, attitudes, and practices (KAP) regarding surgical site infection (SSI) prevention reveal significant variations in knowledge levels, adherence to infection control protocols, and effectiveness of educational interventions.

Across multiple studies, there is evidence of limited knowledge among nursing students and nurses regarding SSI prevention. For instance, Shaheen and Hawash (2021) reported that nurses in Pakistan exhibited low knowledge levels (45%) despite relatively higher practice scores (70%), highlighting a need for educational enhancement. Similarly, a study by Yıldız and Dal Yılmaz (2016) in Turkey found that third-year undergraduate students had moderately higher knowledge scores (mean score: 5.53 ± 2.42) compared to their peers, indicating that students closer to graduation may benefit more from infection control training. While general attitudes toward infection prevention were positive, adherence to SSI protocols often depended on the presence of a supportive institutional environment. In Saudi Arabia, Cruz (2019) highlighted that adherence to SSI protocols improved when students perceived the training environment as supportive of infection prevention measures. This underscores the role of institutional culture in fostering a sense of responsibility and compliance with infection prevention guidelines among nursing students. Studies suggest considerable gaps in SSI prevention practices, with reported practice scores varying widely based on educational methods and institutional support. Kim et al. (2021) demonstrated that simulation-based education in South Korea improved SSI practice scores by over 20% in a pretest-posttest design, suggesting that hands-on, realistic training methods can enhance students' practical application of SSI knowledge. However, Mengesha et al. (2020) found that only about 50% of Ethiopian nurses reported adequate SSI prevention practices, suggesting a need for ongoing, accessible training programs to improve practical competencies. Educational sessions consistently led to significant improvements in both knowledge and practice regarding SSI prevention. In Egypt, Elsharkawy et al. (2019) reported a marked increase in knowledge and practice post-intervention, with mean knowledge scores rising from 18 to 23 and practice scores from 98 to 122 ($p < .001$), demonstrating the value of structured educational programs in enhancing SSI prevention practices. This finding aligns with Olorunfemi et al. (2020), who also observed a statistically significant correlation ($p < 0.001$) between infection prevention knowledge and practice adherence among Nigerian nursing students. While knowledge of SSI prevention remains a challenge for many nursing students and professionals, targeted interventions such as simulation-based training and supportive institutional environments show promise in improving adherence to SSI protocols. These studies highlight the need for a multifaceted approach, combining didactic learning with practical, environment-focused training, to enhance nursing students' preparedness in SSI prevention.

Synthesis of Key Findings

Study	Location	Study Design	Key Findings
Eyi & Eyi (2020)	Turkey	Descriptive Cross-Sectional	High levels of burnout and anxiety; physical and psychological OHS risks observed
Cruz (2019)	Saudi Arabia	Descriptive Cross-Sectional	Need for infection prevention-supportive environments to improve adherence to protocols.
Kim et al. (2021)	South Korea	Pretest-Posttest Design	Simulation increased post-test scores by over 20%

Shaheen & Hawash (2021)	Pakistan	Descriptive Correlational	Low knowledge yet higher practice scores; negative correlation between knowledge and practice
Yıldız & Dal Yılmaz (2016)	Turkey	Cross-sectional study	Third-year students scored higher on infection control knowledge than other years.
Parish et al. (2018)	USA	Retrospective cohort study	Quality improvement protocol reduced SSI rates from 6.4% to 1.6% (p=0.0137) after implementing perioperative guidelines.
Olorunfemi et al. (2020)	Nigeria	Cross-sectional study	Positive attitudes but low practice scores; significant knowledge-compliance correlation
Mengesha et al. (2020)	Ethiopia	Cross-Sectional	Half of the participants reported inadequate practices; suggesting the need for continuous training.
Zucco et al. (2019)	Italy	National Cross-sectional	Only 53.8% were aware of preoperative hair removal timing; many were unaware of "bundle" and misinterpreted prevention protocols.
Elsharkawy et al. (2019)	Egypt	Quasi-Experimental	Significant improvement in both knowledge and practice post-education ($p < .001$)
Rahiman et al. (2018)	South Africa	Cross-sectional study	Recommended critical thinking exercises to enhance infection prevention during clinical training

Discussion

The review's outcome is an evaluation of third- and fourth-year undergraduate nursing students' surgical site infection (SSI) knowledge, attitudes, and practices (KAP). The study emphasized the important role that nursing students play in clinical settings and their impact on patient outcomes, as well as several important insights into infection prevention. The results of the research context and literature evaluation highlighted the disconnect between learning and doing to prevent SSIs.

According to earlier research, nursing professionals and students frequently lack the necessary skills and knowledge to control infections, particularly when it comes to SSI prevention. For instance, research conducted in nations like Turkey. Ethiopia and Nigeria reported that nursing personnel and students did not fully comprehend and did not follow infection control protocols. Additionally, the study emphasized how the clinical training setting affects students' capacity to adhere to basic precautions. Highlighting the necessity of better clinical training instruction on infection prevention (Woldegioris et al., 2019). This is especially important because inadequate infection prevention behaviors, like not wearing the necessary PPE or not washing your hands, directly raise the risk of SSIs, which in turn raises patient morbidity and medical expenses. (Kim et al., 2021)

The results of this study will be consistent with earlier studies showing that while nursing students have some theoretical understanding of infection control, they frequently have difficulty putting that knowledge into practice in clinical settings (Kim et al., 2021). The degree of clinical exposure,

hospital culture, and the existence of clear infection control protocols are some of the variables that make these inequalities worse. Inadequate adherence to effective practices may also result from a lack of ongoing infection prevention education, as noted in other studies.(Mohsen et al., 2020) The study also sought to investigate how nursing students' knowledge and attitudes about SSI prevention were impacted by demographic variables such as age, clinical experience, and educational attainment.

Finding particular areas where nursing students need focused educational interventions is one of the main results this study is expected to produce. To improve students' preparedness to participate in infection control initiatives in a clinical setting (Sadaf et al., 2018b), nursing education and institutions can fill these gaps by putting in place structured infection prevention programs that cover both theoretical knowledge and practical application. Furthermore, the results may help guide more comprehensive infection control plans by emphasizing the necessity of a more thorough evaluation of students' infection prevention skills before they enter the workforce.

Conclusion

In conclusion, this study emphasizes how critical it is to give nursing students the theoretical understanding and practical skills they need to effectively avoid surgical site infections (SSIs). Nursing programs should place a high priority on focused educational interventions that encourage adherence to evidence-based infection control methods to close the knowledge gap between academia and practical implementation. Institutions can better equip nursing students to confidently contribute to patient safety and lower the incidence of SSIs by cultivating an infection prevention culture in clinical settings. Comprehensive training modules emphasizing standardized and consistent infection control procedures should be included in the nursing curriculum. To improve the general standard of patient care and safety, healthcare organizations should also aggressively promote a supportive learning environment that promotes the adoption of these practices.

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