

Effect of the Training Program on Nurses' Performance Regarding Surgical Wounds Management

Naglaa Abd ElKareem Moghazy Basuony⁽¹⁾, Mona Abed El-Rahman Mohamed⁽²⁾,
Fatma Mohamed Abdelhamid Hassanin⁽³⁾, Safaa Hussein Mohamed⁽⁴⁾

(1) Assistant Prof. of Medical Surgical Nursing, Faculty of Nursing, Zagazig University, Egypt,

(2) Assistant Prof. of Medical Surgical Nursing, Faculty of Nursing, Port-Said University, Egypt,

(3, 4) Lecturer of Medical Surgical Nursing, Faculty of Nursing, Zagazig University, Egypt

Abstract

Background: Surgical wounds management is a necessary part of daily nurses' practices. Improper surgical wound management can result in massive complications uppermost of them surgical wound infection (SWI) which have serious implications for patients and health care systems. To effectively manage surgical wounds, nurses involved in patients' care must possess the necessary knowledge and skills to achieve the greatest positive health outcomes and avoid complications. **Study aim:** evaluate the effect of the training program on nurses' performance regarding surgical wounds management. **Design:** a quasi-experimental design. **Setting:** General surgery department and operating room at Zagazig University Hospitals, Al Sharkia Governorate, Egypt. **Subject:** A convenience sample of all available nurses (70), who work in the aforementioned locations. **Tools:** A self-administered questionnaire to assess nurses' socio-demographic characteristics and knowledge; observational checklists to assess nurses' practice regarding surgical wound care and SWI prophylactic measures. **Results:** there was a lack of studied nurses' knowledge and practice regarding surgical wounds management pre-training program intervention, as 11.4%, 12.9%, and 43.3% of nurses had unsatisfactory knowledge regarding surgical wounds management, incompetent practice of wound care and prophylactic measures of SWI respectively, which improved to reach 74.3, 70.0%, 88.6% respectively post program intervention with a percent of improvement equal 42.05%, 43.4%, 16.89% respectively. **Conclusions:** The training program based on the identified needs of the nurses plays an effective role in improving their performance (knowledge and practice) regarding surgical wounds management. **Recommendations:** the developed training program should be implemented on a wide scale in study settings as well as all similar ones including all governmental hospitals.

Key words: Surgical Wounds Management, Training Program, Nurses' Performance.

Introduction:

Surgical procedures are one of the most common hospital procedures and have grown to be a significant component of global healthcare systems, making them one of the most likely to result in postoperative morbidities (Weiser et al., 2015). According to Smith et al., (2016), it entails a surgical wound, in which an incision is made through the skin or mucous membrane with a specific and necessary goal of stopping or fixing damage from developing in the tissue (Sarpel, 2021). There are always serious consequences at the surgical site as a result of improper care of these surgical wounds and non-aseptic dressing techniques (Sharma et al., 2017).

The most significant complication of surgical wounds is surgical wound infection (SWI), often referred to as surgical site infection (SSI) (Ding et al., 2017). Due to poor postoperative wound care, the SWI can develop at any time but typically does so between the fifth and tenth days after surgery or within 30 days of the procedure (Hegarty et al., 2019). According to Rahman et al., (2019) and Patil et al., (2018), it can occur in up to 30% of surgical procedures and accounts for up to 14% of hospital-related infections. The World Health Organization (WHO) claims that, despite being preventable, SWI endangers the lives of millions of patients each year and contributes to the spread of antibiotic resistance (WHO, 2018).

In its guidelines, the WHO established a variety of prophylactic measures for SWI. By putting these prophylactic measures into practice, nurses can avoid SWI and thus improve their patients' health. According to the WHO, pre-operative hair removal should be discouraged, pre-operative showering should be encouraged, hand washing should be encouraged, timely and appropriate antibiotic administration should be provided, pre-and post-operative glycemic control should be maintained, proper wound care or management should be preserved, and surgical site preparation should be encouraged, as these measures are all part of the treatment for SWI (Allegranzi et al., 2016).

One of the primary preventive interventions for surgical site complications, and foremost among them SWI, is believed to be proper wound management (Price et al., 2015). As well, the surgical wound care strategy must be reviewed, updated, and strictly followed in order to avoid and lessen the impact of SWI (WHO, 2009). Additionally, good dressing protects the wound from harm, avoids infection, lessens discomfort, and speeds recovery. Effective surgical wound management also promotes wound healing, results in quicker discharge, and saves investments (Najm & Hussein, 2018).

Changing dressings and teaching patients are just two of the many duties involved in wound management, an essential clinical nursing duty (Kielo et al., 2019). Excellent knowledge and skills are necessary to avoid serious complications such as infection, gangrene, amputation, and in some cases, death (Chen, 2013; Sabour et al., 2017). In order to improve patient outcomes and lower healthcare expenditure (Heerschap et al., 2019), it is important to examine current wound management practices, compare them, and, ideally, lean more toward evidence-based practices. This is true even for the avoidance of postoperative complications (Ubbink et al., 2015).

Because they can identify complications and poorly healing wounds in a timely manner, nurses have a critical role in wound management (Tuinman et al., 2021). Additionally, nurses contribute significantly to

the prevention of SWI by recognizing and following its prophylactic measures (Martins et al., 2020). By following the recommended precautions when taking care of surgical patients, nurses can, according to estimates, prevent 25% of infections. Through the use of information and suggested practices, nurses can therefore aid in the prevention of SWI, reduce patients' financial burden and hospital expenses, and improve patients' quality of life (QoL) (Famakinwa et al., 2014).

In addition, a number of elements, such as the nurses' familiarity with and application of wound care techniques, are necessary for effective nursing management of surgical wounds (Vuolo, 2006). Therefore, evaluating nurses' knowledge and practice regarding wound care is essential to reducing surgical complications (Magalhães et al., 2012); particularly, various studies reported a significant decline in the rates of SWI associated with increased awareness among healthcare workers (Eskander et al., 2013).

It has also been shown that the knowledge, attitude, and practice of nurses in providing patients with evidence-based nursing care have a substantial impact on the quality of nursing care. A recent qualitative study discovered that nurses' knowledge and abilities in using aseptic technique principles in practice were impediments to their adherence to SWI prophylactic measures (Lin et al., 2019).

Because their performance in wound management is impacted by their lack of nursing experience and information, nurses must increase their level of knowledge and skills to provide optimal wound management. Therefore, it is necessary to regularly train all nurses in surgical wound management in order to enhance, update, and renew their skills in light of the most recent evidence-based practices in surgical departments (Sabour et al., 2017).

Significance of the study:

Surgical wounds are the most frequent wounds treated in healthcare facilities since there are an estimated 4511 procedures globally per 100,000 people each year, or one operation every 22 people. Serious complications like SWI and wound dehiscence

are often connected to surgical wounds (Gillespie et al., 2020). SWI is a threat to millions of patients each year; the cost of treating patients with SWI is three times higher than the cost of treating patients who do not develop an infection because patients with infection stay in hospitals for nearly seven days longer than other patients (WHO, 2018). Therefore, it poses a significant burden on everyone involved in healthcare including patients, caregivers, and the system as a whole (Russo et al., 2019).

In order to avoid potential complications at the surgical site, it is essential to manage surgical wounds as best as possible. So, nurses, who are crucial in the management of surgical wounds, should understand the principles of post-operative wound care and proactive wound complications prevention, above all else SWI (Kaihan Yao et al., 2013). As a result, in order to provide the best possible wound care and prevent complications, the knowledge, and skills of the nurses who play a key role in wound management must be kept current and based on evidence-based practices (Martinengo et al., 2020).

Aim of the study:

The current study aimed to evaluate the effect of the training program on nurses' performance regarding surgical wounds management through :

- Assess nurses' knowledge and practice regarding surgical wound care .
- Assess nurses' knowledge and practice regarding prophylactic measures of SWI .
- Design and implement training program based on previously explored actual needs of nurses regarding surgical wound care and application of prophylactic measures of SWI .
- Evaluate the effect of the training program on nurses' knowledge, and practice regarding surgical wound care and prophylactic measures of SWI.

Research hypotheses:

The following research hypotheses were created to reach the study's objective:

- **H1:** After the training program is put into place, it is anticipated that the nurses' knowledge and practice regarding surgical wounds management (surgical wound care and prophylactic measures of SWI) will improve.
- **H2:** After the training program is put into place, there will be a statistically significant relationship between the knowledge, practice competency, and sociodemographic features of nurses.

Subjects and methods:

Research design:

To accomplish the aim of the study, a quasi-experimental design (with one group and pre- and post-intervention testing) was used.

Setting:

The general surgery department and operating room at Zagazig University Hospitals in Egypt's Al Sharkia governorate were the locations for this study.

Subjects:

All available nurses (70), who work in the aforementioned locations, engage in direct clinical patient care and consent to participate in the study, form a convenience sample for the analysis.

Tools of data collection:

There were three tools for data gathering:

I: A self-administered questionnaire is the first tool. It is divided into two parts:

1. Sociodemographic features of nurses: ten items that included data on the nurses' age, sex, marital status, residence region, academic background, income, years of experience in the nursing field and surgical department, attendance of training courses about surgical wound management, and availability of surgical wound management guide in their department.

2. Nurses' knowledge assessment questionnaire: This part was focused on evaluating nurses' knowledge regarding

surgical wound management. It consists of two sections:

- **The first section** covered the nurses' surgical wound care knowledge assessment. It was adapted from **Ferreira et al., (2014) & D'SOUZA (2006)** and modified by researchers after an extensive review of pertinent literature (**Aldousari et al., 2022a; Harris et al., 2021; Dung et al., 2020**); which contained "40" multiple-choice questions (MCQ) covered four areas of knowledge as wounds types or classification (8Q), wound assessment (8Q), wound healing (10 Q), and principles of wound care and dressing (14 Q).
- **The second section** focused on evaluating the SWI prophylactic measures knowledge of nurses. It was adapted by the researchers from **Mengesha, (2018) and Sickder et al., (2014)** and modified based on WHO (2019) guidelines and a thorough review of relevant literature (**Jaleta et al., 2021; Martins et al., 2020; Lin et al., 2019**) about prevention of SWI. It included 30 MCQ covering the meaning, signs & symptoms, risk factors, and diagnostic studies of SWI as well as pre-and post-operative prophylactic measures of SWI such as appropriate surgical site hair removal, surgical site disinfection, and preparation, patients' preoperative showering, administration of prophylactic antibiotic, preoperative maintenance of patient's nutritional status, preoperative management of patients' chronic diseases, appropriate hand hygiene, postoperative wound care, postoperative wound assessment, and the antiseptic solutions used for wound dressing and dressing cart disinfection.
- **Knowledge scoring system:** Each knowledge item consisted of a multiple-choice question with four possible answers. Each correct answer received a score value of "1" whereas the untrue response received a score value of "0". To get the area's mean score, the item scores were added up, the sum divided by the number of items, and the results were then converted to % scores. According to data entry and statistical analysis, the nurse's knowledge was rated as satisfactory if the percent score was over 80% and

unsatisfactory if it was below 80%, giving the test a total knowledge score of 70.

II: Nurses' practices observation checklist:

Two observational checklists were used to assess the competency of nurse's practice regarding surgical wound management as follows:

- **The first observational checklist** was used to evaluate the nurses' practices of surgical wound care in accordance with recommendations of WHO (2016), and the Canadian Association of Wound Care (CAWC) (2018), it was adapted from **Mwakanyamale, (2013)** and modified by researchers after reviewing the appropriate scientific literature (**Yuan et al., 2022; Morgan-Jones et al., 2020; Timmins et al., 2018**). It consisted of "71" steps categorized into three phases: The assessment phase "7 steps", the Performing phase "58 steps" which included (equipment preparation, patient preparation, care implementation, care of patient, and articles after the procedure), and the Evaluation phase "6 steps" which included (documentation and communication with the patient while performing the procedure).
- **The second observational checklist** was developed by the researchers based on clinical practice guidelines (CPG) and standards specific to the prevention of wound infection that has been published and updated by WHO, (2019), and after reviewing the pertinent scientific research (**Ayamba et al., 2022; Mengesha et al., 2019**), it was originally adapted from **Getaneh et al., (2019) & Sickder et al., (2017)** to evaluate the practice of the SWI prophylactic measures by nurses. It had "30" steps that included hand washing, preoperative preparation of patient such as appropriate patients' showering, surgical site hair removal, surgical site disinfection, and preparation, appropriate administration of prophylactic antibiotic, glycemic management or control, nutritional status assessment and support, dressing cart disinfection and preparation, and postoperative surgical incision care.

- **Practice scoring system:** each practice item that was seen to be correctly completed was given a "1" while those that were not were given a "0". The item scores for each practice area were added up, the total was divided by the number of items, and the result was the area's mean score. These ratings were transformed into % ratings. Based on data entry and statistical analysis, a practice was deemed competent if its percent score was above or equal to 80% and incompetent if it was below 80%. Due to the critical situation, the nurse is in, which demands a very high degree of knowledge and practice, a high cutoff limit was established.

III: Nursing training program:

The researchers created it in accordance with previously determined needs of nurses discovered during the assessment process. It was created to modernize and enhance nurses' understanding of surgical wound management (surgical wound care and application of SWI prophylactic measures) and practice competency. It is formatted as a booklet in straightforward Arabic and is based on expert perspectives and a review of pertinent literature (nursing textbooks, periodicals, and online resources) about managing surgical wounds. The effectiveness of the training program was assessed by comparing the knowledge and practice of nurses before and after it was delivered.

Tools validity and reliability:

The content validity of the data collection instruments was evaluated after they were presented to a panel of five experts from various nursing and medical professions. Two medical-surgical nursing professors, one general surgery professor, and two infection control unit specialists from Zagazig University Hospital were on the panel. These experts evaluated the instruments' applicability, thoroughness, clarity, and administration ease. Small adjustments were made in accordance with the expert's opinion. Using Cronbach's Alpha test, the internal consistency reliability of each tool's items was evaluated. For tool I, which measured nurses' knowledge, it was 0.91; for tool II, which measured nurses' practice in terms of surgical

wound care and prophylactic measures of SWI, it was 0.87 and 0.85 respectively.

Ethical consideration:

Before beginning the study, official approval was sought from the directors of the previously stated settings as well as the dean of the nursing faculty. To guarantee the greatest level of cooperation and to make preparations for the participants' presence, an oral agreement was sought from participating nurses prior to data collection after they had been informed of the nature, purpose, and methodology of the study. Additionally, the participants were made aware of their ability to opt out of the study at any moment. All nurses were given the assurance that their data would only be utilized for research throughout the study process, which was conducted under strict confidentiality guidelines.

Pilot study:

To test the tools' clarity, relevance, comprehensiveness, understanding, applicability, and simplicity of execution, and to estimate the amount of time required to complete these forms, a pilot study was conducted on 10% (7 nurses) of the overall study sample. Nurses who participated in the pilot trial were included in the actual study population because the tool was not changed.

Field work:

Three stages were used to carry out the study as the following:

(1) The preparatory stage:

- The data for the present study were gathered between the first of February 2023 and July 2023. The training program's execution required six months to complete: one month for the preparatory stage, one month for the theoretical component, three months for the practical component, and one month for the collection of post-program data. The directors of the study locations and Zagazig University Hospital granted the researchers all necessary licenses during the planning phase.
- To preserve their cooperation throughout data collection and to organize the study's schedule so that it does not interfere with

nurses' work, the researchers visited the study settings, talked with the directors, and described the purpose of the study as well as the data collection process to them. The nurses were then invited to participate in the study after being informed of their rights by the researchers, who had previously discussed the study's purpose and the method of data collecting with each individual nurse.

- The self-administered questionnaire to determine the nurses' actual knowledge needs for surgical wound management was given to the nurses who provided their assent, and they were given instructions on how to complete it. The researchers were available at all times to address any questions or ambiguities. The completed forms were then gathered and checked for accuracy. Each nurse spent 10 to 15 minutes on this. The nurses' practices for managing surgical wounds (surgical wound care and application of SWI prophylactic measures) were evaluated using two observational checklists, and each nurse was watched as they went about their daily patient care routines.

(2) The implementation stage:

- After the evaluation stage was over, the identified needs were converted into objectives, and the researchers then built the training program in accordance with the study objectives as well as educational background, and previously assessed nurses' needs. Its goal was to enhance and modernize nurses' knowledge and practice regarding surgical wound management.
 - The training program was created as a booklet in an easy-to-understand Arabic dialect in accordance with the most recent and updated guidelines for surgical wound care and prophylactic measures of SWI published by the World Health Organization (WHO, 2019), National Institute for Health & Clinical Excellence (NICE, 2019); Centers for Disease Control and Prevention (CDC, 2016); and Australian Wound Association, (2016) as well as based on experts' recommendations and evaluations and reviews of pertinent literature (nursing books, publications, and online resources), after which every study participant gained a copy of the booklet.
- The researcher coordinated the teaching sessions for the program's theoretical and practical components with nurses. Since it was difficult to assemble all the nurses at once, they were separated into 10 smaller groups, each of which consisted of seven nurses. The researchers were accessible in the morning and afternoon shifts three days a week. Researchers executed the training program throughout "18" educational sessions (six for the theoretical portion and twelve for the practical portion), as follows:
 - **The theoretical portion** was implemented over the course of six sessions, which coated three sections, *the first section* covered the Surgical wounds and Nursing measures before and after surgical operations (introduction about surgical operations, Surgical wounds definition and its classifications, stages of surgical wound healing, factors affecting wound healing, factors that reduce inflammation and wound contamination, general procedures and nursing measures before and after surgeries); *The second section* covered Postoperative complications and Surgical wound infection (SWI definition, methods of transmission, causes and sources of SWI, danger factors, manifestations, types, diagnosis, and its treatment). *The third section* covered the SWI prophylactic measures (Pre-, Intra-, and Post-operative SWI prophylactic measures); each session had taken from 35-45 minutes.
 - **The practical portion** enclosed the postoperative surgical wounds care procedure, dressing car preparation, and SWI prophylactic measures such as hand washing procedure, preoperative patients' showering technique, surgical site hair removal technique, personal protective gear putting on and removing technique, incision site disinfection and preparation procedure, medical & surgical equipment cleaning, disinfection, and sterilization procedures, and waste disposal technique; additionally, as part of SWI prophylactic measures, glycemic management or control such blood glucose monitoring and insulin injection techniques were explained. Each practical

session lasts even 60 minutes, and it often begins with a recap of the lessons covered in the previous sessions as well as the goals of the upcoming one. During the implementation of the training program, encouragement was used by praising and/or recognizing the interested nurses.

- A presentation, group discussion, role-playing, demonstration, and re-demonstration of the different beforehand practical skills were used to carry out the training program. Multiple teaching aids, such as a booklet, posters, colored handouts, audiovisual materials, and actual surgical wound care equipment, were also cited.

(3) The evaluation stage:

- A post-test was conducted using the same pretest tools or forms to assess the effect of the training program on nurses' performance regarding surgical wounds management. Finding differences or not between the pre-intervention stage (assessment stage) and the post-intervention stage of the training program was used to determine the success or the effectiveness of a training program.

Statistical analysis of the data:

SPSS 20.0 software Windows (SPSS Inc., Chicago, IL, USA 2011.) was used to gather, tabulate, and statistically analyze all of the data. The mean, standard deviation, and range were used to describe quantitative data, and absolute frequencies (number) and relative frequencies (%) were used to convey qualitative data. When applicable, the Fisher's exact test or the Chi-square test was used to compare the percentage of categorical variables. To compare two dependent groups of categorical data, the McNemar test was utilized. The (+) sign denotes a direct connection and the (-) sign denotes an inverse connection in the Spearman correlation coefficient that was calculated to evaluate the relationship between the various study variables, as values close to "1" denote strong association, whereas values close to "0" denote weak association. All tests had a two-sided design, and a p-value of less or equal to 0.05 was regarded as statistically significant (S), a p-value less than 0.001 was highly statistically

significant (HS), and a p-value above 0.05 was statistically non-significant (NS).

Results:

Table 1 reveals that 68.6% of participant nurses were under or equal to thirty years of age, 77.1% were females, and a majority of them (84.3%, 80%, 84.3%) were married, residing in urban regions, and had more than five years of experience at the department where they worked, respectively. Nursing technical institute and diploma degrees were held by 51.4% and 42.9% of nurses, respectively, while nursing bachelor's degrees were held by just 5.7% of nurses. Additionally, 60% of nurses hadn't attended surgical wound management training courses, although the fact that 77.1% of them reported the availability of surgical wound management guide in their department.

Table 2 clarifies that pre-implementation of the training program, 85.7% and 90% of the examined nurses had unsatisfactory total knowledge regarding surgical wound care and prophylactic measures of SWI, respectively, while 77.1% and 74.3% of them had satisfactory knowledge post- implementation of program; With a mean difference of 10.8 and 5.55 and percentage improvement equal to 44.6% and 38% of nurses' knowledge about surgical wound care and prophylactic measures of SWI, respectively, there was generally a highly statistically significant difference and improvement in nurses' total knowledge post-program implementation as opposed to pre-program implementation ($p < 0.001$).

Concerning overall nurses' knowledge regarding surgical wounds management, **figure 1** shows that only 11.4 of nurses had satisfactory overall knowledge pre-implementation of the program, while this percentage had improved to 74.3% post-program; Generally, there was a highly statistically significant improvement and difference in overall nurses' knowledge post-implementation of program as contrasted with pre- implementation of program ($p < 0.001$), with a mean difference of 16.36 and a percentage of improvement equal to 42.05%.

Figure 2 demonstrates that only 12.9% of the studied nurses had a competent practice of surgical wound care in the pre-implementation phase of the program, while more than two-thirds (70.0%) of them become had competent practice in the post-program implementation phase. There was a highly statistically significant improvement and difference in overall nurses' practices regarding surgical wound care post-implementation of a program than pre-program ($p < 0.001$), with a mean difference of 18.4 and a percentage of improvement in nurses' practice of 43.4%.

Figure 3 illustrates that whilst in the pre-program implementation phase only 43.3% of the nurses under study had a competent practice for prophylactic measures of SWI, this percentage had increased to 88.6% in the program's post-implementation phase. With a mean difference of 9.57 and an improvement percentage of 16.89%, overall nurses' practices regarding prophylactic measures of SWI post-program implementation as compared to pre-program implementation were statistically significantly improved and different ($p < 0.001$).

Table 3 demonstrates a statistically significant relationship between nurses' age ($p = 0.006$), sex ($p = 0.003$), marital status ($p = 0.017$), place of residence ($p = 0.0001$), number of years of nursing experience ($p = 0.001$), and availability of surgical wounds management guide in their department ($p = 0.003$) and overall nurses' knowledge level regarding surgical wounds management post-program implementation. It is clear that urban-dwelling female nurses with experience longer than five years, age greater than 30, and who reported the availability of surgical wounds management guide in their department had a satisfactory post-program knowledge level than other nurses.

According to **Table 4**, there was a statistically significant relationship between the overall level of practice for surgical wound care among nurses and their sex ($p = 0.004$), marital status ($p = 0.013$), place of residence ($p = 0.003$), number of years of nursing experience ($p = 0.019$), and the availability of a surgical wounds management guide in their department ($p = 0.004$) post the program's implementation. It appears that nurses with certain characteristics—female, married, residing in an urban region, >5 years of nursing experience, reporting the availability of a surgical wounds management guide in their department—had a satisfactory post-program knowledge level than other nurses.

Table 5 demonstrates that there was a statistically significant relationship between nurses' sex ($p = 0.001$), region of residence ($p = 0.006$), and the availability of a surgical wounds management guide in the department ($p = 0.001$) and overall nurses' practices level regarding SWI prophylactic measures at the post-implementation phase of the program. It is clear that urban-dwelling female nurses who reported the availability of surgical wound management guide in their department had a higher level of practice competency than other nurses.

Table 6 exhibits that there was a statistically significant positive correlation of overall nurses' knowledge score regarding surgical wounds management with their practice score of wound care ($p < 0.001$) in the pre-and post-program implementation phase as well as with their application of prophylactic measures of SWI ($p = 0.021$) at the post-program implementation phase. Furthermore, there was a statistically significant positive correlation between overall nurses' practice scores regarding surgical wound management and application for prophylactic measures of SWI post-program implementation ($p = 0.029$).

Table (1): Frequency and percentage distribution of Sociodemographic features of participant nurses (n=70):

Sociodemographic features	No.	%
Age per years:		
- ≤30 years	48	68.6
- > 30 years	22	31.4
Sex:		
- Male	16	22.9
- Female	54	77.1
Marital status:		
- Married	59	84.3
- Unmarried	11	15.7
Residential region:		
- Rural	14	20.0
- Urban	56	80.0
Academic background:		
- Diploma	30	42.9
- Technical institute	36	51.4
- Bachelors	4	5.7
Income:		
- Sufficient	42	60.0
- Insufficient	28	40.0
Years of experience in nursing field:		
- ≤5	35	50.0
- >5	35	50.0
Years of experience at the department:		
- ≤5	11	15.7
- >5	59	84.3
Attendance of training courses about surgical wound management:		
- Yes	28	40.0
- No	42	60.0
Availability of surgical wound management guide in the department:		
- Yes	54	77.1
- No	16	22.9

Table (2): Nurses' knowledge regarding surgical wound care and prophylactic measures of SWI throughout training program implementation phases (n= 70):

Items	Nurses' Knowledge Throughout Program Phases				MC p-value
	Pre-program		Post-program		
	No.	%	No.	%	
Nurses' total knowledge about surgical wound care:					<0.001
- Satisfactory	10	14.3	54	77.1	
- Un satisfactory	60	85.7	16	22.9	
Mean± SD	24.2 ± 7		35 ± 4.6		
Range	6 - 36		24 - 40		
Mean difference	10.8				
% of Improvement	44.6 %				
Nurses' total knowledge about prophylactic measures of SWI:					<0.001
- Satisfactory	7	10.0	52	74.3	
- Un satisfactory	63	90.0	18	25.7	
Mean± SD	14.6 ± 3.7		20.2 ± 3.9		
Range	5 - 21		12 - 25		
Mean difference	5.55				
% of Improvement	38 %				

Mc=McNemar test

p≤0.05 statistically significant

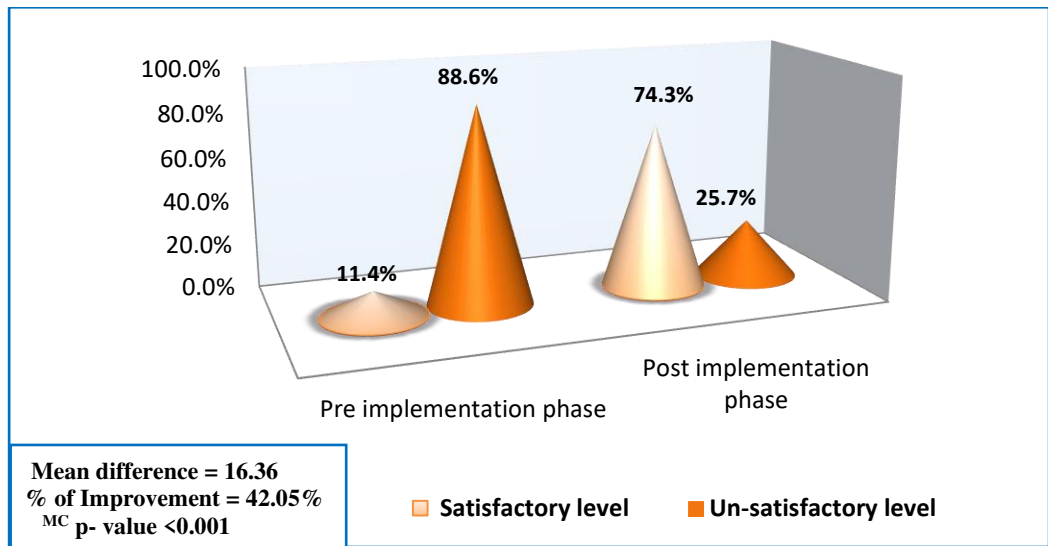


Figure 1: Overall nurses' knowledge regarding surgical wounds management throughout training program implementation phases (n= 70)

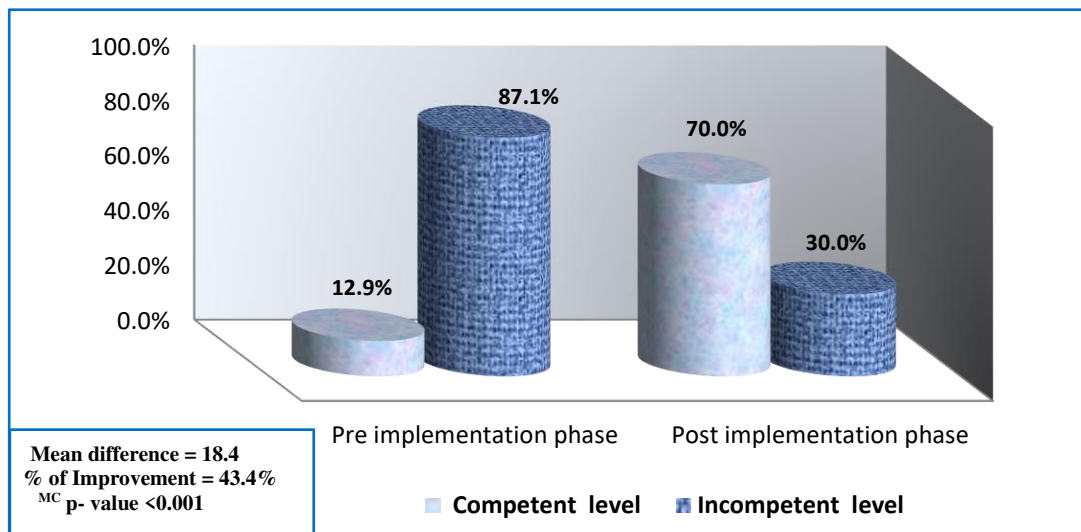


Figure 2: Overall nurses' practices regarding surgical wound care throughout training program implementation phases (n= 70)

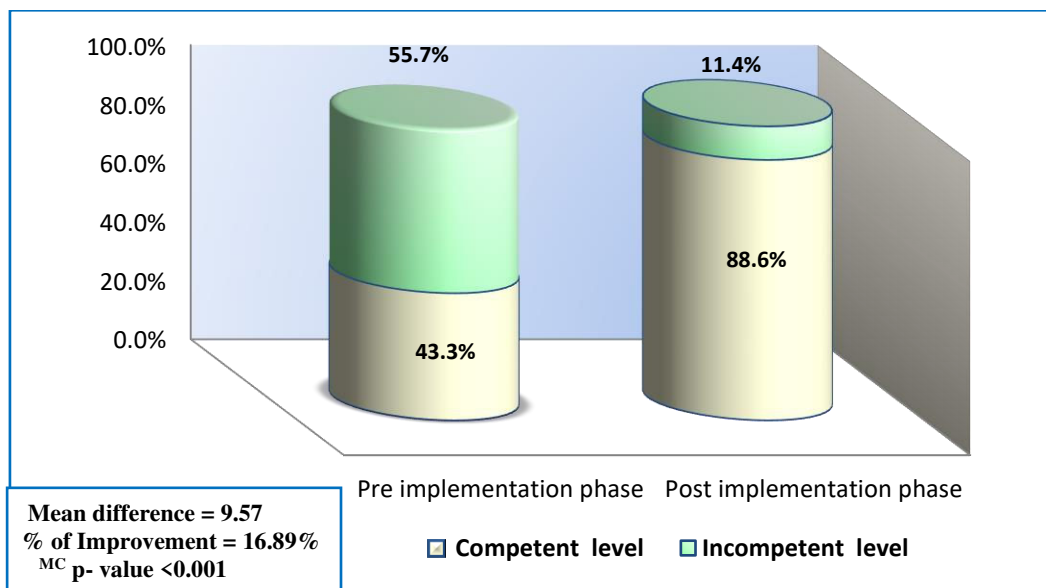


Figure 3: Overall nurses' practices regarding prophylactic measures of SWI throughout training program implementation phases (n= 70)

Table 3: Relation between overall nurses' knowledge regarding surgical wounds management and their demographic features in the post-program implementation phase (n=70):

Demographic features	Nurses' overall knowledge level post program				χ ²	f p-value
	Satisfactory ≥80%		Unsatisfactory <80%			
	No.	%	No.	%		
Age per years:						
- ≤30 years	31	64.6	17	35.4	7.5	0.006*
- > 30 years	21	95.5	1	4.5		
Sex:					f	0.003*
- Male	7	43.8	9	56.3		
- Female	45	83.3	9	16.7		
Marital status:					5.6	0.017*
- Married	47	79.7	12	20.3		
- Unmarried	5	45.5	6	54.5		
Residence region:					f	0.0001*
- Rural	4	28.6	10	71.4		
- Urban	48	85.7	8	14.3		
Academic background:					2.5	0.28
- Diploma	20	66.7	10	33.3		
- Technical institute	28	77.8	8	22.2		
- Bachelors	4	100.0	0	.0		
Income:					1	0.31
- Sufficient	33	78.6	9	21.4		
- Insufficient	19	67.9	9	32.1		
Years of experience in nursing field:					10.7	0.001*
- ≤5	20	57.1	15	42.9		
- >5	32	91.4	3	8.6		
Years of experience at the department:					f	0.99
- ≤5	8	72.7	3	27.3		
- >5	44	74.6	15	25.4		
Attendance of training courses about surgical wound management:					1.5	0.22
- Yes	23	82.1	5	17.9		
- No	29	69.0	13	31.0		
Availability of surgical wound management guide in the department:					f	0.003*
- Yes	45	83.3	9	16.7		
- No	7	43.8	9	56.3		

χ² = Chi square test

f= Fisher exact test

(*) Significant p≤0.05

Insignificant p>0.05

Table 4: Relation between overall nurses' practices regarding surgical wound care and their demographic features in the post-program implementation phase (n=70):

Demographic features	Nurses' overall practice level post program				χ^2	r p-value
	Competent $\geq 80\%$		Incompetent $< 80\%$			
	No.	%	No.	%		
Age per years:						
- ≤ 30 years	32	66.7	16	33.3	0.81	0.37
- > 30 years	17	77.3	5	22.7		
Sex:						
- Male	6	37.5	10	62.5	f	0.004*
- Female	43	79.6	11	20.4		
Marital status:						
- Married	45	76.3	14	23.7	f	0.013*
- Unmarried	4	36.4	7	63.6		
Residence region:						
- Rural	5	35.7	9	64.3	f	0.003*
- Urban	44	78.6	12	21.4		
Academic background:						
- Diploma	18	60.0	12	40.0	2.5	0.29
- Technical institute	28	77.8	8	22.2		
- Bachelors	3	75.0	1	25.0		
Income:						
- Sufficient	29	69.0	13	31.0	0.045	0.83
- Insufficient	20	71.4	8	28.6		
Years of experience in nursing field:						
- ≤ 5	20	57.1	15	42.9	5.5	0.019*
- > 5	29	82.9	6	17.1		
Years of experience at the department:						
- ≤ 5	9	81.8	2	18.2	f	0.48
- > 5	40	67.8	19	32.2		
Attendance of training courses about surgical wound management:						
- Yes	20	71.4	8	28.6	0.045	0.83
- No	29	69.0	13	31.0		
Availability of surgical wound management guide in the department:						
- Yes	43	79.6	11	20.4	f	0.004*
- No	6	37.5	10	62.5		

 χ^2 = Chi square test

f= Fisher exact test

(*) Significant $p \leq 0.05$ Insignificant $p > 0.05$

Table 5: Relation between overall nurses' practices regarding prophylactic measures of SWI and their demographic features in the post-program implementation phase (n=70):

Demographic features	Nurses' overall practice level post program				χ^2	p-value
	Competent $\geq 80\%$ N = 62		Incompetent $< 80\%$ N = 8			
	No.	%	No.	%		
Age per years:						
- ≤ 30 years	41	85.4	7	14.6	f	0.42
- > 30 years	21	95.5	1	4.5		
Sex:						
- Male	10	62.5	6	37.5	f	0.001*
- Female	52	96.3	2	3.7		
Marital status:						
- Married	54	91.5	5	8.5	f	0.1
- Unmarried	8	72.7	3	27.3		
Residence region:						
- Rural	9	64.3	5	35.7	f	0.006*
- Urban	53	94.6	3	5.4		
Academic background:						
- Diploma	24	80.0	6	20.0	3.9	0.14
- Technical institute	34	94.4	2	5.6		
- Bachelors	4	100.0	0	.0		
Income:						
- Sufficient	39	92.9	3	7.1	f	0.25
- Insufficient	23	82.1	5	17.9		
Years of experience in nursing field:						
- ≤ 5	29	82.9	6	17.1	f	0.26
- > 5	33	94.3	2	5.7		
Years of experience at department:						
- ≤ 5	10	90.9	1	9.1	f	0.99
- > 5	52	88.1	7	11.9		
Attending training courses about surgical wound management:						
- Yes	25	89.3	3	10.7	f	0.99
- No	37	88.1	5	11.9		
Availability of surgical wound management guide in the department:						
- Yes	52	96.3	2	3.7	f	0.001*
- No	10	62.5	6	37.5		

 χ^2 = Chi square test

f= Fisher exact test

(*) Significant $p \leq 0.05$ Insignificant $p > 0.05$

Table 6: Correlation matrix between nurses' overall knowledge score, overall practice score of surgical wound care, and application of prophylactic measures of SWI throughout training program implementation phases (n=70)

Parameters	Pre – Program Implementation Phase			
	Knowledge score		Practice score	
	(r)	p	(r)	p
Practice score of wound care.	.477	<0.001**		
Application of prophylactic measures of SWI.	0.18	0.136	0.121	0.319
Parameters	Post – Program Implementation Phase			
	Knowledge score		Practice score	
	(r)	p	(r)	p
Practice score of wound care.	.719	<0.001**		
Application of prophylactic measures of SWI.	.275	0.021*	.261	0.029*

(r) Correlation coefficient

* Significant $p \leq 0.05$ **Highly significant $p < 0.01$

Discussion:

According to **Martins et al., (2020)**, inadequate postoperative surgical wound management is directly responsible for 75% of infection-related fatalities among surgical patients. Regardless of the magnitude or location of the surgery, SWI is one of the most common postoperative complications that can develop in all different types of surgical approaches. The SWI affects 5.6% of surgical procedures overall in Low and Middle-income Countries and is the most frequent surgical complication and complex healthcare-associated infection as well as it is a major source of mortality and morbidity globally (**Yaouba et al., 2016**).

Through effective wound management, nurses can help avoid SWI and promote the healing of wounds (**Hegarty et al., 2019**) as well as due to their crucial role in ensuring patient safety through proper clinical care, their duty for wound care has therefore expanded (**Annesley, 2019**). A well-trained nurse is the foundation of a well-organized department, also, modern technical and scientific advancements in nursing, along with growing consumer demand for high-quality healthcare, forced nurses to stay up-to-date in a field that is exploding with new information, necessitating the creation of nursing staff education (**Derrick et al., 2017**).

Earlier research has revealed that different training interventions can enhance nurses' competence in wound management (**Martinengo et al., 2020**), which could enhance patient outcomes and safety (**Church, 2016**). So, we can lessen the strain on healthcare systems, reduce hospital stays, and ultimately improve patient outcomes by improving surgical nurses' understanding and practice of wound management. Therefore, this study aimed to evaluate the effect of the training program on nurses' performance regarding surgical wound management. A discussion of the current results will cover four key areas, in the order listed below:

Firstly, the Socio-demographic features of studied nurses:

According to the current study's analysis of the sociodemographic features of the nurses under study, more than two-thirds of them were under 30 years old, more than three-quarters of them were female, and the majority of them were married and had more than five years of experience working in the surgical department. Additionally, about two-thirds of the studied nurses hadn't participated in training courses about surgical wound management, and more than three-quarters of them reported the availability of surgical wound management guide in their department. The majority of the nurses were either nursing technical institute or diploma graduates, while the minority had bachelor's degrees in nursing.

According to the researchers, the majority of nurses working in Zagazig University hospitals are female, and this conclusion may be related to the fact that nursing education used to be exclusively for women. Additionally, the fact that the least number of nurses at Zagazig University Hospital possessed a bachelor's degree in nursing may have something to do with the hospital's chronic lack of highly qualified nurses due to their constant administrative workload.

The current results agree with **SAEED et al., (2021)** who mentioned in a study about "Evaluation of nurses practice about postoperative wound care at Al-Diwaniya Teaching Hospital" that more than half of the nurses were between the ages of 20 and 28; the lowest percentage of nurses had a BSc degree; the majority of respondents had 1 year or more of service experience; and the remaining had more than 11 to 20 years. While the current results diverge from his study in certain areas, as the distribution of male to female participants is the same (50% female and 50% male), most of the nurses were single, and the majority of them had taken training courses.

These results are also consistent with a study by **Dung & Tung (2020)** about "Nurses' knowledge, practice, and confidence after the training program on wound care at the Agriculture General Hospital in Vietnam", which found that only 16.3% of nurses had a university degree and that nearly all had worked for more than or equal five years. While the current results are contradictory with some of his study's findings, as 67.4% of nurses had attended training courses or workshops on wound care, however, no nurse provided a detailed description of these courses.

Meanwhile, the current findings are consistent with **Sheta (2020)** study, which examined the "Effect of educational program on nurses' knowledge and practice regarding negative pressure wound therapy among patients with acute and chronic wounds" and clarified that more than half of the nurses were between the ages of 25 and 30; the majority of them were females; half of the nurses had technical institutes; and the majority of the

studied nurses did not participate in an educational program.

Also, these results are consistent with a study by **Abid et al., (2018)** titled "Assessment of nurses documentation for nursing care at surgical wards in Baghdad teaching hospitals", which found that 60% of the study samples were female, most of them belonged to the 18–27 age group, a high percentage of them had graduated from an institution, and the majority of the nurses were married.

Secondly, nurses' knowledge regarding surgical wounds management throughout the training program implementation phases:

In terms of nurses' total knowledge about surgical wound care, the current study's findings revealed that, prior to program implementation, the majority had unsatisfactory knowledge, while more than three-quarters of them had satisfactory knowledge after program implementation. Overall, there was a 44.6% improvement in nurses' total knowledge of surgical wound care after program implementation compared to pre-program, which is a highly statistically significant difference and improvement.

The current findings are in conformity with **Gizaw et al., (2022)**, who stated in a study titled "Knowledge, practice, and associated factors towards postoperative wound care among nurses working in public hospitals in Ethiopia: A multicenter cross-sectional study in low resource setting area" that more than half of the studied nurses had poor knowledge and practice about postoperative wound care and came to the conclusion that improving the nurse's knowledge and practice towards postoperative wound care was necessary to prevent postoperative wound infection.

Additionally, these results also support **Tegegne et al., (2022)** explanation in their study titled "Knowledge and practice of wound care and associated factors among nurses working in South Wollo Zone Government Hospitals, Ethiopia" that nurses' wound-care knowledge and practice were lacking and that they required training programs.

Too, this result also concurs with **Chuang et al., (2022)**, who discovered that participants

correctly answered 51.96 percent of questions about pressure injury prior to the intervention and 75.5% of questions following the intervention. They came to the conclusion that the interactive training program for pressure injury through the pressure injury E-book app was successful in enhancing nurses' knowledge of and attitudes toward pressure injury care as well as their confidence in providing it.

Meanwhile, these results align with a study published by **Mohamed et al., (2019)** on the "Effect of training program on performance of nurses caring for patients with negative pressure wound therapy" which suggested that the hospital should encourage ward-based education through demonstrations and workshops rather than lectures only to motivate nurses and allow them to update their knowledge. This will aid in bridging the performance gap between knowledge and practice in wound care.

Moreover, **Sürme et al., (2018)** affirmed in a study named "Knowledge and Practices of nurses regarding wound healing" that education should be carried out to increase the knowledge, attitude, and skill sets of nurses regarding wound healing and care, supporting this finding. While, this finding is in contrast to **Berhe et al., (2018)**, who found that more than half of nurses had good knowledge of postoperative wound care in a study titled "Nurses' knowledge, practice, and associated factors regarding postoperative wound care of hospitalized pediatric patients in public hospitals of Mekelle City, North Ethiopia"

In terms of nurses' total knowledge about prophylactic measures for SWI, the current study discovered that most of the nurses had unsatisfactory knowledge before the start of the program, but that nearly three-quarters of them had improved their knowledge after it had begun. In general, there was a 38% improvement in nurses' total knowledge of SWI prophylactic measures after program implementation compared to pre-program, which was a highly statistically significant difference and improvement.

These findings parallel with those of **Hassan & Masror-Roudsary, (2023)**, who discovered that 58.3% of nurses had poor knowledge and practice of preventative measures of SWI or

SSI, and just 20% of them had good knowledge and 21.7% had average knowledge in a study titled "Nurses' knowledge and practice regarding prevention of surgical site infection (SSI) at governmental hospitals in Wasit City, Iraq".

These results also align with a study by **Abdelhameed et al., (2022)**, which looked at the "Effect of a mind map using on improving nurses' performance regarding infection control at Surgical Departments" and found that the majority of the participants nurses were unaware of infection control precautions before the mind map intervention, but that knowledge had increased for the majority of them following the intervention. They also noted that prior to the application of the teaching sessions; the overall score of nurses' understanding of infection control applications was low.

Additionally, the results of the study are consistent with those of **Feng et al., (2022)**, who stated in a study "Knowledge, attitude, and practice of surgical site infection prevention among operating room nurses in Southwest China" that sixty percent of operating room nurses still lacked sufficient knowledge of SSI prevention measures, but they had a positive attitude and high levels of practice.

Moreover, the current findings line up with those of **AbuAlkishik et al., (2020)**, who stated that nurses should have sufficient knowledge and practical skills about prevention strategies for surgical wound infection because prior research has established the useful benefits of nurses having the right knowledge about surgical wound infection prevention. Additionally, its study supports the idea that training might help nurses become more knowledgeable about infection control measures.

Also, **Zhang et al., (2019)** study supports the current findings and emphasizes the significance of training on nurses' knowledge, which shows that operating room nurses with three times or more above training had a stronger understanding of terminal disinfection of infection than others.

Furthermore, **Desta et al., (2018)** noted in a study titled "Knowledge, practice and associated factors of infection prevention among healthcare workers in Debre Markos referral hospital, Northwest Ethiopia" that participation in training programs was associated with a high level of knowledge about infection prevention among the nurses.

While these results contradict **Phillips et al., (2019)**, who demonstrated that there, is no need to improve nurses' knowledge and skills linked to infection control measures in a study titled "Effectiveness of the spaced education pedagogy for clinicians' continuing professional development".

Concerning overall nurses' knowledge about surgical wounds management and according to the current results, less than one-fifth of the nurses had satisfactory overall knowledge of surgical wound management prior to program implementation, while nearly three-quarters of them had satisfactory knowledge following program implementation. Overall, there was a mean difference of 16.36 and a percent improvement equal to 42.05% in overall nurses' knowledge regarding surgical wound management post-program implementation as compared to pre-program, indicating a highly statistically significant difference and improvement.

According to the researchers, the fact that more than two-thirds of the studied nurses were recent graduates (less than 30 years old), that most of them held nursing technical institute or diploma degrees rather than bachelor's degrees, and that the highest percentage of the studied nurses hadn't attended training courses about surgical wounds management may be responsible for the unsatisfactory level of the studied nurses' knowledge prior to the implementation of the training program. Otherwise, due to a lack of nursing staff, Egyptian nurses, especially those who provide bedside care, are overworked and have little opportunity to further their education.

The current findings correspond with those of **Nawaz & Bibi (2023)**, who stated in a study titled "Assessment of knowledge among nurses about wound infection in cardiothoracic surgery patients" that nurses have a significant

knowledge gap in the field of wound management and that they must take continuing professional education courses to close this knowledge gap to advance and maintain their professional practice. Further support for these findings comes from **Serag et al., (2021)**, who demonstrated that nurses' knowledge and practice of wound care and management increased as a result of an educational program.

In addition, **Mohamed et al., (2019)** demonstrated that there was a statistically significant difference between the total knowledge score of nurses before and following the implementation of the educational program. The results revealed that the majority of nurses had a fair knowledge of negative pressure wound management before the educational program, whereas the entire sample had good knowledge following its implementation.

These findings are also supported by **Sabour et al., (2017)**, who noted in a study titled "Nurses' knowledge and practices regarding wound vacuum-assisted closure (VAC) therapy" that nurses' knowledge and practices regarding wound VAC therapy are insufficient. As a result, they should be encouraged to attend ongoing education and workshops to improve their knowledge and practices. Additionally, **Burrow et al., (2016)** assertion that the healthcare system should assist nurses' professional growth by hosting seminars and workshops is backed by this.

Furthermore, the present findings are consistent with those of **Zarchi et al., (2014)**, who investigated "Significant differences in nurses' knowledge of basic wound management" and discovered that hospital nurses had less theoretical understanding of wound management than home care nurses and nurses employed at advanced wound care clinics. While the current study's findings differ from those of **Altaweli et al.,(2023)** who reported that nurses' knowledge of wound management was generally good but that there were gaps in the practical component that needed to be filled to prevent wound complications in a study titled "Management of acute surgical wounds in Saudi Arabia: nursing staff knowledge and practice".

Thirdly, nurses' practices regarding surgical wounds management throughout the training program implementation phases:

Concerning overall nurses' practices of surgical wound care, it is evidenced by the results of the current study that less than one-fifth of the nurses had a total competent practice of surgical wound care prior to the implementation of the program, but more than two-thirds of them had a competent practice after the program. Overall, nurses' practices for surgical wound care showed a highly statistically significant difference and improvement in the post-program implementation phase as compared to the pre-program phase, with a mean difference of 18.4 and a percent improvement of 43.4%.

According to the researchers, the incompetent practices level regarding surgical wound care among the studied nurses may be attributed to that the majority of studied nurses had inadequate knowledge about surgical wound care before the implementation of the training program, which is thought to be the main barrier to implementing the standard of care and having a negative impact on the quality of care that is provided to surgical patients as well as on their safety

Additionally, a lack of education and training may be a contributing factor to nurses' incompetent practices, as most of the nurses in the study either held a diploma or degree from a nursing technical institute, and more than two-thirds of them were recent graduates (less than 30 years old) who hadn't taken any courses on managing surgical wounds. Also, incompetent practices may have resulted from nurses failing to follow the wound care standard checklist because it would take a lot of time for them to do so as well as there were more patients than nurses available.

The findings of the current study coincide with those of **Ielapi et al., (2022)** who stated in a study titled "Wound care self-efficacy Assessment of Italian registered nurses and wound care education in Italian Nursing Education System: A Cross-Sectional Study" that nurses must possess a variety of skills when caring for patients with wounds. They also stated that nursing students' education in wound care is generally subpar due to a lack of

consistent learning goals, content, and duration of academic training. As a result, many skills are acquired during a registered nurses career in an empirical manner, which renders the nurses' skills incompetent.

As well, these results are consistent with those of **Aldousari et al., (2021b)** who demonstrated in a study titled "Scoping Review: Nurse's Knowledge and practices regarding wound dressing at primary health care centers" that the studied nurses lacked proficiency in carrying out conventional wound dressing protocols. These findings also support the findings of **Dung & Tung (2020)**, who found that the training program improved nurses' knowledge, practice, and confidence in the area of wound care. They also showed that the program had succeeded in achieving its initial goals and should be repeated in other medical facilities.

The existing findings additionally correspond with those of **Tela et al., (2020)**, who investigated "Post-operative wound care and its associated factors of hospitalized patients in public hospitals of Mekelle City, Tigray, Ethiopia" and found that the majority of nurses practiced subpar or poor post-operative wound care. They also recommended that highly qualified nurses instruct other staff nurses in the standardized dressing techniques of postoperative wounds.

Too, **Mohamed et al., (2019)** noted that there had been improvement in the nurses' overall practice score following the application of the educational program as well as the majority of them had adequate practice levels three months after the program's start, with statistically significant differences between the two ($p < 0.001$).

Also, the current results are in line with a study by **Mwakanyamale et al., (2019)**, which looked at "Nursing practice on post-operative wound care in surgical wards at Muhimbili National Hospital, Dar-es-Salaam, Tanzania", and found that more than half of nurses demonstrating bad post-operative wound practice and poor wound dressing techniques.

While the current findings differ from those of **SAEED et al., (2021)**, who found that the majority of nurses (50%) had a high degree of

postoperative wound care practice, followed by 40% of all participants who had moderate practice, and finally a small number of study participants (10%) who had low degree of practice, the current findings are nonetheless consistent with those authors' findings. Furthermore, the current findings are at odds with a study by **Greatrex-White & Moxey (2015)**, which showed that the nurses under observation provided an acceptable and good degree of post-operative wound care.

Concerning overall nurses' practices for prophylactic measures of SWI, Less than half of the nurses in the study had competent practices for SWI prophylactic measures before program implementation, while the majority of them had competent practices after program implementation, according to the current study's findings. Overall, nurses' practices for prophylactic measures of SWI showed a highly statistically significant difference and improvement in the post-program phase in comparison to the pre-program phase, with a mean difference of 9.57 and a percentage of improvement equal to 16.89%.

According to the researchers, the studied nurses' incompetent practice regarding prophylactic measures of SWI during the program's pre-implementation phase may be attributed to a lack of knowledge and training, so the practice of the studied nurses improved after the training program was put into place.

The present findings coincide with those of **Hassan & Masror-Roudsary, (2023)**, who discovered that only 10.6% of nurses had sufficient practices regarding SWI prevention and 13.9% of them had moderate practices, while 75.6% of them expressed insufficient practices, and they advised providing those nurses with more training.

Likewise, the current findings concur with those of **El Sebaey et al., (2022)**, who showed in a study titled "Effect of infection control training Course on Knowledge and Practices of medical interns in a large academic hospital in Egypt: an intervention study" that practices of all infection control measures significantly improved and that the mean total score of practices increased significantly from 65.4 ± 13.9 to 80.2 ± 7.9 .

Additionally, the current findings are in line with those of **Ali et al., (2022)**, who showed in a study titled "Web-Based Intervention Improves Surgical Units Nurses' Performance about Infection Control Precautions during Corona Virus Outbreaks" that nurses' practices of infection control precautions were highly statistically significant improved post-web-based Intervention.

Furthermore, the current findings match with a study by **Kebede et al., (2021)** that looked at "Postoperative wound Infection prevention practices and associated factors among nurses working for the South Gondar public hospitals, Ethiopia" and revealed that poor knowledge and attitude as well as lack of training on infection control and prevention led to that nurses' post-operative SWI prevention practices were subpar.

Additionally, **Paulos Jaleta et al., (2021)** reported in a study titled "Nurses Knowledge, practice, and associated factors toward prevention of surgical site infection in Benishangul Gumuz Hospitals Northwest Ethiopia" that 51.8% of nurses were not knowledgeable and around 47.2% of nurses were having poor practice toward SSI prevention strategies and concluded that training and close monitoring is required from respective facility and stakeholders for standard SSI prevention guidelines.

Moreover, the findings of the present study are consistent with those of **Anderson et al., (2018)**, who concluded in a study titled "Strategies to Prevent Surgical Site Infections in Acute Care Hospitals" that continuous in-service training programs for nurses are a very important issue that aids the professional nurse in learning the most recent developments in nursing science that improve nursing practice.

The current study results are corresponding with **Anderson et al., (2018)** who concluded in a study entitled "Strategies to Prevent Surgical site infections in acute care hospitals" that continuous in-service training program for nurses is considered a very important concern that helps the practitioner nurse to know the new in the nursing science and improves the delivery of nursing care. These results are also consistent with those of **Koo et al., (2016)**, who demonstrated that educational

interventions had increased healthcare professionals' knowledge and practice of infection prevention measures in acute care.

Fourthly, the relations and correlation between the study variables:

Concerning the relation between overall nurses' knowledge regarding surgical wounds management and their demographic features post-program implementation phase, the existing study results found that a statistically significant relationship between nurses' age, sex, marital status, place of residence, number of years of nursing experience, and availability of surgical wounds management guide in their department and overall nurses' knowledge level regarding surgical wounds management. It is clear that urban-dwelling female nurses with experience longer than five years, age greater than 30, and who reported the availability of surgical wounds management guide in their department had a satisfactory post-program knowledge level than other nurses.

These findings concur with those of **Tegegne et al., (2022)**, who noted a strong relationship between age and the availability of guidelines and nurses' knowledge of wound management. Furthermore, **Berhe et al., (2018)** found a significant relationship between postoperative wound management knowledge and practice among nurses working in public hospitals and participant age, sex, surgical unit experience, the presence of standards (protocols, manual), and the availability of postoperative wound infection guidelines.

Also, the present results support **Desta et al., (2018)** observation that older healthcare professionals (those older than 30) understood and practiced infection control more than younger nurses. Meanwhile, **Novelia et al., (2017)** research showed that nurses with more than five years of experience in the field know more than those with less. While the current findings are in conflict with **Zarchi et al., (2014)** who reported that nurses' knowledge was unaffected by their experience level.

Concerning the relation between overall nurses' practices regarding surgical wound care and their demographic features post-program implementation phase, the current study results clarified that there was a

statistically significant relation between overall nurses' practice for surgical wound care post the program's implementation and nurses' sex, marital status, place of residence, number of years of nursing experience, and availability of surgical wounds management guide in the department. It appears that nurses with certain characteristics—female, married, residing in an urban region, >5 years of nursing experience, reporting the availability of a surgical wounds management guide in their department—had a satisfactory post-program knowledge level than other nurses.

These results agree with those of **Tegegne et al., (2022)**, who explained that the number of years of expertise and the availability of guidelines were strongly associated with practices of wound care. Additionally, it was revealed that nurses with greater work experience—more than ten years—was 1.82 times more likely to have good practice than nurses with less experience. The current findings also align with those of **Tela et al., (2020)**, who noted that nurses' ability to provide post-operative wound care depends on their level of education, job experience, and access to resources.

Concerning the relation between overall nurses' practices for prophylactic measures of SWI and their demographic features post-program implementation phase, the current study results demonstrated that there was a statistically significant relationship between nurses' sex, region of residence, and the availability of surgical wound management guide in the department and overall nurses' practices level regarding SWI prophylactic measures post the program's implementation. It is clear that urban-dwelling female nurses who reported the availability of surgical wound management guide in their department had a higher level of practice competency than other nurses.

The current findings correspond with those of **Mengesha et al., (2020)**, who showed that nurses' application of infection prevention measures was strongly influenced by the availability of infection prevention guide. Additionally, according to **Alabdulrazaq et al., (2018)**, female nurses were more likely than male nurses to take proper preventive

measures against SWI. They also discovered that there was no correlation between practice scores and participation in SWI prevention programs.

Moreover, the findings of this study are consistent with those of **Nofal et al., (2017)**, who showed in their study titled "Factors influencing compliance to the infection control precautions among Nurses and Physicians in Jordan: A cross-sectional study" that gender and years of experience are associated with a high level of use of nosocomial preventive measures by Jordan nurses.

Concerning the correlation between nurses' overall knowledge score, practice score of surgical wound care, and application of prophylactic measures of SWI throughout training program implementation phases, the current study results illustrated that there was a statistically significant positive correlation of nurses' knowledge score regarding surgical wounds management with their practice score of wound care at pre- and post-program implementation phase as well as with their application of prophylactic measures of SWI at post-program phase. Furthermore, there was a statistically significant positive correlation between overall nurses' practice scores regarding surgical wound management and application for prophylactic measures of SWI post-implementation of the program.

The current findings are in line with those of **Ayamba et al., (2022)**, who showed in a study titled "Nurses' Knowledge and Practices on Surgical Site Infections in Sub-Saharan Africa" that there was a significant and favorable correlation between nurses' knowledge and practices regarding the prevention strategies, care, and management of patients' SSI. This indicates that providing more education to nurses through seminars and educational programs will improve their knowledge and keep them up to date with the latest trends, which will have an impact on their practice.

Likewise, the current findings line up with **Sheta (2020)**, who found a highly statistically significant relationship between the total nurses' knowledge score and the level of practice for negative pressure wound care before and following program implementation. This implies that as knowledge increased,

competent nursing practice for wound care also increased. Moreover, these findings are consistent with those of **Lobo et al., (2019)**, who reported that there was a linear correlation between knowledge and attitude as well as between knowledge and practice scores of surgical site infection prevention measures.

The aforementioned results are also consistent with **Kwon et al., (2018)** study findings, which demonstrated that it is impossible to isolate technical skills from intellectual and interpersonal skills. Knowledge of the principles and steps of the technique is an example of intellectual competence tied to technical skills in nursing. Also, **Sabour et al., (2017)** indicate that once nurses' knowledge regarding wound care is improved through education and training, their practice will be improved too.

Conclusion:

The study lead to a conclusion that the training program based on the identified needs of the nurses plays an effective role in improving their knowledge and practice regarding surgical wounds management, as at the pre-implementation phase of the training program the studied nurses had unsatisfactory knowledge and incompetent practice regarding surgical wounds management which includes surgical wounds care and application of prophylactic measures of SWI, while post-implementation of the training program there was rising of their knowledge and practice scores, which reflects training program effectiveness in improving their performance regarding surgical wounds management, which supports the hypotheses of the current study.

Recommendation:

According to the study's findings, the following recommendations are advised:

- The developed training program should be implemented on a wide scale in study settings as well as all similar ones including all governmental hospitals.
- It is very important to provide all nurses in surgical departments with clear guidelines to help them deliver standardized quality care for patients with surgical wounds. The developed booklet could serve as a nucleus or prototype for such guidelines.

- Close monitoring and supervision of staff nurses' performance is highly recommended to improve it rather than blame them for errors.
- The surgical staff nurses need continuing on-job training to improve and update their performance.
- More research is recommended to determine the effect of the surgical department nurses' educational training program on preventing SWI in patients with surgical wounds.

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