Peri-Operative Nurses' Knowledge and Practice on Surgical Site Infection Prevention and Adherence to WHO Guidelines in Surgical Units at GISC

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Abstract

Background: Surgical Site Infections (SSIs) remain one of the most prevalent healthcare-associated infections, affecting millions of patients worldwide and leading to increased morbidity, mortality, prolonged hospital stays, and financial burdens on healthcare systems. The role of healthcare professionals, particularly nurses, in preventing SSIs is well established in clinical research, with various studies emphasizing the importance of knowledge, practice in reducing infection rates**. Aim:** This study aimed to investigate Peri-operative nurses' knowledge and practice on surgical site infection prevention and adherence to WHO guidelines in surgical units at gastrointestinal surgery center. **Research design:** A descriptive research design was utilized for conducting the study. **Setting:** This study was conducted in surgical Units of the Gastrointestinal Surgical Center **Subject:** A convenient sample (150) of all available staff nurses who are involved in direct patient care with different levels of education, have at least one year of work experience in surgical wards. **Tool:** Tool I: Self-administered questionnaire: It is composed of two parts: Part I: Demographic characteristics of nurses, Part II: Nurse's knowledge assessment. Tool II: Nurses' practices observational checklist: Tool III: Nurses' adherence to WHO guidelines **Results:** The results of current study revealed that the majority of (66%) of the nurses had good knowledge regarding SSI prevention and more than half (59%) of the nurses have competent practice regarding surgical site infection prevention Moreover, in this study correlation between knowledge and practice was positive**. Conclusion:** As a final point, there is a significant difference between Nurse's knowledge and practice and their demographic characteristics. Moreover, the nurses in this study had a good adherence to WHO guidelines regarding. **Recommendations:** investigate the effectiveness of interdisciplinary training approaches involving surgeons, nurses, and infection control specialists. about surgical site infection

Keywords: Peri-Operative, Surgical Site Infection (SSI), Nurses, Knowledge, practice, Infection Prevention, Adherence, WHO.

Introduction:

Perioperative nurse performs many vital roles in all stages of surgery, especially in prevention of surgical site infections (SSIs), serving in various roles clinician, educator, and leader to Implement evidence-based practices and improve patient outcomes **(Misti et al., 2023).**

The prevention of surgical site infections (SSIs) and the promotion of optimal patient recovery are two of the most important responsibilities of perioperative nurses. Perioperative nurses play an important role in reducing the risk of infections and their complications by implementing evidence-based practices. These practices include adhering strictly to aseptic techniques, practicing proper surgical hand hygiene, performing antibiotic prophylaxis promptly, and effectively managing wound care **(Chellam Singh, and Arulappan, 2023).**

Surgical Site Infections (SSIs) continue to pose a significant challenge in modern healthcare systems, contributing to increased patient morbidity, prolonged hospital stays, higher healthcare costs, and, in severe cases, mortality. SSIs account for a substantial percentage of healthcare-associated infections (HAIs) worldwide, despite advancements in surgical techniques, sterilization methods, and infection control protocols **(Manan et al., 2024).**

Among the most common postoperative complications, affecting millions of surgical patients annually. SSIs are defined as infections occurring at or near the surgical incision site within 30 days of surgery (or up to one year in cases of implant-related procedures), it can lead to severe complications such as prolonged wound healing, deep tissue infections, systemic infections, and sepsis. **(Druye et al., 2024). (Zakir, et al., 2025)**

Seidelman et al., 2023 clarify Surgical site infections (SSIs) as infections that appear at the incision site of a surgery within 30 days following a surgery in the body where the surgical incision was performed. This type of infection brings major challenges to healthcare worldwide as it accounts for a significant percentage of the hospital-acquired infections and puts more risks and burdens on the patients and society at large.

Globally, SSI. Are one of the most prevalent healthcare-associated infections (HAIs) It accounts for 29% of admitted patients and 38% of patients in surgical wards, making it the second cause of HAI **(Bhattacharyya, et al.,2021)** The CDC reports that the annual rate of surgical procedures is relatively high. Approximately 0.5% to 3% of surgical patients will get an infection at or near the site of the incision **(Centers for Disease Control and Prevention (CDC),2025)**

Concerning the low-and middle-income countries, SSI affecting up to one-third of patients undergoing surgery. However, in high-income countries, such as Europe and the US, SSI remains the second most common type of HAI **(WHO Global guidelines on the prevention of surgical site infection,2023).**

In Egypt the incidence rate of surgical site infection is around (3.3%-4.2%). The rate of surgical site infection varies depending on the type of surgery and the degree of contamination. surgical site infection according to type of surgery, for clean surgery occurs at rate of 2.1 for every 1000 operation and surgical site infection according to the degree of contamination, for clean contamination surgery it occur at rate 3.3 for every 1000 operation, while surgical site infection occur at rate of 6.4 for contamination surgery and 7.1 for every 1000 operation, for dirty surgery surgical site infection typically occur within thirty days after surgery **(Abdel -Hady et al, 2020; Mohsen et al, 2020).**

Risks for SSIs have been classified into numerous factors; intrinsic and extrinsic, the intrinsic factors include advanced age, malnutrition, metabolic diseases, smoking, obesity, hypoxia, immune suppression, and length of pre operation. Pre-operative skin preparation and skin antiseptics, antibiotic prophylaxis, inadequate sterilization of surgical instruments, surgical drains, surgical hands scrubs, and dressing techniques formed the extrinsic factors. **(Famakinwa et al., 2024)**

There are two types of risk factors for surgical site infections (SSIs) in an operating room setting: those that can be controlled and those that cannot. Factors that may be regulated and maximized by strict standards and training include things like surgical equipment sterilization, adherence to aseptic practices, and the conduct of surgical workers **(Rosa, Sposato, and Abbo, 2023).** However, there are some aspects of patients' microbiota or unexpected reactions to surgery that are considered uncontrollable variables since they are intrinsic to the patient and cannot be changed during surgery **(Calderwood et al., 2023).**

The World Health Organization (WHO) and the Centers for Disease Control and Prevention (CDC) have established evidence-based guidelines for SSI prevention, emphasizing key measures such as appropriate antibiotic prophylaxis, strict hand hygiene compliance, proper aseptic techniques, and optimal wound care practices. Despite these guidelines, SSI rates remain a concern, particularly in resource-limited settings where infection control infrastructure and adherence to protocols may be inadequate **(Ranoto, et al.,2025)**

Preventive strategies of SSI primarily focus on the role of health workers and the risk factors related to the surgical procedure. Although routine surveillance and standard prevention protocols have been established, active involvement of patients in the prevention of SSIs should also be considered because patient involvement can be beneficial **(Cox et al., 2023)**

Understanding the current level of nurses' knowledge and their compliance with SSI prevention measures is crucial in identifying areas for improvement. While various factors influence infection prevention, including institutional policies, resource availability, and workload constraints, the role of education and training remains paramount. Continuous professional development through structured educational interventions has been shown to enhance nurses' competency, improve compliance with infection control measures, and ultimately reduce SSI incidence **(Kanani et al.,2025).**

Nurses play a critical role in ensuring proper infection control before, during, and after surgery. Their knowledge and adherence to SSI prevention guidelines significantly impact patient outcomes, yet research indicates that gaps in knowledge and inconsistencies in practice **(Chao et al., 2025).**

Good patient knowledge is expected to help patients participate in SSI prevention efforts, comply with treatment protocols, monitor their health conditions, report emerging symptoms, and collaborate with health workers in the decision-making process regarding effective preventive measures to reduce the risk of SSIs If patients do not actively participate in efforts to prevent SSIs, the risk of developing infections may increase, leading to extended hospital stays, a higher risk of death, and increased treatment costs **(Oliveira et al., 2023)**

Improved surgical outcomes, quicker recovery, and reduced hospital stays are all results of their treatments, which also increase patient safety. Better recovery rates and decreased healthcare costs are the end results of perioperative nurses' tireless efforts to minimize surgical site infections (SSIs) through the continual assessment and implementation of infection control strategies **(Sun et al., 2024).**

The consistency and efficacy of these preventative procedures are further enhanced by efficient communication and coordination among surgical personnel **(Tobiano et al., 2024).** Surgical site infections (SSIs), poor patient outcomes, and the high expense of treating postoperative complications can all be greatly reduced if perioperative nurses make these practices a regular part of their work **(Mamasydykov, 2023).**

Important methods implemented by perioperative nurses include keeping the operating room clean, making sure the patient's skin is ready for surgery, and giving antibiotics at the correct times **(Lv and Yang, 2021).** In addition, the risk of surgical site infections can be greatly reduced by closely monitoring patients, recognizing infection symptoms early on, and following best practices for wound care **(Ye et al., 2025).**

Improving patient safety and contributing to reduced hospital stays and healthcare costs are both achieved via the integration of interdisciplinary teamwork and procedures supported by research. Surgical success rates and patient care quality are both improved when evidence-based nursing practices are prioritized **(Laing et al., 2022).**

Poor implementation of SSIs preventive measures is attributed to various obstacles such as insufficient knowledge, funding, inadequate surveillance, performance monitoring, excessive workload, staff, training, and poor orientation program. **(Tesfaye et al., 2022**

Additionally, insufficient in-service training and skill renewal are significant issues that impact SSIs prevention strategies in hospital settings **(Mengesha et al., 2020)**

Surgical nurses perform a critical function of making sure that all instruments used in surgeries, drapes, nears, and other equipment and items are thoroughly disinfected. They also observe the surgical team's adherence to the principles and practice of asepsis, including hand washing and the use of sterile gowns and gloves **(Yilmaz et al., 2024).**

Nurses play critically in avoiding nosocomial infections. They provide hands-on care, including wound dressing, administering medications, and assisting with hygiene, making their adherence to infection control protocols vital in minimizing infection risks. High compliance can significantly reduce infection rates, while lapses can lead to serious outbreaks. Improving the practices of nursing staff is indeed strongly linked to acquiring solid knowledge in hygiene

and asepsis. This knowledge forms the foundation for effective infection control and prevention strategies **(Khatrawi et al., 2023)**

The prevention of SSIs remains a significant challenge in ensuring optimal care for surgical patients. Despite the availability of advanced surgical techniques and sterilization methods aimed at reducing SSIs, these infections continue to be considered a major obstacle in healthcare settings. SSIs not only leading to prolonged hospital stays, increased morbidity and mortality rates, and higher healthcare costs but also, they have detrimental impact on the overall quality of life for patients **(Ahmed., (2023)**

Significance of the study

Surgical site infections (SSIs) are considered a significant life-threatening illness and major public health hazard that has a negative impact on patient safety, resulting in a longer hospital stay and re-admission after surgery. Despite the lack of comprehensive global data, the prevalence of SSI is higher in low- and middle-income countries than in high-income countries **Avsar, (2022).**

Surgical Site Infections (SSIs) are a serious public health concern. It is a common postoperative complication that can occur anywhere in the body, including the site of the incision, the surgically operated organs or tissues, or other locations where surgical instruments were placed. Along with other pathogens obtained in the community or hospital, opportunistic endogenous bacteria can cause Surgical Site Infections (SSIs) by contaminating surgical wounds or implanted medical devices. A substantial cost on patients, healthcare providers and the healthcare system overall is linked to SSIs, which impacts 0.5% to 3% of surgical patients. When compared to patients without SSIs, SSIs may result in longer hospital stays. The rates of SSI remain surprisingly high, even though many laws and standards have been put in place to avoid these infections; this puts the healthcare system at risk for morbidity and mortality **(Nawal Salama, 2025).**

The prevention of SSIs remains a significant challenge in ensuring optimal care for surgical patients. Despite the availability of advanced surgical techniques and sterilization methods aimed at reducing SSIs, these infections continue to be considered a major obstacle in healthcare settings. SSIs not only leading to prolonged hospital stays, increased morbidity and mortality rates, and higher healthcare costs but also, they have detrimental impact on the overall quality of life for patients. **Ahmed., (2023).**

Surgical site infection is a common healthcare associated infection worldwide which is a burden on both patients and health care systems. Nursing is an integral part of health care system. Nurses' knowledge and practice are a vital part in patient care. Their up-to-date knowledge and practices play a significant role to control these infections. That is why this study was carried out to assess their knowledge and practice towards prevention of surgical site infection and nurse's adherence to WHO Guidelines.

Aim of the Study

This study was established to investigate the nurses' knowledge and practices regarding prevention of surgical site infections and nurse's adherence to WHO Guidelines in Surgical Units at Gastrointestinal Surgical Center

Research questions

To fulfill the aim of this study, the following research questions were formulated:

Q1: What is the level of nurses' knowledge regarding prevention of surgical site infection?

Q2: What is the level of nurses' practice regarding prevention of surgical site infection?

Q3: What is the level of Nurses' adherence to WHO guidelines?

Subjects and Methods

The study was completed in four major stages:

I. Technical design
II. Operational design
III. Administrative design
IV. Statistical design

Stage I: Technical design:

Technical design includes research design, setting, subjects and tools of data collection.

A. Research Design:

A descriptive research design was utilized to fulfill the aim of the study and answer the research questions. Also, this design is used to collect data from a sample of participants at a single point in time as well, it helps to establish a database for future research **(Polit & Beck, 2022).**

B. Research Setting:

This current study was carried out at the Surgical Unit of the Gastrointestinal Surgical Center affiliated to Mansoura University which occupies the fifth, sixth and economic floor, it has 16 private rooms as well as 110 beds and receives annually more than 4000 patients.

Surgical wards	Beds No	Nurses No	Private room	General Wards
Fifth floor	26	60	8	3
Sixth floor	26	55	8	3
Economic floor	16	35	8	-

C. Subjects:

All available staff nurses (150) involved in the current study, who are working in the previously mentioned settings (surgical wards) and give direct nursing care and directly contact with surgical patients regardless their age, sex, education and years of experience.

D. Tools of data collection

To achieve the aim of the current study, three tools were used to collect data.

Tool I: Self-Administered Nurse's Questionnaire: it was developed by the investigator in an Arabic language after reviewing the recent and relevant literature It was divided into **two parts:**

Part one: Nurses' demographic and Occupational Characteristics

This part was used to assess the demographic and occupational characteristics of nurses it includes nurse's age, sex, marital status, educational level, professional qualification and years of experience in surgical unit.

Part two: Nurses' Knowledge

This tool was adapted from (**Sickder et al., 2014) (Haleema et al., 2017) (Mohamed, 2022)** and aimed to assess the level of nurses' knowledge regarding prevention of surgical site infection, which consists of (25) multiple-choice questions (MCQs)

SSI Nurses' Knowledge includes two sections:

section I: knowledge of pre-operative prevention of SSI (8 questions)

1. Preoperative Bathing/ showering
2. Preoperative Hair removal
3. Surgical site shaving
4. Antibiotic Prophylaxis

section II: knowledge of post-operative prevention of SSI (17 questions)

1. Surgical wound care with aseptic precaution
2. Wound Assessment and monitoring of SSI
3. Patient Monitoring and Education

Knowledge's Scoring System

- Each correct answer will have (1) mark, incorrect or missed answer have (0).
- The total level of knowledge score was further divided into three levels as follows:
- poor knowledge if the score was less than 60%,
- fair knowledge if the score was 60% to less than 75%

- good knowledge if the score was 75% and above

Tool II: Nurses practice observational checklist, this tool adaptive from **(Sickder etal.,2014) (Anjana etal.,2023)** included a checklist that aims to assess nurses' practices for prevention of surgical site infection among surgical patients. This tool has 25 statements It consists of 2 parts.

Part 1: preoperative surgical site infection (14 Questions)

1. Surgical Site & Skin Preparation
2. Prophylactic Antibiotics
3. Controlling underlying medical condition
4. Maintaining nutritional status

Part 2: postoperative surgical site infection (11Questions)

1. Surgical wound care with aseptic precaution
2. Wound Assessment and monitoring of SSI

Nurse Practice Scoring System

Each step was observed, categorized, and scored (range from 1 never to 5 always

The total practice score level further divided into the following:

- Competent level when ≥90%
- Incompetent level when <90%.

Tool III: peri-operative Nurses' adherence to WHO Guidelines regarding prevention of surgical site infection questionnaire This tool adapted from **(Nezianya et al., 2025)** that aims to assess nurses' adherence to WHO Guidelines regarding prevention of SSI. This tool included 16 steps graded using the following (Very great extent=4 Good extent=3 Low extent =2 Very low extent=1)

Operational design

The operational design includes preparatory phase, content validity, tool reliability, pilot study and fieldwork.

preparatory phase:

- It includes reviewing national and international literature related to present study using scientific published articles, internet searches, and textbooks. This review was a guide for developing the study tools.

Validity of the Tool.

- The panel of 5 expertise in medical surgical nursing specialties reviewed the tool for its inclusiveness, simplicity, relevancy, and applicability. Accordingly, the required adjustments were made. and the necessary modifications were made.

Reliability of the Tool

The reliability for the study was calculated by: The Cronbach Alpha was calculated for both knowledge (0.871), practice (0.720) to confirm the reliability of the questionnaire by test- retest on two occasions of the pilot of the instrument on the same population and the Cronbach alpha were greater than the recommended value of 0.7

Pilot Study

- The pilot study was carried out on 10% of the nurses from the sample to check the clarity and understanding of the study tools and the necessary modifications made before data collection.
- This pilot sample was to estimate the time needed to answer the study tools.
- Pilot study excluded from the studied sample
- Participant nurses in the pilot study were omitted from the main study sample.

Fieldwork:

- An approval was obtained from hospital directors and nursing directors at Gastrointestinal Surgical Center affiliated Mansoura University
- The sample of the study was recruited according to the inclusion and exclusion criteria.
- The purpose of the study was simply explained to the nurses who agreed to participate in the study prior to any data collection.
- The investigator collects data from the nurses at the general surgical unit (3unit; Fifth, sixth and economic surgical unit) at Gastrointestinal Surgical Center.
- Nurses' informal consent to participate in the study was obtained after explaining the study's aim and nature of the study and confidentiality was preserved.
- The researcher collected participant nurses' demographic data using part I of the tool. Completing this part lasted about 10 minutes for each nurse.
- Participant nurses' practices regarding SSI were observed in the mentioned setting using part (2) of the tool two days per week at the beginning of morning shift. to collect data from nurses and to observe nurses practice due to routine patients' procedure of the wound change begin at the beginning of the shift and stay with them along day shift
- The observational checklist was filled by the investigator based on observing nurses' regarding application of SSI, it took from 20:30 minutes.
- The self-administered questionnaire was distributed to the nurses in their workplace; each questionnaire part takes about 5 to 10 minutes to be filled by the nurses with a total time of 15 to 30 minutes

Stage III: Administrative design

- To get permission to perform the study, the Gastroenterology and Liver Transplantation Surgical Center's director received an official letter from the Faculty of Nursing. To obtain collaboration and support through data collection.
- The director was briefed on the purpose of the study and its methodology.

Ethical Considerations

- Mansoura University Faculty of Nursing's Research Ethics Committee (REC) gave its approval (0771) to the study proposal, following thorough explanation of the study's purpose and nature, the hospital administrative authorities obtained formal consent to carry out the study.
- There was no risk in study participants during application of the research. The study was following common ethical principles in clinical research. Following an explanation of nature and goal of the study, nurses who were willing to participate provided written consent.
- Data anonymity and confidentiality were guaranteed.
- Study participants were free to decline participation and/or leave the study at any moment and without explanation.
- The privacy of study participants was considered when gathering data. They received assurances that their personal information would be kept private, and data would be coded.

Data Collection Process

- Data collection process starts and is completed within three months (from June 2025 to September 2025)
- After outlining the purpose of the study, the director of the Gastroenterology and Liver Transplantation Surgical Center granted formal approval to perform the study before the start of data collecting.

4. Statistical design

Data were fed to the computer and analyzed using **IBM SPSS version 20.0** software. package version 26.0. Qualitative data were described using number and percent Quantitative data were described using mean, standard deviation. **(Mean, SD).** Significance of the results obtained was judged at the **5% level**. For categorical variables, **Chi-square tests** are used to compare different categories. Pearson correlation coefficient used to correlate between two normally distributed quantitative variables. **Monte Carlo correction for** chi-square when more than 20% of the cells have expected count less than 5.

Results

Table (1): summarized the distribution of nurses' demographic characteristics studied. Regarding their ages, nearly two thirds (64.0%) of studied nurses their age ranged from 20 to 30 years. For their educational qualifications, less than one half of nurses (45.3%) had bachelor's degrees, concerning their marital status, two thirds of them (61.3%) were married, less than half of the nurses (42.7%) worked in fifth surgical ward, regarding their experience more than half of studied nurse had 1 – 5 years of experience

Table (2): Illustrated relation between nurses' knowledge and practice there was highly positive significant relation between nurses' knowledge and practice with $p \leq 0.001$

Figure (1): Shows overall nurses knowledge level regarding prevention of surgical site infection (SSI)

Figure (2): Shows overall nurses practice regarding prevention of surgical site infection (SSI)

Figure (3): shows Nurses' adherence to WHO guidelines regarding prevention of surgical site infection mean percent (62.29±9.65)

Table (1): Frequency & distribution of the studied nurses regarding their demographic characteristics (n = 150)

~~Socio~~-demographic Characteristics	Participant Nurses (n= 150)	
	N o	**%**
Age (Years)		
• **20-30**	96	64.0
• **31-40**	31	20.7
• **≥40**	23	15.3
Qualification (Level of education)		
• **Diplom**	36	24.0
• **Technical institute of nursing**	46	30.7
• **Bachelor of nursing Sciences**	68	45.3
Marital status		
• **Single**	58	38.7
• **Married**	92	61.3
Working unit		
• **Six surgical ward**	64	42.7
• **Fifth surgical ward**	55	36.7
• **Economic surgical ward**	31	20.7
Years of Work Experience		
• **1-5**	79	52.7
• **6-10**	32	21.3
• **11-15**	18	12.0
• **≥15**	21	14.0

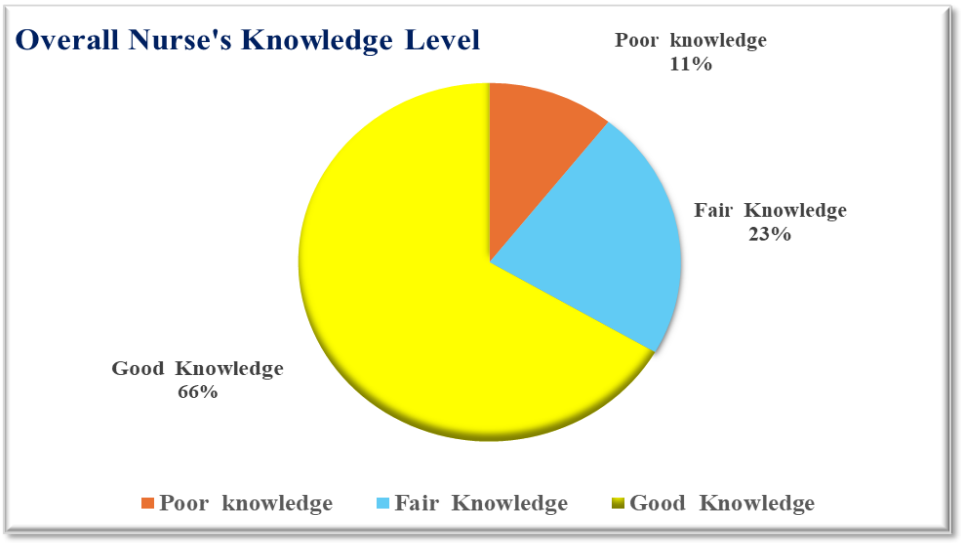

Figure (1): Overall Nurses Knowledge level regarding prevention of surgical site infection (SSI)

Figure (2): Overall Nurses practice regarding prevention of surgical site infection (SSI)

Table (2): Correlation between knowledge and practice of studied nurses regarding surgical site infection prevention

		Practice								
Knowledge		**Surgical Site & Skin Preparation**	**Prophylactic Antibiotics**	**Controlling underlying medical condition**	**Maintaining nutritional status**	**preoperative nursing practice**	**Surgical wound care with aseptic precaution**	**Wound Assessment and monitoring of SSI**	**Post operative nursing practice**	**Overall practice**
Preoperative Bathing/ showering	**r**	0.523*	0.373*	0.334*	0.290*	0.477*	0.507*	0.490*	0.539*	0.545*
	p	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*
Preoperative Hair removal	**r**	0.413*	0.402*	0.377*	0.469*	0.527*	0.391*	0.523*	0.503*	0.551*
	p	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*
Surgical site shaving	**r**	0.312*	0.402*	0.248*	0.272*	0.407*	0.269*	0.423*	0.384*	0.423*
	p	<0.001*	<0.001*	0.002*	0.001*	<0.001*	0.001*	<0.001*	<0.001*	<0.001*
Antibiotic Prophylaxis	**r**	0.441*	0.399*	0.267*	0.357*	0.470*	0.495*	0.395*	0.475*	0.506*
	p	<0.001*	<0.001*	0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*
Total Nurses' Knowledge (Pre-operative)	**r**	0.601*	0.562*	0.433*	0.488*	0.668*	0.591*	0.650*	0.675*	0.719*
	p	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*
Surgical wound care with aseptic precaution	**r**	0.564*	0.536*	0.445*	0.440*	0.636*	0.505*	0.636*	0.626*	0.675*
	p	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*
Wound Assessment and monitoring of SSI	**r**	0.594*	0.575*	0.449*	0.392*	0.647*	0.427*	0.568*	0.547*	0.638*
	p	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*
Patient Monitoring and Education	**r**	0.611*	0.433*	0.407*	0.496*	0.608*	0.577*	0.528*	0.595*	0.644*
	p	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*
Total Nurses' Knowledge (post -operative)	**r**	0.744*	0.640*	0.543*	0.560*	0.790*	0.636*	0.719*	0.738*	0.818*
	p	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*
Overall, Knowledge	**r**	0.745*	0.660*	0.541*	0.575*	0.803*	0.668*	0.748*	0.771*	0.843*
	p	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*

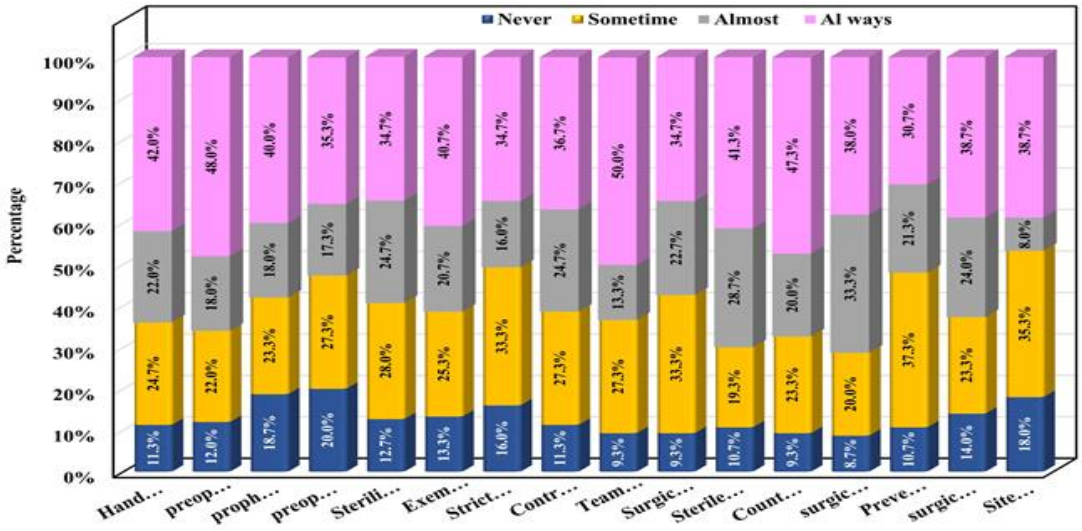

Figure (3): Nurses' adherence to World Health Organization guidelines regarding prevention of surgical site infection

Table (3): Nurses' adherence to World Health Organization guidelines regarding prevention of surgical site infection

Nurses' adherence to World Health Organization guidelines regarding prevention of surgical site infection	Never		Sometime		Almost		Al ways	
	No	%	No	%	No	%	No	%
Washing hands before wearing surgical gloves	17	11.3	37	24.7	33	22.0	63	42.0
Performing preoperative shaving right before surgery	18	12.0	33	22.0	27	18.0	72	48.0
Administering preoperative prophylactic antibiotics within one hour before surgery	28	18.7	35	23.3	27	18.0	60	40.0
Advising patients to take preoperative showering/bathing with antimicrobial agent	30	20.0	41	27.3	26	17.3	53	35.3
Sterilizing dressing material before cleaning surgical wound dressing	19	12.7	42	28.0	37	24.7	52	34.7
Exemption of staff with upper respiratory tract infection intra-operative	20	13.3	38	25.3	31	20.7	61	40.7
Strict adherence to asepsis	24	16.0	50	33.3	24	16.0	52	34.7
Control of visitors and workers movement (traffic)	17	11.3	41	27.3	37	24.7	55	36.7
Teamwork spirit and effective communication among the team members	14	9.3	41	27.3	20	13.3	75	50.0
Surgical consciousness	14	9.3	50	33.3	34	22.7	52	34.7
Sterile dressing of incision site post operative	16	10.7	29	19.3	43	28.7	62	41.3
Counting of surgical swab, sutures, instruments and needles after surgery.	14	9.3	35	23.3	30	20.0	71	47.3
Ensuring standard and excellent clearing and sterilization process of surgical bundles and instruments	13	8.7	30	20.0	50	33.3	57	38.0
Prevention of specimen loss through adequate management	16	10.7	56	37.3	32	21.3	46	30.7
Participating in surgical team debriefing after running a day list	21	14.0	35	23.3	36	24.0	58	38.7
Site marking is important to prevent wrong site	27	18.0	53	35.3	12	8.0	58	38.7
Total score	**45.90±4.63**							
Mean percent score	**62.29±9.65**							

Discussion

Surgical Site Infections (SSIs) remain a significant concern in healthcare settings, as they contribute to increased morbidity, prolonged hospital stays, and higher healthcare costs. Nurses, as frontline healthcare providers, play a crucial role in preventing SSIs through their knowledge and adherence to best practices. This study aimed to assess nurses' existing knowledge, practices regarding SSIs.

Regarding the demographic data of the nurses under the present study. The study's findings indicate that nearly two thirds of nurses (64.0%) their age of between 20-30yeras this explains that most of those nurses were newly graduated young and tolerate the nature of the work. **Amina et al., (2023)** in her study "Nurses' Knowledge and Practice Regarding Prevention of Surgical Site Infection at Governmental Hospitals in Wasit City "confirmed this finding, stating that almost half of nurses age ranged from 21-30 years old (58.3%).

This finding is congruent with **Khalid et al., (2023)** who revealed that about 74% of participants were between ages 25 and 30 years of age.

Also, the findings of the present study are consistent with a study conducted by **Jaleta, (2021)** who studied "Nurses Knowledge, Practice, and Associated Factors Toward Prevention of Surgical Site Infection" and revealed that more than two thirds of their studied nurses (67.4%) are in the age group (20-29) years.

Meanwhile, the current result consistent with the study of **Mohsen et al., (2020)** who studied "Compliance and Barriers Facing Nurses with Surgical Site Infection Prevention Guidelines" noted that more than one-third of the sample was in the age group of 20 - 30 years. but finding is contradicted with **Sham, et al., (2021)** who studied "Nurses' knowledge and practice towards prevention of surgical site infection" revealed that the minority of their studied nurses with age 20 -25 years

In terms of gender, all studied nurses included in this research were female. This can be interpreted that old perception that nursing profession is caring job that more suitable for females more than males, the higher proportion of the nurses in Egypt were females and may also be related to the nursing study in the Egyptian Universities was limited for females only till fifteen years ago.

This finding is congruent with **Horgan, et al., (2023)** who studied "Healthcare professionals' knowledge and attitudes towards surgical site infection and surveillance" " and stated that more than two thirds of their studied nurses were female

This finding is contradicted with **Hassan, et al., (2023)** who studied" nurses' knowledge and practice regarding prevention of surgical site infection " and found that more than half of their studied nurses Male.

This study result is in line with study finding conducted by **(Mwakanyamale, 2013)** who reported that Majority of the respondents in their study (76.5%) were female nurses. Meanwhile this result was dissimilar to **Amina et al., (2023)** who showed that, half of studied sample were males (n=92;51.1%) as compared with female (n=88; 48.9%).

Marital status related findings, the results of present study indicate that more than two thirds (61.3%) of studied nurses were married compared to those still single; the result comes because most of these age groups are the age of marriage, especially after the completion education and appointment in the nursing field. Both **Sham et al., (2021)** and **Shaheen et al., (2021)** supported the result of this study, who reported that the majority of their studied nurses were married.

Also, a study by **Amina et al.,2023 Nurses'** Knowledge and Practice Regarding Prevention of Surgical Site Infection at Governmental Hospitals in Wasit City, mentioned that most of sample were married (67.2) this finding contradicted with **Gizaw et al., (2022)** who studied "knowledge, practice and associated factors towards postoperative wound care among nurses" and found that more than half of their studied nurses were single.

Concerning the educational level, the results of present study indicated that less than half of studied nurses (45.3%) had Bachelor nursing degree This finding is in contrast with **Hassan et al ., 2023** who studied "Nurses' Knowledge and Practice Regarding Prevention of Surgical Site Infection at Governmental Hospitals in Wasit City", found that almost one half of their studied nurses had diploma in nursing. This was dissimilar with **Amina et al.,2023**, who declared that the majority of

nurses graduated from nursing secondary school (45.6%), and also contraindicated with **EL-Azab et al.,(2023)** who studied "Assessment of Nurses' knowledge and Performance Regarding Prevention of Open Heart Surgery Site Infection" and showed that more than one third of their studied nurses had Nursing technical institute.

Consequently, regarding their experience, in current study more than half of nurses (52.7%) had 1-5 years of experience, highlighting the presence of a relatively young workforce in surgical care settings, also this could be due to their young age, this finding is contradicted with **Shaheen et al .,(2021)** who study Assessment of Nurses' Knowledge and Practices Regarding Prevention of Surgical Site found that more than half of their studied nurses had more than 20 years of experience and also with **Khalid et al., (2023)** who studied "Nurses' knowledge and practice regarding the prevention of surgical site infection "and reported that less than half of their studied nurses have 6-10 years of clinical experience.

Regarding knowledge of surgical site infections, it was revealed from the study that the majority of the staff nurses (66%) had good knowledge regarding preventing site infection. this result was in line with **Samah et al., 2021** in a study Assessment of Nurses' Knowledge and Practices Regarding Prevention of Surgical Site Infection, who reported that more than half of studied nurses (57.5%) had good knowledge. This study finding was contradictory with **Qasem et al., 2017** revealed that the total knowledge scores of Jordanian registered nurses working in acute care settings regarding evidence-based guidelines for the prevention of SSIs was low based on their median score.

Dissimilarly to current study, a study by **Amina et al., 2023** has shown that the level of total knowledge regarding SSI prevention was at the low level (marginal to moderate level) (M = 7.68 %, SD = 7.441 %).

On the other hand, in contrast with current study, **Gizaw, et al., (2022)** results found that more than half of nurses had poor knowledge of postoperative wound care and **Hassan, et al., (2023)** who found that more than half of their studied nurses had poor knowledge regarding surgical site infection prevention.

The current study findings are aligning with **Asfaw (2021)** that found that more than half of their studied nurses had good knowledge and **Sham, et al., (2021)** who studied "Nurses' knowledge and practice towards prevention of surgical site infection" and reported that the majority of their studied nurses had good knowledge of SSI prevention

A quasi-experimental study in Lahore by **Nazir et al., 2022** showed similar results (post educational interventional results) that most nurses have good knowledge and practices.

As regards the total nurses' practice, the present study showed that the majority of studied nurses (59.3) had competent levels of practice regarding surgical site infection prevention.

This finding is consistent with **Tadesse., (2023)** who stated that less than two third of their studied nurses had poor level of total practice. Also, this result was disagreed with **Hassan, et al., (2023)** who stated that more than three quarters of their studied nurses expressed an inadequate practice regarding surgical site infection

Contrarily, these findings disagree with **Mohsen, Riad & Badawy, (2020)** who study "compliance and barriers facing nurses with SSI prevention guidelines" and declared that three-quarters of them had a low level of practice.

These findings are paralleled to with **Khalid, et al., (2023)** that stated that the results showed that more than three quarters of Practice statements indicated good practice.

Unparallel to current study, Mengesha et al., (2020) who study "Practice of and associated factors regarding prevention of surgical site infection among nurses working in the surgical units of public hospitals in Addis Ababa city, Ethiopia" found that less than half (48.9%) of nurses had good practice in preventing SSI

This finding is the same line with **Tadesse., (2023)** who stated that less than two

thirds of their studied nurses had poor level of total practice. Also This result was in the line with **Hassan, et al .,(2023)** who stated that more than three quarters of their studied nurses expressed an inadequate practices regarding surgical site infection and this findings agree with **Mohsen, Riad & Badawy, (2020)** who study "compliance and barriers facing nurses with SSI prevention guidelines" and declared that three-quarters of them had a low level of practice.

This finding is contradicted **with Khalid, et al., (2023)** that stated that the results showed that more than three quarters of Practice statements indicated good practice.

Conversely, the current study disagreed with **Samah et al.,2021** study who examines the level of nurse's practice regarding the prevention of SSIs, and less than half (45.0%) of them were found to have good practice regarding the prevention of SSI.

Concern the relation between studied nurses' socio- demographic characteristics and their knowledge, our study result shows there was Statistically significant relationship between nurse's knowledge and age, working experience years at the (P-value = 0.001, 0.009) the association between year of experience and practice of surgical site infection prevention activities can be explained by the fact that practice makes perfect, their practice might be improved from year to year , this finding agrees with result of previous study done by **Ibrahim et al., (2025)** findings showed that there was highly significant statistical relation between studied nurses' knowledge and their years of experience. This finding is line with **Mohamed. (2022)** that note that there was a highly statistically significant relation between the studied nurses' total level of knowledge and their experience as nurses' knowledge increased with increasing years of experience.

As regards relation between nurses' practice with socio-demographic data, there were statistically significant differences that were noticed between nurse's age and their practice with (p = 0.001) and with their experience years with (p = 0.004),these findings are further supported by **Samah et al., 2021** who noticed that there was statistically significant difference was noticed between nurses age and their practice with (p = 0.001)

Current results are in contrast with **Ibrahim et al., (2025)** in his study who mentioned that there was highly significant statistical relation between studied nurses' practice and educational qualification. This finding is disagreed with **Ibraheem., (2023)** that demonstrates that there was no statistically significant relation between total scores of their studied nurses' practice level and demographic characteristic Also with **Getaneh et al., (2019),** who illustrated that there was significant relation between nurses' practice and their educational level and years of experience.

While there was no significant statistical relation between studied nurses' practice and their years of experience. This finding is contradicted with **Mohamed., (2022)** that indicated that there was a highly statistically significant relation between the studied nurses' total level of practices and their experience

About the correlation matrix between studied nurses' knowledge and their practice regarding surgical site infection prevention, there were highly significant between studied nurses' knowledge and their practice with p-value (<0.001). This finding is in the same line with **Ibrahim et al., (2025)** who stated that there were highly significant between studied nurses' knowledge and their practice regarding surgical site infection bundle of care.

The current results are paralleled to **Mengesha et al., (2020)** who demonstrated that insufficient knowledge, inadequate resources to implement surgical safety checklists, insufficient performance, monitoring systems, lack of surgical site infection assessment and preventive measure feedback systems and insufficient orientation programs during unit rotation were identified as factors affecting the nurse's practice regarding prevention of SSIs.

Also, these findings are further supported by **(Abdelgilil et al., 2020)** who found that there was a positive correlation between knowledge scores and practice scores and **Sadaf., (2018)** who studied Nurse's

knowledge and practice regarding prevention of surgical site infection and found that there was a strong significant positive correlation between knowledge and practice.

Concerning nurses' adherence to WHO guidelines regarding prevention of surgical site infection the result shows that perioperative nurses had a good level of adherence to WHO's guidelines, such as performing preoperative shaving right before surgery, washing hands before wearing the surgical gloves, counting of surgical swabs, sutures, instruments and needles after surgery and Sterile dressing of incision site post operative this finding of present study are consistent with a study conducted by **Nezianya et al.,2025** who clarify that perioperative nurses in her study had a good level of adherence to WHO's preoperative guidelines, such as washing hands before wearing the surgical gloves, strict adherence to asepsis, surgical consciousness, and counting of surgical swabs, sutures, instruments and needles after surgery. This is in agreement with the study carried out by **Famakinwa et al. (2014)** on reported precautionary measures adopted by the majority of the nurses (70%) in Obafemi Awolowo University Teaching Hospital, Ile-Ife which supported strict adherence to asepsis and sterile dressing of incision sites, as well as the findings of **Boyce and Pitt (2012)** which reveal that health workers place higher value on adherence to asepsis by washing hands more with antiseptic for surgical patients.

According to **Harris et al. (2018),** maintaining strict adherence to procedure and a clear delivery of consistent and optimal health outcome

Conclusion

Based on the findings of the present study and research questions, the study concluded that:

Most of nurses age ranged (20–30) years, with working experience in surgical units ranging between 1-5 years

Conclusively, nurses displayed a good level of knowledge with competent practice level, and adherence for surgical site infections prevention. Meanwhile, there were highly significant relations between studied nurses' knowledge and their practice regarding surgical site infection prevention. And there was significant relation between the nurse's knowledge, practice and their socio-demographic characteristics such as age and experience. Moreover, the nurses' knowledge and practice were associated with years of work experience.

In conclusion, enhancing nurses' knowledge, practice and adherence to SSI

prevention measures is paramount in reducing infection rates and improving patient safety

Recommendations

Based on the study findings, the subsequent recommendations were emphasized to improve the quality of care and patient safety from suffering surgical site infections.

- The necessity of in-service continuous education and structured training programs to enhance nurses' awareness and adherence to SSI prevention measures.
- Activate the role of hospital leadership in reinforcing infection prevention policies, providing adequate resources, and implementing regular monitoring systems are essential in ensuring sustainable improvements in SSI prevention.
- Creating a concise and thorough handbook including instructions for nursing about surgical site infections such as definition, risk factor and nursing role towards prevention, and should be available at all surgical units.
- Develop a system for continuous, strict follow up for nurses during work, with periodical evaluation of their attitudes and their adherence to evidence –based preventive measures for SS.

- To ensure generalizability, the study should be reproduced with a larger sample size and in diverse hospital settings.
- Future programs should focus on: Hands-on, simulation-based training to enhance practical skills, patient education programs to improve compliance with post-surgical care.
- Increased hospital support; resources, facilities, time allocation for SSI prevention to overcome problems affecting adherence to surgical site infection guidelines.

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