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Nurses' knowledge and practice Regarding Bundle of care for prevention of Surgical site infection

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ABSTRACT

Background: Surgical site infections (SSIs)also called surgical wound infections which develop within 30 to 90 days after surgery or as a result of surgical intervention .A care bundle is a combination of successful interventions that when implemented completely and consistently can lead to best results to in compering to the implementation of individual measures .**Aim:** This study aimed to investigate the nursing knowledge and practices regarding bundle of care for prevention of surgical site infection. **Research design:** A descriptive research design was utilized for conducting the study. **Setting:** The current study was conducted at the General Surgical Unit at Beni-Suef University Hospital. **Subjects:** .A Convenience sample (40) of all available staff nurses (males & females) involved in current study, who are working in the previously mentioned settings. **Tools for Data Collection:** Two tools were used: tool (1) Nurses self –administered questionnaire, and tool (2) Nurses' observation checklist. **Result:** the study revealed that more than half of the studied nurses (55%) were aged between 20 and 25 years with mean age (25.45±1.67),. more than half of studied nurses (52.5%) had technical nursing institute,. less than two third (65%)of them have unsatisfactory level of knowledge regarding bundle of care for prevention of surgical site infection and the majority **(90%**) of studied nurses have incompetent level of practice regarding surgical site infection bundle of care. **Conclusion:** Less than two third of the studied nurses had unsatisfactory total level of knowledge regarding bundle of care for prevention of surgical site infection and the majority of the studied nurses had incompetent level of total Practice**. Recommendations** Developing a simplified and comprehensive booklet including basic information about surgical site infection .

Keywords: Bundle of care, knowledge, Nurses', practice, Surgical Site infection

INTRODUCTION

Healthcare-associated infections (HAIs) are a prevalent adverse event that compromises patient safety on a global word. Surgical site infections (SSIs), also called surgical wound infections, which develop within 30 to 90 days after surgery or as a result of surgical intervention. According to the World Health Organization (WHO), surgical site infections (HSIs) impact one-third of patients undergoing surgical operations and are the most frequently reported and researched kind of HAI in low- and middle-income countries. Among HAIs, SSIs are the second most commonly reported complication globally. SSIs continue to be a major worldwide issue, affecting patient morbidity and mortality, healthcare systems, and additional expenses, even though they are preventable like HAIs **Borchardt., (2018).**

A surgical site infection (SSI) is a form of wound infection that is believed to be caused by either the surgery or the post-operative care provided to the surgical site. HAI has major side effects, including significant cost increases as well as increased rates of morbidity and mortality. A surgical site infection is one that develops in the area of the body where the surgery was performed. Infections at the surgical site might sometimes just harm the skin's surface. Organs, implanted materials, or subcutaneous tissues may experience damage from more severe infections at the surgery site **(Gizaw et al., 2022).**

Surgical site infection is the most serious and undesired outcome of surgery, and it is widely regarded as the most common complication. Although SSIs are among the most preventable HAIs, they have been identified as critical issue that is affecting the quality of health care and has a significant impact on patient security. SSI prevention is complex because the risk results from several factors arising from the surgical patient journey, including sometimes after discharge, but like any other HAI, SSI is largely avoidable and up to one-half can generally be prevented through the successful implementation of clinical practice guidelines using a multimodal improvement strategy **(Allegranzi et al., 2018).**

Numerous strategies, including surgical cleaning, nutritional assistance, preoperative bathing, mechanical bowel preparation, oral antibiotic use, hair removal, and surgical site skin preparation, might prevent or lessen surgical site infections. Nurses can play a major and comprehensive role in preventing surgical site infections (SSIs) by improving the quality of care they provide, such as by correcting improper use of prophylactic antibiotics, poor hand hygiene and skin reparation practices, and proper implementation of all other surgical safety care bundles. This is because nurses spend the most of their time with patients and handle the majority of SSI prevention measures **(Lavallée et al., 2019).**

A care bundle is a combination of successful interventions that when implemented completely and consistently can lead to best results in compering to the implementation of individual measures .The term of "care bundle" refers to a collection of implementations used to standardize hospital care and treatments .Another definition suggests that a care bundle is the co-administration of numerous evidence-based procedures (typically three to five) that positively enhance the patient's healing process and increase the quality of care . **Resar .,(2020**).

Nurses should be knowledgeable about high-quality nursing care, as well as the causes, effects, management, and evidence-based recommendations for SSI. Nurses should be aware of SSI classifications, risk factors and populations at risk, signs and symptoms of surgical site infection, antibiotic prophylaxis, preoperative skin preparations, postoperative surgical field care, infection control standards, and surgical site infection prevention strategies **Boga (2019**).

Significance of the study:

Surgical site infection (SSI) is a major clinical problem that affects hospitalized surgical patients. Every year, SSIs have a substantial impact on surgical morbidity and mortality. Surgical site infection (SSI) accounts for 15% of all nosocomial infections and is the most prevalent nosocomial infection among surgical patients, ranking second in terms of healthcare-associated illnesses. It is an infection that develops within 30 days of an operation, causing redness, fever, pain, and swelling.. It is also one of the most imperative complications of a surgical intervention. **Shaheen et al., (2021).**

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 readmission after surgery. Surgical site infections (SSI) are among the most prevalent surgical consequences, particularly in developing countries . 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).**

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 consider 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).**

SSIs complicate around 1.9% of surgical procedures in the United States, resulting in high health-care costs. In contrast, SSIs are the most common postoperative complication in African countries, accounting for 10% of surgeries and resulting in a 9.7% case fatality rate. It has been estimated that around 50% of SSIs are avoidable **(National Institute for Health & Clinical Excellence, 2019; Mengesha et al., 2020).**

The global incidence of SSIs ranges from 2.5 to 7% in low- and middle-income countries, with SSI affecting up to one-third of patients and a pooled incidence of 11.8 per 100 surgical procedures. SSI remains the most common kind of HAI in high-income countries , despite decreased incidence ranging from 1.2 to 5.2%.**Mengistu .,(2018).**

In Egypt The incidence rate of surgical site infection is around (3.3%-4.2%). the rate of surgical site infection vary 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*).**

AIM OF THE STUDY

This study aimed to investigate the nursing knowledge and practices regarding bundle of care for prevention of surgical site infection at Beni-Suef University hospital.

Research questions

1. Does the surgical nurse have correct knowledge regarding bundle of care for prevention of surgical site infection?

2. What is level of practice of surgical nurse regarding bundle of care for prevention of surgical site infection?

SUBJECTS AND METHODS

1- Technical design:

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

A-Research design:

A descriptive research design was utilized to conduct the study an descriptive research design was adopted to fulfill the aim of the study and answer the research questions. It helps the investigator to describe and document aspects of a situation as it naturally occurs. As well, this design helps to establish a database for future research.

B Research setting:

The current study was carried out at the General Surgical Unit (2unit; male general surgical unit (21 nurses) and female general surgical unit (19 nurses) at Beni-Suef University Hospital. Beni -Suef University Hospital is one of the specialized medical Buildings in Beni-Suef City, the hospital consists of seven-floor building that consists of 16 main department, and 11units providing multi services. The male general surgical unite was located in the fourth floor, Consist of four rooms contain 44 beds and female general surgical unite was located in the fourth floor, consist of three rooms contain 38 beds.

C- Subjects:

1-Sample type and size: Convenience sample of all available staff nurses (males & females) involved in the current study , who are working in the previously mentioned settings and give direct nursing care and directly contact with surgical patients regardless their age, sex, education and years of experience.

D- Tool of data collection:

To achieve the aim of the current study, two tools were used to collection of data;

1. Nurses self –administered questionnaire
2. Nurses' Observation checklist.

Tool I: Nurses Self -Administered Questionnaire; it was developed by the investigator in an Arabic language after reviewing the recent and relevant literature, this tool aimed to assess nurses' knowledge and it consists of **two part**.

Part 1: Socio -Demographic data tool

This tool consists of Socio-demographic data characteristics of studied nurses. It include nurse's age, sex, marital status, level of education, pervious training courses regarding infection control ,professional qualification and years of experience in surgical unite.

Part 2: Nurses' Knowledge Questionnaire: This tool was adapted from ***(Mohamed, S. 2022)*** and aimed to assess level of nurses' knowledge regarding bundle of care for prevention of surgical site infection, This part consist from three sections that consists of **62** questions in form of multiple choice questions **(MCQs)** Based upon the scoring system utilized .The knowledge level was categorized into three categories.

- **Section 1;** include knowledge about surgical site infection, it consist of **7** question
- **Section 2;** include knowledge about recommendations to reduce surgical site infection, it consist of **5** question
- **Section 3;** include knowledge about surgical site infection bundle of care that divided into **2** phases (preoperative phase consist of question **19**, post –operative phase consist of **31** question).

❖ **Scoring system:**

Answers were either yes or no with total score (62mark) the **correct answer** was scored **"1"**, while the **incorrect answer** was scored **zero.).** It was adapted from ***(Mohamed ,S.2022).***

The total knowledge score was further divided into**:**

- **satisfactory level** of knowledge when **≥85% (≥53 mark)**
- **unsatisfactory level** of knowledge when **<85% (<53 mark**)**Tool II: Nurses' Observation checklist**:

This tool adaptive from ***(Mohamed, S. 2022)***, this tool included a checklist that aim to physically assess nurses' practices of care bundle for prevention of surgical site infection among surgical patient. This tool consist of 2 part.

- **Part 1;** preoperative surgical site infection bundle of care observational checklist **(19 steps)**
- **Part 2;** postoperative surgical site infection bundle of care observational checklist**.(23 steps)**

Scoring system:

Each items was scored by **correctly done** = **1** or **not done**=**zero**. It was adapted from ***(Mohamed,S.2022).***

The total practice score level further divided into the following:

- **competent level** when **≥90%**
- **incompetent level** when **<90%.**

2. Operational design:

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

a- preparatory phase:

It includes reviewing of related literature and studies related to present study using national and international resources.

b. Content validity:

The revision of tools was established by a group of 5 experts in medical surgical nursing department specialties all of them were assistant professors of medical surgical nursing at Faculty of Nursing Beni-Seuf University who was reviewed the instruments for the clarity, relevance, comprehensive understanding, applicability and easiness for administration to measure the validity of tools.

✓ Some questions were removed, others adapted. A concesus approach with experts in medical surgical was used to confirm the validity of the modified questionnaire.

Reliability of the tools

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

d. Pilot study:

The pilot study was carried out on 4 of the nurses under study, it was done to ensure the clarity of questions, the applicability, clarity and efficiency of tools. Assessment of feasibility of field work, the time needed to complete them and to detect any possible obstacles that might face the investigator and interfere with data collection. Necessary Modifications were done according to result of the pilot study. The sample of the pilot study was 10% of total sample .The pilot study participants was excluded from the actual sample size.

e. Fieldwork:

- An approval was obtained from hospital directors and nursing directors at Beni-Suef University Hospital.
- The purpose of the study were simply explained to the nurses who were agree to participate in the study prior to any data collection.
- The investigator was collect data from the nurses at the general surgical unit (2unit; male general surgical unit and female

general surgical unit) at Beni-Suef University Hospital.

- Nurses' informal consent to participate in the study was obtained after the researcher explained to the nurses the objective of the study and confidentiality was preserved.

- The researcher was receive nurses at Beni-Suef University Hospital in general surgical unites two days per week at the beginning of morning shift . The researcher was attended the sessions that was scheduled in the morning 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.

- .Nurse's practices were assessed using observational checklist by the researcher at Beni-Suef University Hospital. .The self-administered questionnaire sheet weredistributed to the nurses in their workplace; each questionnaire was take 30 to 45 minutes to fill it.

- Maximum three nurses were observed in the day duringproviding the care for surgical patients in their work placethen they fill questionnaire sheet

- Maximum three nurses were observed in the day during providing the care for surgical patients in their work place then they fill questionnaire sheet.

- Data collection process start and complete within six month (from the beginning of June2023 to the end of November 2023)

3. **Administrative design:**

An approval was obtained from the Research and Ethics committee at Faculty of medicine Beni-Suef University. Official approval with written letter, clarifying the purpose and setting of the study was obtained from the director of faculty of nursing at Beni-Suef University .Another official litter containing the title and aim of the study was directed to the director of the Beni-Suef University Hospital for approval to conduct the study.

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- **Ethical consideration:**

Before the actual fieldwork, ethical approval for data collection from the nurses was obtained from the Scientific Research Ethical Committee of the Faculty of medicine, Beni-Suef Univer sity. Oral consent was obtained from each participant to participate in the study after the researcher clarify and discussion the aims, objectives and expected outcomes from the study. Anonymity and confidentiality of participants was assured and they were given the right to choose to participate or not in the study, and the right to withdraw from the study at any time without giving any explanation. They are secured that all the gathered information was confidential and used for the research purpose only.

Statistical design

The collected data were organized, categorized, tabulated and statistically analyzed using the statistical package for social science (SPSS) version (18) to assess nurses' level of knowledge and practice regarding surgical site infection bundle. Data were presented in tables and graphs. The statistical analysis included; percentage (%),the arithmetic mean ($\bar{X}$), standard deviation (SD) and chi-square (X2**&** P-value).

RESULTS

Table 1 summarized the distribution of studied nurses' socio-demographic characteristics. Regarding their ages, more than half of the studied nurses (55%) were aged between 20 and 25 years with mean age (25.45±1.67). Concerning their gender, less than two thirds of studied nurses (65%) were female. For their marital status, less than two third of studied nurses (62.5%) were married. Pertaining to their educational qualifications, more than half of studied nurses (52.5%) had technical nursing institute. Regarding their experience and training less than two third of studied nurses had less than two years of experience and less than three quarters of them had training course regarding surgical site infection (60%and70 %) respectively.

Table2 displayed the distribution of studied nurses' knowledge levels regarding bundle of care for prevention of surgical site infection .Related to Knowledge regarding SSIs, Postoperative phase of bundle of care and Preoperative phase of bundle of care the studied nurses had unsatisfactory knowledge level(70% , 80% and 55%) respectively. While for Recommendations to reduce SSIs more than have (55%) of the studied nurses had satisfactory knowledge level.

Figure 1 illustrated that, more than one third (35%) of the studied nurses have satisfactory level of knowledge regarding bundle of care for prevention of surgical site infection, while less than two third (65%)of them have unsatisfactory level of knowledge regarding bundle of care for prevention of surgical site infection.

Table 3 illustrated the distribution of studied nurse' practices regarding surgical site infection bundle of car*e*. Related to Preoperative Phase and Postoperative Phase .The majority of studied nurses had incompetent levels of practice (95%and90%) respectively

Figure 2 illustrated that the minority **(10%)** of the studied nurses have competent level of practice regarding surgical site infection bundle of care while the majority **(90%**) of studied nurses have incompetent level of practice regarding surgical site infection bundle of care

Table4 summarized the correlation matrix between studied nurses' knowledge and their practice regarding surgical site infection bundle of care. Using Pearson's correlation coefficients, there were highly significant between studied nurses' knowledge and their practice regarding surgical site infection bundle of care.

Table 5 revealed the Relation between studied nurses' socio-demographic characteristics and their knowledge regarding surgical site infection bundle of car. There were highly significant statistical relation between studied nurses' knowledge and their years of experience. While there were non-significant statistical relation between studied nurses' knowledge and their age, gender, marital status, educational qualification and their training course.

Table 6 Summarized the Relation between studied nurses' socio-demographic characteristics and their practice regarding surgical site infection bundle of care. There were highly significant statistical relation between studied nurses' practice and their educational qualification. While there were non-significant statistical relation between studied nurses' practice and their age, gender, marital status, Years of Experience and their training course.

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Table (1): Frequency studied nurses‘ distribution according to their socio-demographic characteristics (N=40**).**

Personal characteristics	**No.**	**%**
Age (years)		
– 20 < 25	22	55
– 25 < 30	18	45
Mean±SD	**25.45±1.67**	
Gender		
– Male	14	35
– Female	26	65
Marital status		
– Single	15	37.5
– Married	25	62.5
Nursing Qualifications		
– Nursing Technical Institute	21	52.5
– Bachelor of Nursing	14	35
– Post graduate	5	12.5
Experience (years)		
– < 2	24	60
– 2< 4	10	25
– 4 < 6	6	15
Mean±SD	**2.57±1.50**	
Training courses on Infection control and prevention		
– Yes	28	70
– No	12	30

Table (2): Frequency studied nurses‘ distribution according to their knowledge levels regarding bundle of care for prevention of surgical site infection (N=40)

Nurses' Knowledge Levels	**Unsatisfactory**		**Satisfactory**	
	No.	**%**	**No.**	**%**
Knowledge regarding SSIs	28	70	12	30
Recommendations to reduce SSIs	18	45	22	55
Preoperative phase of bundle of care	34	85	6	15
Postoperative phase of bundle of care	22	55	18	45
Nurses' Overall Knowledge Levels	**26**	**65**	**14**	**35**

Fig.(1): Frequency studied nurses' distribution according to their knowledge levels regarding bundle of care for prevention of surgical site infection (N=40)

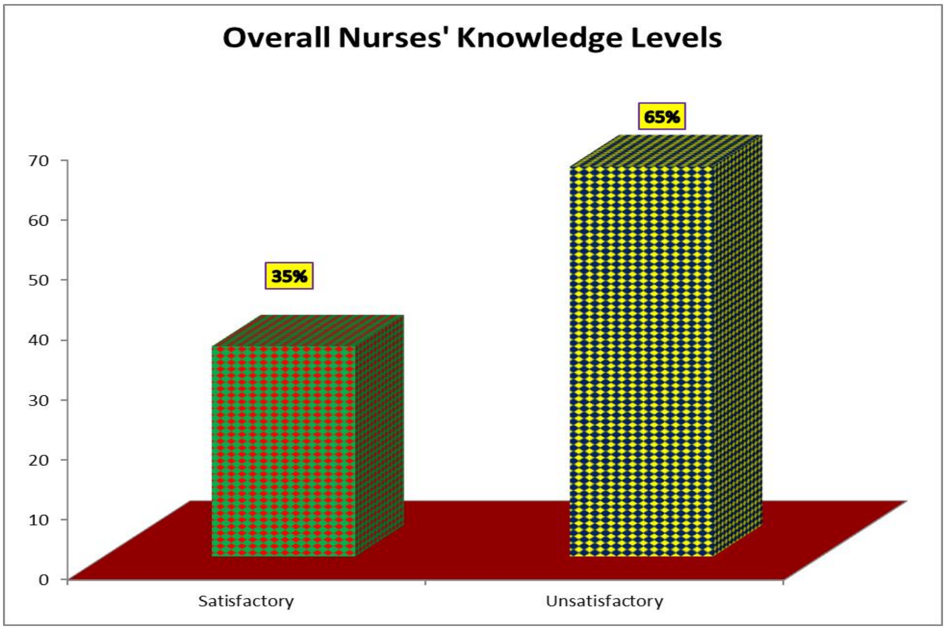

Table (3): Frequency studied nurse' distribution according to their practices regarding surgical site infection bundle of care (N=40)

Nurses' Practice Levels	Incompetent		Competent	
	No.	%	No.	%
Preoperative Phase	38	95	2	5
Postoperative Phase	36	90	4	10
Nurses' Overall Practice Levels	**36**	**90**	**4**	**10**

Figure (2) Frequency studied nurse' distribution according to their practices regarding surgical site infection bundle of care (N=40).

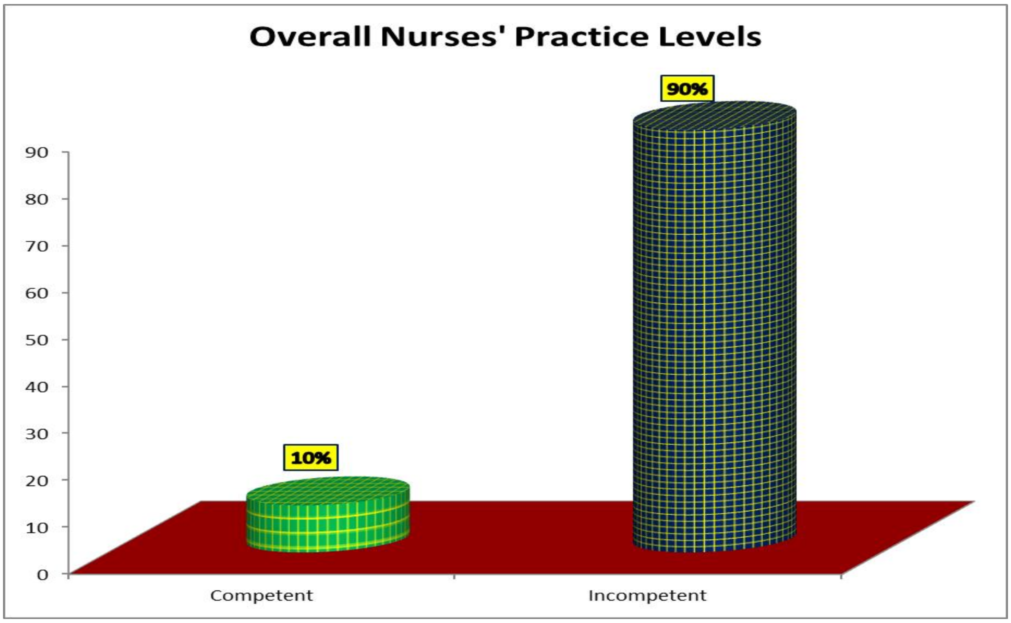

Table (4) Correlation Matrix Between Studied Nurses' Knowledge and their Practice Regarding Surgical Site Infection Bundle of Care (N=40

Variables		Total Practice	Preoperative Practice Bundle	Postoperative Practice Bundle
Total Knowledge	***r***	0.672	0.456	0.674
	P-Value	0.000**	0.003**	0.000**
Total Practice	***r***		0.876	0.715
	P-Value		0.000**	0.000**
Preoperative Practice Bundle	***r***			0.289
	P-Value			0.070
** Correlation is significant at the 0.01 level (2 tailed).				

Table (5): Relation between Studied Nurses' Socio-Demographic Characteristics and their Knowledge Regarding Surgical Site Infection Bundle of Care (N=40

Socio-demographic Characteristics	Knowledge Levels				χ^2	P-value
	Unsatisfactory		Satisfactory			
	No.	%	No.	%		
Age						
– 20 < 25	16	40	6	15	1.283	0.257
– 25 < 30	10	25	8	20		
Gender						
– Male	10	25	4	10	0.391	0.532
– Female	16	40	10	25		
Marital Status						
– Single	7	17.5	8	20	3.546	0.060
– Married	19	47.5	6	15		
Nursing Qualifications						
– Nursing Technical Institute	13	32.5	8	20	0.398	0.820
– Bachelor of Nursing	10	25	4	10		
– Post graduate	3	7.5	2	5		
Years of Experience						
– < 2	20	50	4	10	12.454	0.002**
– 2 < 4	2	5	8	20		
– 4 < 6	4	10	2	5		
Training						
– Yes	18	45	10	25	0.021	0.885

Table (6) Relation between studied nurses' socio-demographic characteristics and their practice regarding Surgical Site Infection Bundle of Care (N=40

Socio-demographic Characteristics	Practice Levels				χ^2	P-value
	Incompetent		Competent			
	No.	%	No.	%		
Age						
– 20 < 25	20	50	2	5	0.045	0.832
– 25 < 30	16	40	2	5		
Gender						
– Male	14	35	0	0	2.393	0.122
– Female	22	55	4	10		
Marital Status						
– Single	13	32.5	2	5	0.296	0.586
– Married	23	57.5	2	5		
Nursing Qualifications						
– Nursing Technical Institute	21	52.5	0	0	31.111	0.000**
– Bachelor of Nursing	14	35	0	0		
– Post graduate	1	2.5	4	10		
Years of Experience						
– < 2	22	55	2	5	4.815	0.090
– 2 < 4	10	25	0	0		
– 4 < 6	4	10	2	5		
Training						
– Yes	24	60	4	10	1.905	0.168

DISCUSSION

Surgical Site Infection (SIS) is the most prevalent healthcare-associated infection, having a substantial impact on patient safety and financial losses for health systems. Improving nurses' knowledge and practice is regarded as a crucial component in preventing the transmission of infection. The study's goal is to assess nurses' knowledge and practice regarding the care bundle for preventing surgical site infection. A care package is a set of beneficial actions that, when applied

Completely and consistently improve patient outcomes. The "bundle" idea, developed to improve critical care processes and patient outcomes, has been applied in a variety of medical and surgical settings, including surgical site infection prevention **Shaheen .,(2021)**.

Regarding the demographic characteristics of the nurses under the present study. The results of the present study revealed that about more than half of the studied nurses were aged between 20 and 25 years with mean age **(25.45±1.67).** This explains that most of those nurses were newly graduated young and tolerate the nature of the work. This finding 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 that more than two third of their studied nurses is in the age group (20-29) years. Also 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", and noted that more than one-third of the sample was in the age group of 20 - 30 years.

This findings is contradicted with **Sham, et al.,(2021)** that revealed that the minority of their studied nurses with age 20 -25 years old**.**

Also Related to gender, the present study results showed that less than two thirds of studied nurses were female which could 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 and also with **Hassan, et aL .,(2023)**who found that the less than two third 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.

Concerning For their marital status, less than two third of studied nurses were married, this finding is agreement with **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 were married beside that **Shaheen et al .,(2021)** who studied "Assessment of Nurses' Knowledge and Practices Regarding Prevention of Surgical Site Infection" and reported that the majority of studied nurses were married **.** also this findings 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.

Additionally regarding educational qualifications level the results of present study indicated that more than half of studied nurses had technical nursing institute from the researcher point of view, this could be interpreted that some nurses prefer technical nursing institute for early graduation and catching job also due to difficult of studying in nursing faculties that require high scores in secondary school and also require hard studying.

This finding is congruent with **El*sayed et al .,(2023)*** who studied " Assessment of Nurses' Knowledge Regarding Pre and Postoperative Care of Patients with Total Knee Arthroplasty" and revealed that more than half of their studied nurses had technical degree in addition to **Ibraheem .,(2023)** that found that more than half of their studied nurses had technical degree .

This finding is in congruent with **Hassan et aL .,(2023)** who found that almost one half of their studied nurses had diploma in nursing 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, the result of the current study revealed that less than two third of studied nurses had less than two years of experience, from the researcher point of view, this could be due to their young age. This finding is contradicted with **Shaheen et al .,(2021)** that found 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 having 6-10 years of clinical experience.

Also the present study was incongruent with the study of **Getaneh et al., (2019)** that examined the "Surgical Site Infection Prevention Practices and Associated Factors among Nurses Working in Government Hospitals of Harari Regional State, Eastern Ethiopia" who revealed that the mean (±SD) experience of their studied nurses was 8.91 (±7.59) years

Also regarding training course the results of the present study indicated that less than three quarters of studied nurses had training course regarding infection control and prevention in surgical unites. This finding is consistent with **Naji .,(2021)**who studied "Nurses' Knowledge Regarding Prevention of Surgical Site Infections"

And Showed that the majority of their studied nurses having participation in training session and **Aktas.,(2022)** who studied "determining operating room nurses' knowledge and use of evidence- based recommendation on preventing surgical site infections " and reported that the majority of their studied nurses receiving training course on prevention of surgical site infection . This finding is contradicted with **Shaheen et al .,(2021)** that noted that about less than one third with a mean score **3.0 ±2.45** of their studied nurses receive training regarding infection control**.**

regarding knowledge of surgical site infection, the current study showed that less than three quarters of the studied nurses had unsatisfactory knowledge level related surgical site infection .this result was contradicted with **Jaleta (2021)** a study from Sonia University in Lebanon, where the results showed that more than two third of their studied nurses had satisfactory knowledge of the SSI.

Also regarding Recommendations to reduce SSIs, the results of this study revealed to that more than half of the studied nurses had satisfactory knowledge level. this findings congruent with **Woldegioris et al., (2019)** who studied "Nurses' knowledge and practice regarding prevention of surgical site infection in Bahir Dar, Northwest Ethiopia" and revealed that nearly three quarters of nurses had satisfactory knowledge about SSI and recommendation for infection prevention.

This study in congruent with ***Mohamed (2022***) who studied "nursing performance regarding bundle of care for prevention of wound site infection" and found that nearly two fifth of nurses had unsatisfactory total knowledge regarding surgical site infection and recommendations to reduce surgical site infection.

Regarding total nurses' knowledge, the results of the current study indicated that less than two third of studied nurses had unsatisfactory knowledge level regarding surgical site infection bundle This results are consistent with **Tadesse .,(2023)**that found that more than half of their studied nurses have unsatisfactory level of total knowledge ,also agreement with **Gizaw, M.A, et al., (2022)** who found that more than half of their studied 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.

On the other hand this current study findings is contraindicated 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

Also this findings of the current study disagrees with **Gezie, (2021)** which declared that their studied nurses had good knowledge toward hospital acquired infection.

As regards to the total nurses' practice, the present study showed that the majority of studied nurses had incompetent levels of practice regarding surgical site infection bundle of car*e* This finding in the same line with **Tadesse .,(2023)**who stated that less than two third 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.

Regarding the correlation matrix between studied nurses' knowledge and their practice regarding surgical site infection bundle of care. Using Pearson's correlation coefficients, there were highly significant between studied nurses' knowledge and their practice regarding surgical site infection bundle of care. from the researcher point of view this could be related to that nurse who got unsatisfactory knowledge had unsatisfactory practice, this means that the level of nurses' performance depends on the nurses' knowledge. This may be explained that when nurses have adequate knowledge about bundle of SSI prevention, practice satisfactory and vice versa when there is a lack of knowledge the practice was incompetent also, may be explained that nurses' level of information showed a great impact on their knowledge and skills for patients care and that the effective professional education requires close and more appropriate connection between theory and practice.

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.

This findings is disagree with **Alaa Eldin .,(2023)** who studied "Nurses' Knowledge and practices regarding the Perioperative Care of Patients with Cholelithiasis "and concerning the correlation between the studied nurses' level of intervention and level of knowledge, their study revealed that there was no statistically significant relationship between the nurses' level of knowledge and their level of intervention .But it disagreed with **(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.

Concern the Relation between studied nurses' socio-demographic characteristics and their knowledge regarding surgical site infection bundle of car. There were highly significant statistical relation between studied nurses' knowledge and their years of experience. This findings is agree 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.

Conversely the study disagreed with **Mohsen et al., (2020)** that showed that there was no statistical difference among nurses who attended surgical site infection prevention guidelines.

Relation between studied nurses' socio-demographic characteristics and their practice regarding surgical site infection bundle of care. There were highly significant statistical relation between studied nurses' practice and educational qualification. This findings is disagree 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 were non-significant statistical relation between studied nurses' practice and their years of experience .This findings 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**.**

CONCLUSION

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

Less than two third of the studied nurses had unsatisfactory total level of knowledge regarding bundle of care for prevention of surgical site infection .concerning nurses' practice, the results of the current study revealed that the majority of the studied nurses had incompetent level of total Practice. Meanwhile, there were highly significant between studied nurses' knowledge and their practice regarding surgical site infection bundle of care. As well as there were highly significant statistical relation between studied nurses' knowledge and their demographic characteristic, their years of experience. Also there were highly significant statistical relation between studied nurses' practice and demographic characteristic , educational qualification.

RECOMMENDATIONS

In the light of the result of the present study, the following recommendations are suggested:

- Developing a simplified and comprehensive booklet including basic information about surgical site infection as; definition, risk factor and nursing role towards prevention, components of surgical site infection bundle and its importance and should be available at all surgical units.
- Unit protocols regarding hospital acquired infections especially SSI should be developed and reviewed regularly as updates and new evidence for best practice are constantly surgical nurses should be educated on updated protocols.
- To ensure generalizability, the study should be reproduced with a larger sample size and in diverse hospital settings.
- Future research should be conducted to examine surgical nurses' knowledge and practices before and after implementation of an educational program regarding SSI bundle in surgical patients.
- 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.

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