Effect of Multimedia Educational Program on the Pediatric Nurses' Performance toward Surgical Site Infection Prevention in PICU

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Abstract

Background: A surgical site infection (SSI) is the second most common type of healthcare-associated infection. Even though surgical site infection is considered one of the most preventable healthcare-associated infections (HAI), it remains a leading cause of postoperative morbidity and mortality in children who undergo cardiac surgery. **Aim:** to evaluate the effect of multimedia educational program on the pediatric nurses' performance toward surgical site infection prevention in pediatric intensive care unit. **Design:** A quasi- experimental design (Pre & Post-Test) was utilized. Setting: The study was conducted at pediatric intensive care unit affiliated with Mansoura University Children's Hospital, Egypt. **Sample:** A convenient sample of 40 pediatric nurses was included in the study. Tools for data collection; the first consists of two parts: Part I deal with the personal and professional data of the nurses. Part II is based on the pediatric nurses' knowledge regarding surgical site infection. The second is an observation checklist to assess nurses' practice toward surgical site infection prevention. **Results:** most of the studied nurses after the multimedia education implementation had satisfactory knowledge and competent practice level on surgical site infection prevention with highly significant differences. **Conclusion:** the study concluded that the multimedia education program regarding surgical site infection prevention had a positive effect on the nurses' performance. **Recommendations:** Further research should also assess the best teaching strategies, other than the multimedia approach, to improve nurses' SSI prevention performance.

Keywords: Educational Program, Multimedia Methods, Pediatric Nurses' Performance, Surgical Site Infection Prevention.

Introduction:

A surgical site infection (SSI) is the second most common type of healthcare-associated infection (HAI). Even though SSI is considered one of the most preventable HAIs, it remains a leading cause of postoperative morbidity and mortality in children undergoing cardiac surgery **(Alshaya et al., 2021)**. According to the Centers for Disease Control and Prevention (CDC), SSI is defined as an infection associated with a surgical procedure occurring within 30 days of the procedure, or within 90 days of the implant if the prosthetic material is implanted during the surgery. SSIs can expand into deep tissues but are frequently localized to the wound site either superficial or deep **(Zukowska, & Zukowski, 2022)**.

The prevalence of hospital acquired infections (HAIs), specifically SSI, differs from country to country. The World Health Organization (WHO) was documented the rate of HAIs at 3–21%. Despite improvements in surgical technique and infection control practices, postoperative pediatric infections are reported to range from 0.25% to 6% with 7% to 20% associated mortality **(Alshaya et al., 2021)**.

Following pediatric surgeries, numerous risk factors have been reported including surgery duration, timing of extracorporeal circulation, delayed sternal closure, severity of postoperative bleeding, and longer use of cardiopulmonary bypass **(Meng et al., 2020)**. A majority of SSIs are caused by Gram-positive skin colonizers, such as Staphylococcus aureus and Staphylococcus epidermises, while Gram-negative bacilli and fungi are less common **(Hrynyshyn, Simões, & Borges, 2022)**.

Enormous challenges of SSI had been reported in terms of re-admissions, extended durations of hospital stays, additional treatment costs, long-term disabilities, emotional distress for both patients and their families, and significant economic burden on hospitals. Additionally, SSI patients were 2 to 11 times more likely to die than other postoperative patients without SSI; moreover, 77% of postoperative deaths occurred

among those patients with SSI. **(Nicolazzo, Rusin, Varese, & Galassi, 2023)**.

Unlike other healthcare professionals, pediatric nurses spend most time with pediatric patients and carry out most of the SSI prevention activities. This shows the significant role that nurses play in prevention efforts, as they can enhance the quality of care delivered to their patients., as; improve inappropriate prophylactic antibiotic use, poor hand hygiene practices, improper dealing with personal protective equipment, and correct implementation of all patient safety checklists, including the prevention of SSIs **(Mengesha, Tewfik, Argaw, Beletew, & Wudu, 2020)**.

Pediatric nurses' practice regarding SSIs prevention is mostly influenced by personal factors, including their knowledge and attitudes towards the preventive measures recommended by the World Health Organization (WHO). Institutional Factors, such as inadequate on-the-job training, a lack of resources for the implementation of surgical safety checklists, and insufficient orientation programs during unit rotations, can significantly impact pediatric nurses' knowledge and practices regarding the prevention of surgical site infections (SSIs) **(Tesfaye et al., 2022)**. An innovative educational approach is the use of multimedia methods. Utilizing multimedia resources enhances clarity within the learning process, makes the educational content more interesting and understandable, improves continuity in learning, and allows for desirable feedback **(Ayed, Ismail, Hegazy, & Magor, 2022)**. The multimedia education is not yet delivered in Mansoura University Children's Hospital, despite the availability of equipment needed for its implementation. In addition, research that investigated the effect of this educational modality on the nurses' performance is limited, particularly in the pediatric nursing field. This inspired us to conduct this research.

Significance of the study:

A surgical site infection continues to be a major reason of morbidity and mortality following pediatric surgery and place an important financial burden on health systems, even though the majority of infections are treatable with antibiotics **(Catania, Boscarelli, Lauriti, Morini, & Zani, 2019)**. In Egypt, there are limited researches focusing on educational interventions designed specifically for ISS prevention. Hence, the current study aimed to evaluate the effect of multimedia educational program on the pediatric nurses' performance toward surgical site infection prevention in PICU.

Aim of the Study:

To evaluate the effect of multimedia educational program on the pediatric nurses' performance toward surgical site infection prevention in PICU.

Research hypotheses:

To accomplish the research's aim, the following research hypotheses were developed:

H1: The multimedia educational program will improve pediatric nurses' knowledge level towards surgical site infection prevention.

H2: The multimedia educational program will improve pediatric nurses' practice level towards surgical site infection prevention.

Method:

Research design:

This study was conducted through a quasi-experimental (one group pre/posttest) research design.

Setting:

The study was conducted at pediatric intensive care unit (PICU) affiliated to Mansoura University Children's Hospital.

Subjects and sampling technique:

A convenience sample of the pediatric nurses who are working in the previously mentioned setting and agree to participate in the study regardless of their age, qualifications, gender, and years of experience.

Sample size calculation:

Sample size was determined based on the study parameters of **Khalafallha, Mohammed, and Bahnsawy (2018),** and by using the Power formula:

$$n = \left(\frac{Z_{1-\alpha/2} + Z_{1-\beta}}{ES} \right)^2$$

The effect size was determined to be medium (0.5), the study power at 80%, and α error rate was set at 0.05. The minimum acceptable sample size is 31 nurses, adding 30% to allow for participants dropping out of the study results in a final sample size of 40 nurses.

Data collection tools:

The data collection process was carried out utilizing two self-developed tools, which were translated into simple Arabic to collect the essential information for this research.

Tool I: **Self-administrated knowledge questionnaire:** this tool was developed based on the related literature **(Khalafallha et al., 2018; Woldegioris, Bantie, & Getachew, 2019; Hrynyshyn et al., 2022; Nicolazzo et al., 2023).** It involved two parts.

Part I: included the personal and professional data of the pediatric nurses as (age, gender, qualifications, years of experience, and previous attendance at educational program about SSI prevention …… etc.)

Part II: was related to pre-post knowledge test to assess pediatric nurses' knowledge regarding surgical site infection for instance (definition, classification, time of SSI, healing process, factors effecting healing process, and wound infection preventive measures…etc), hospital-associated infection (HAI), and infection control precautions.

Scoring system:

Each correct answer was scored (1), while an incorrect answer was scored (0). The total knowledge score ranged from (0:37), which was converted to percentages to be classified based on **Ayed et al., (2022)** study as follows: satisfactory level of knowledge (≥80%) and unsatisfactory level of knowledge (< 80%) of the total score.

Tool II: An observation checklist to assess nurses' practice towards surgical site infection prevention. It was constructed by the researchers after reviewing the related literature **(Gomarverdi, Khatiban, Bikmoradi, & Soltanian, 2019; Woldegioris et al., 2019; Meoli et al., 2022; Hassan & Roudsary, 2023)** to assess the practice of nurses towards surgical site infection prevention, including infection control measures, appropriate administration of prophylactic antibiotics, maintaining normothermia, strict glycemic control, management of fluids, and an adequate assessment of normovolemia, maintaining the patient nutritional status, surgical site assessment, surgical dressing management, surveillance of SSIs, and patients families education of wound care.

Scoring system:

The steps of the observed practice were checked using a 3-item rating scale: two (2) marks were scored for completely and correctly done, one (1) mark was scored for incompletely and correctly done, and (0) was scored for not done. The total practice score was calculated by summing up (0–114) and converted into a percent score, to be competent or incompetent practice. It was termed incompetent practice if the nurse's score was < 80% and competent practice if the nurse's score was ≥80% of the total score. (**Ayed et al., 2022)**

An administrative design:

An official approval to carry out this study was obtained by the researchers through sending letters from the Faculty of Nursing to the director of Mansoura University Children's Hospital to carry out this research, explaining the aim of the research and procedures together with its possible benefits.

Validity and Reliability:

The ***content validity index*** of SSI's program was evaluated by five academic pediatric nursing experts for the conceptualization and effectiveness of the program regarding its language, content, illustrations, and material (CD containing the educational sessions' content) and emerged as an excellent index (0.92).

Pilot study was implemented to test the face validity of the first draught of the program's content and tools on 10% of the total sample size of the pediatric nurses (4), who were excluded from the studied sample. Consequently, the experts and pilot nurses made the required modifications. Additionally, the ***reliability*** of the practice' observational checklist was tested by Cronbach's α and emerged as very good (0.84).

Ethical considerations:

The Faculty of Nursing's Research Ethics Committee granted ethical permission with approval number (Ref. No. p. 0548). Additionally, verbal informed consent was secured from the pediatric nurses involved in the study, who were made aware of their right to withdraw from participation at any point without the necessity of providing justification.

Study Procedure:

The actual field work of the study started in November 2023 and was completed in January 2024. The multimedia educational program included four phases: assessment, planning, implementation, and evaluation.

Assessment phase:

The pediatric nurses' personal and professional characteristics were assessed by the researchers using **Tool (I) part (1)**. Additionally, the baseline data on the nurses' knowledge deficits and practical needs related to surgical site infection prevention at the PICU were assessed through utilizing **Tool I part (2) & Tools II**

Planning phase:

The objectives, priorities, and anticipated results of the program were defined depending on the updated international literature, searching YouTube videos, and the results of the assessment phase to meet the practical needs of the nurses. and correct their knowledge gaps. In this phase, two well-tailored sessions (one theoretical and one practical) were planned by the researchers to meet the nurses' demands. The multimedia educational sessions involved audio teaching with PowerPoint and displaying YouTube videos on SSIs prevention measures. In addition, CDs of the program content were delivered to participant nurses to enhance the permanence of learning and knowledge retention.

During the implementation phase, The SSI educational session was conducted for 60–90 minutes before the participant nurses begin their duty in the afternoon shift. A fixed room and time were determined for the educational sessions that were supplied with good electrical sources and internet connection service. The multimedia educational sessions for SSI prevention delivered for nurses included brainstorming, role-play, small group discussion, demonstration, and re-demonstration, audiovisual aids such as PowerPoint presentations, and YouTube videos used as teaching methods. There was a total of two sessions: one included pure theoretical content, and the other involved practical skills with the display of YouTube videos.

Each educational session submitted to a maximum of 3-5 nurses and sometimes carried out individually in accordance with the schedule for nursing work over a two-week period. Each nurse obtained a copy of the CD included general theoretical content on surgical site infection in addition to practical skills in wound assessment, surgical dressing management, correct timing of prophylactic antibiotics, controlling underlying medical conditions, maintaining nutritional status, infection control measures, maintaining normothermia, strict glycemic control, fluid management, surveillance of SSIs, and family education of wound care.

During the evaluation phase, the knowledge posttest was conducted with all participants immediately after they finished the multimedia program to evaluate their knowledge about surgical site infection by **Part 2 of Tool I**. Additionally, the participant nurses were observed while giving care to postoperative pediatric patients in the PICU to assess their SSI prevention practice.

Statistical analysis:

The analysis of data was conducted utilizing the Statistical Package for Social Sciences (SPSS) version 20 (SPSS Inc., Chicago, IL, USA). Descriptive statistics were computed, employing the mean and standard deviation (SD) for continuous variables, while percentages were utilized for categorical data. The normality of the variables was assessed using the Kolmogorov-Smirnov test, and the paired t-test was applied to evaluate the mean differences among normally distributed variables. Furthermore, the Pearson correlation test was employed to examine the linear relationship between the overall knowledge and practice scores of nurses. A significance level of 5% was established for the analysis, with p-values less than 0.05 deemed statistically significant.

Results:

Table (1) illustrates that nearly three-fourths of the studied nurses (70%) were female (62.5%) aged between 30 to less than 40 years, with a

mean age of (34.75 ± 6.07) years old. Their educational level revealed that around two-thirds of them had bachelor's degrees and were married (60%, 65%, respectively). As regards nurses' years of experience, it was noticed that nearly two-thirds of the nurses (60%) had work experience of 10 years or more, with a mean experience (11.80±3.96) year. Concerning residence, more than half of them (55%) resided in rural areas. In spite of the fact that all of the studied nurses attended infection control training, only 5% of them had previously attended training courses about surgical site infection prevention. Additionally, 80% of them reported that their PICUs didn't have any guidelines, bundles, or stated rules for surgical site infection prevention.

Table (2) demonstrates knowledge of the studied nurses' subscales before and immediately after the multimedia education implementation. In relation to the studied nurses' knowledge about hospital-associated infection, standard infection control precautions, and SSI definition at PICU, only 10%, 52.5%, and 5%, respectively, of the studied nurses had satisfactory knowledge levels before the multimedia education implementation, compared to 75%, 95%, and 90%, respectively, post-program implementation. As regards SSI timing, SSI classification, healing process, and the SSI preventive measures subscales, only (0%, 22.5%, 62.5%, and 27.5%) of the studied nurses had a satisfactory level of knowledge before the program, compared to immediately after the multimedia education implementation, these percent improved to (80%, 92.5%, 100%, and 95%). The Paired t-test results demonstrated statistically significant improvements regarding all the previously mentioned knowledge subscales throughout the program phases at **(P ≤ 0.001)**.

Table (3) shows the studied nurses' subscales of observed practices of surgical site infection prevention at the PICU before and immediately after the multimedia education implementation. Regarding their observed practice of infection control measures, administration of prophylactic antibiotics, maintaining normothermia, and strict glycemic control, it is noticed from the table that 40%, 35%, 60%, and 30%, respectively, of nurses demonstrated "Competent" levels of practice before the implementation of education, but this percentage increased immediately after the multimedia education implementation to reach 100%, 85%, 100%, and 100%. Concerning the nurses observed practice of fluid management and maintaining the patient nutritional status subscales, only 27.5% and 67.5%, respectively, of nurses displayed "Competent" levels of practice before the implementation of education, while this percentage improved to 95% for both subscales immediately after the multimedia education implementation. The Paired t-test also illustrated that there were highly statistically significant differences (improvements) in practices of nurses in all previous subscales immediately post-program implementation from preprogram phase at **(P ≤ 0.001)**.

Cont. Table (3) shows the studied nurses' subscales of observed practices of surgical site assessment, dressing management, SSI surveillances, and the families' education of wound care at PICU pre- and immediately post-multimedia education implementation. As regards their observed practice before implementation the program (0%, 10%, 17.5%, and 22.5%, respectively) of nurses showed "Competent" levels of practice, but this percentage increased immediately after the multimedia education implementation to reach (92.5%, 75%, 92.5%, and 92.5%, respectively), with highly statistically significant improvements at the post-program implementation from the preprogram phase at **(P ≤ 0.001)**

Table (4) presents the total score of the studied nurses' knowledge and observed practice towards surgical site infection prevention throughout the program' phases. Regarding the total nurses' knowledge score of surgical site infection prevention, most of the studied nurses (95%) had an "unsatisfactory" level of knowledge before the program's implementation, with a mean score of (21.92±5.03). Immediately after the multimedia program implementation, this level of knowledge was elevated to "satisfactory" among 92.5% of the nurses, with a mean of (35.45±2.07) score as illustrated also in **Figure (1)**. In the same line, the total nurses' observed practice score of surgical site infection prevention showed that most of the studied nurses (95%) had an "incompetent" level of practice before the program's implementation, with a mean score of (61.92±17.49). While in the immediate-post phase, this level of practice was elevated to "competent" among 95% of the nurses, with a mean score of (105.72±6.42) as portrayed also in

Figure (2). Additionally, there were highly statistically significant improvements in the overall nurses' knowledge and observed practice score from the pre-phase to the post-program phase at ***(P≤0.001)*.**

Table (5) revealed that there was a statistically significant positive correlation between the total nurses' knowledge and observed practices scores regarding surgical site infection prevention before and immediately after the multimedia education implementation (r=0.815, P≤0.001**) and (r=0.413, P≤0.001**) respectively.

Table (1): Distribution of personal and professional characteristics of the studied pediatric nurses

Items		No=40	
		No.	**%**
Age	20-<30ys	10	25
	30-<40ys	25	62.5
	40-<50ys	5	12.5
	Mean (SD)	**34.75(6.07)**	
Gender	Male	12	30
	Female	28	70
Educational level	rsing technical Institute	12	30
	Bachelor's degree	24	60
	Higher studies	4	10
Years of experience	1-<5ys	11	27.5
	5-<10ys	5	12.5
	≥10 ys	24	60
	Mean (SD)	**11.80(3.96)**	
Marital Status	Single	13	32.5
	Married	26	65
	Divorced	1	2.5
Residence	Urban	18	45
	Rural	22	55
Previous attendance of training program about infection control measures	No	00	00
	Yes	40	100
Previous attendance of training program about surgical site infection prevention	No	38	95
	Yes	2	5
Does the unit have guidelines/bundles or stated rules for surgical site infection prevention	No	32	80
	Yes	8	20

Table 2: Distribution of the studied pediatric nurses' total knowledge subscale scores regarding surgical site infection prevention

Knowledge' subscales	Total number =40				Significance test
	Pre-Education		Immediate-post Education		
	No.	%	No.	%	
Hospital associated infection (HAI) score = (4)					
Unsatisfactory knowledge	36	90	10	25	**t= *8.67***
Satisfactory knowledge	4	10	30	75	***P-value***≤0.001
Mean (SD)	1.68(0.98)		3.70(0.56)		
Standard Infection control precautions score = (9)					
Unsatisfactory knowledge	19	47.5	2	5	**t= *6.79***
Satisfactory knowledge	21	52.5	38	95	***P*-value**≤0.001
Mean (SD)	6.95(1.30)		8.65(1.21)		
Surgical site infection definition score = (3)					
Unsatisfactory knowledge	38	95	4	10	**t=13.36**
Satisfactory knowledge	2	5	36	90	***P-value***≤0.001
Mean (SD)	1.18(0.74)		2.90(0.30)		
Surgical site infection timing score = (2)					
Unsatisfactory knowledge	40	100	8	20	**t= *16.40***
Satisfactory knowledge	00	00	32	80	***P-value***≤0.001
Mean (SD)	0.38(0.40)		1.80(0.40)		
Surgical site infection classification score = (4)					
Unsatisfactory knowledge	31	77.5	3	7.5	**t= *8.86***
Satisfactory knowledge	9	22.5	37	92.5	***P-value***≤0.001
Mean (SD)	1.95(1.28)		3.85(0.53)		
Healing process score = (5)					
Unsatisfactory knowledge	15	37.5	00	00	**t= *7.16***
Satisfactory knowledge	25	62.5	40	100	***P-value***≤0.001
Mean (SD)	3.53(1.17)		4.93(0.67)		
Surgical site infection Preventive measures score = (10)					
Unsatisfactory knowledge	29	72.5	2	5	**t= *9.79***
Satisfactory knowledge	11	27.5	38	95	***P-value***≤0.001
Mean (SD)	6.2(2.05)		9.78(0.69)		

t: Paired t test; * Significance at level P < 0.05.

Table 3: Distribution of the studied pediatric nurses' total observed practice subscale scores regarding surgical site infection prevention

Practice' subscales	Total number =40				Significance test
	Pre-Education		mmediate-post Education		
	No.	%	No.	%	
Infection control measures score= (18)					
Incompetent practice	24	60	00	00	**t= *6.19***
Competent practice	16	40	40	100	***P-value***≤0.001
Mean (SD)	14.03(4.06)		18.00(0.00)		
Appropriate administration prophylactic antibiotic score= (8)					
Incompetent practice	26	65	6	15	**t= *5.85***
Competent practice	14	35	34	85	***P-value***≤0.001
Mean (SD)	4.70(3.0)		7.60(0.74)		
Maintaining Normo-thermia score= (4)					
Incompetent practice	16	40	00	00	**t= *5.09***
Competent practice	24	60	40	100	***P-value***≤0.001
Mean (SD)	3.20(0.99)		4(0.0)		
Strict glycemic control score=(6)					
Incompetent practice	28	70	3	7.5	**t= *10.54***
Competent practice	12	30	37	92.5	***P-value***≤0.001
Mean (SD)	3.38(1.39)		5.85(0.53)		
Fluid management and an adequate assessment of normovolemia score= (6)					
Incompetent practice	29	72.5	2	5	**t=8.47**
Competent practice	11	27.5	38	95	***P-value***≤0.001
Mean (SD)	3.85(1.59)		5.88(0.46)		
Maintaining the patient nutritional status score= (6)					
Incompetent practice	13	32.5	2	5	**t= *3.39***
Competent practice	27	67.5	38	95	***P-value***=0.002
Mean (SD)	5.05(1.50)		5.90(0.70)		

t: Paired t test; * Significance at level P < 0.05.

Cont. Table 3: Distribution of the studied pediatric nurses' total observed practice subscale scores regarding surgical site infection prevention, cont.

Practice' subscales	Total number =40				Significance test
	Pre-Education		mmediate-post Education		
	No.	%	No.	%	
Surgical site assessment score = (6)					
Incompetent practice	40	100	3	7.5	**t= *13.00***
Competent practice	00	00	37	92.5	***P-value***≤0.001
Mean (SD)	2.50(0.87)		5.70(1.06)		
Surgical dressing management score = (28)					
Incompetent practice	36	90	10	25	**t= *8.72***
Competent practice	4	10	30	75	***P-value***≤0.001
Mean (SD)	11.4(8.96)		25.7(4.21)		
Surveillance of SSIs score = (4)					
Incompetent practice	33	82.5	3	7.5	**t= *9.09***
Competent practice	7	17.5	37	92.5	***P-value***≤0.001
Mean (SD)	1.60(1.49)		3.85(0.53)		
Families' education of wound care score = (28)					
Incompetent practice	31	77.5	3	7.5	**t= *8.92***
Competent practice	9	22.5	37	92.5	***P-value***≤0.001
Mean (SD)	12.23(7.43)		23.45(3.43)		

t: Paired t test; * Significance at level P < 0.05.

Table 4: Total score of the studied pediatric nurses' knowledge and observed practice regarding surgical site infection prevention.

Total score	Total number =40				Significance test
	Pre-Education		Immediate-post Education		
	No.	%	No.	%	
Total knowledge score = (37)					
Unsatisfactory knowledge	38	95	3	7.5	**t=14.89**
Satisfactory knowledge	2	5	37	92.5	***P-value***≤0.001
Mean (SD)	21.92(5.03)		35.45(2.07)		
Total observed practice score = (114)					
Incompetent practice	38	95	2	5	**t= *15.48***
Competent practice	2	5	38	95	***P-value***≤0.001
Mean (SD)	61.92(17.49)		105.72(6.42)		

t: Paired t test; * Significance at level P < 0.05.

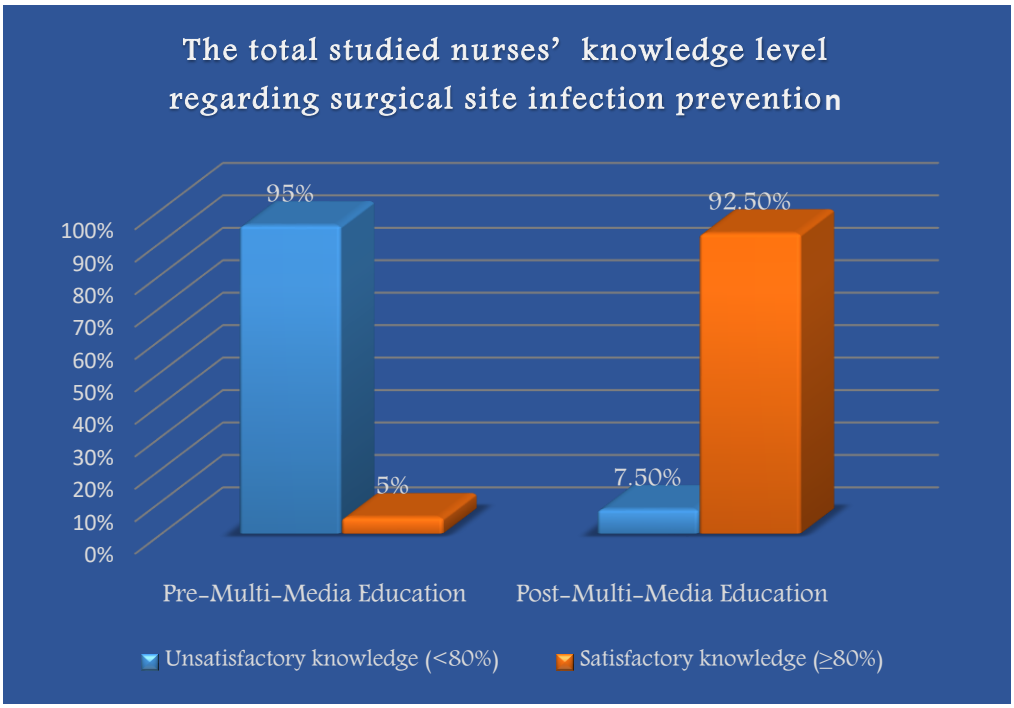

Figure (1): Total score of the studied pediatric nurses' knowledge regarding surgical site infection prevention.

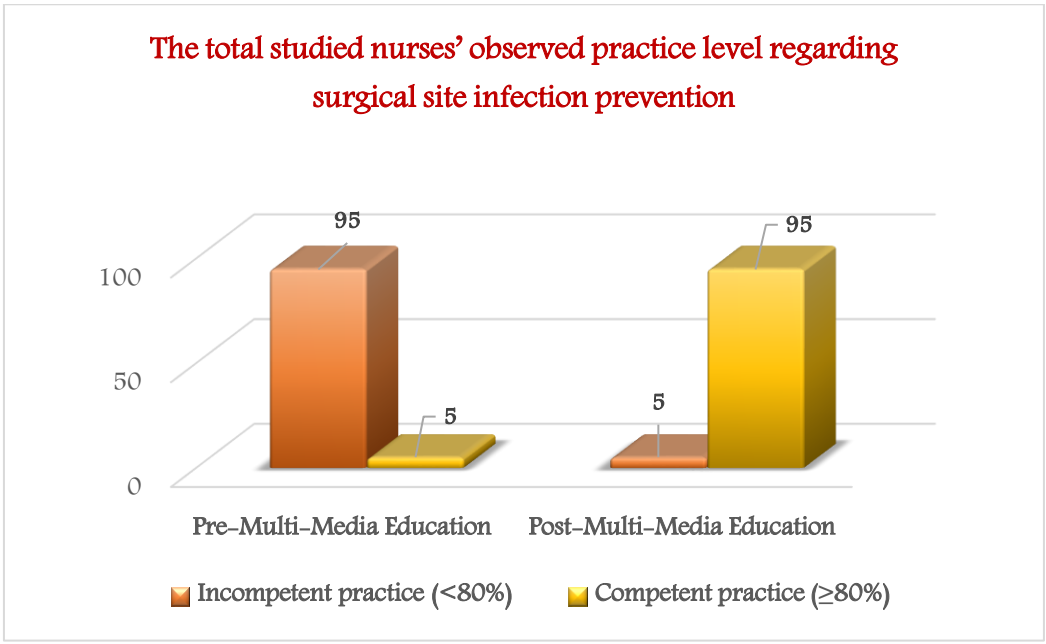

Figure (2): Total score of the studied pediatric nurses' knowledge regarding surgical site infection prevention.

Table (5): Correlation between the total studied pediatric nurses' knowledge and their observed practice regarding surgical site infection prevention

Item	The total studied Nurses' practice N=40			
	Pre-Education		Immediate-post Education	
	R	*P*	*r*	*P*
The total studied Nurses' knowledge	0.815	≤0.001**	0.413	≤0.001**

Correlation is significant at the 0.01 level (2-tailed). **
Correlation is significant at the 0.05 level (2-tailed).

Discussion:

Surgical site infection is one of the most serious complications of surgical procedures as well as the most prevalent types of healthcare-acquired infections (HAIs). The SSI prevention strategies require a multi-disciplinary approach that depends mainly on the awareness of health care providers. Nurses can help surgical pediatric patients avoid SSI by providing adequate post-operative wound care in PICU and ensuring thorough discharge planning after surgery **(Mengesha et al., 2020)**. Therefore, PICUs' nurses need continous education and training for more understanding and appropriate application of the surgical site management. Therefore, this study aimed to evaluate the effect of multimedia educational program on the pediatric nurses' performance toward surgical site infection prevention in PICU.

The personal and professional characteristics of the current research indicated that 60% of the participant nurses had a bachelor's degree in nursing with a mean age of (34.75±6.07) years old. The findings of this study illustrate the policy of the higher health authorities to employ the bachelor's graduates in PICU to raise the quality of the nursing care delivered to pediatric patients, as they have higher nursing knowledge and skills.

The results of this study are partially supported by **Hassan and Roudsary (2023)** who studied "Nurses' Knowledge and Practice Regarding Prevention of Surgical Site Infection at Governmental Hospitals in Wasit City, Iraq" that showed that, most of the studied nurses were over 30 years old, while only 10% of them had a bachelor's degree in nursing. Regarding the

remaining personal and professional data, around half of the participant nurses were female and married and had work experience of more than five years; additionally, the majority of them reported that their PICUs didn't have SSI prevention guidelines or bundles. All these findings are indicated by consistent studies of **(Elsharkawy, Badawy, Atia, & Hasaneen, 2019; Mengesha et al., 2020; Rabea, EL-Sheikh, Henedy, & Alabassy, 2022).**

In terms of knowledge about hospital-acquired infections, the current study reported a highly significant increase in the mean score of the post-test than pre-test score. This conclusion agreed with two consistent studies **(Goyal, & Chaudhry , 2019; Arafat, Mahdy, & El-Kashif, 2018)** who studied "Impact of Educational and Training Programs on Knowledge of Healthcare Students Regarding Nosocomial Infections, Standard Precautions and Hand Hygiene" and found highly significant improvements in the HAI overall score between pre- and post-test assessments of participants nurses, suggesting that education has a positive effect on the knowledge and practice associated with preventing HAIs. As regards HAI definition, timing, classification, and the wound healing process, the present study demonstrated highly statistically significant differences in the post-education knowledge test at (P≤0.001). This finding is supported by the study of **Belal et al. (2020), who studied "**In-services education program for improving nurses' performance regarding infection control measures in a rural hospital" and reported that "there were highly statistically significant improvements post-program implementation at (P < 0.0000) regarding the meaning, causative factors, and types of nosocomial infection.

Concerning the knowledge and practice of infection control precautions, the current results showed significant positive differences between the participant nurse's level of knowledge and practice pre- and post-multimedia education implementation. Similarly, educational programs done by **(Mehta, Gupta, Tripath, & Bansal, 2022; Hassan et al., 2018)** who studied "Educational Intervention to Foster Best Infection Control Practices Among Nursing Staff" which demonstrated a significant increase in the post-test results of their participants in comparison to pre-test results. These findings also highlight the significance of various teaching strategies, including multimedia modalities, being responsible for the major increase in knowledge in addition to practice changes in infection control practices.

Various management strategies have been implemented to control the multifaceted problem of inappropriate use of prophylactic antibiotic post-operative. By the way, nurses, being a key member of the antibiotic management team, could play an important role in controlling such problem, but there is insufficient research investigating nurses' practice regarding this subscale. Therefore, this study provided comprehensive multimedia content about appropriate administration of the prophylactic antibiotics and revealed significant improvement in the post-practice score, with a highly significant difference at (P≤0.001). Similar to our findings, the impact of educational intervention of **Butt, Ahmad, Saeed, Saleem, and Javaid (2019),** who have reported "remarkably improved rate of appropriate surgical antibiotic prophylaxis from 54% to 100% via educational intervention." Through their paper post-surgical antibiotic prophylaxis: Impact of pharmacist's educational intervention on appropriate use of antibiotics

Regarding the practical level of normal temperature and strict blood glucose management, this study found that there were statistically significant alterations between pre- and post-test assessment at (P≤0.001). Conversing with the studies of **(Mohamed, 2021; Rabea et al., 2022)** who studied "effect of bundled interventions to reduce site infection after gynecologic cancer surgery" and reported that "there were statistically insignificant differences between both study groups post-intervention regarding the appropriate management of vital signs and managing blood glucose level".

In relation to the nurses' practice level towards appropriate post-operative fluid management and nutritional support; the current results demonstrated significant improvements in the post-multimedia education practice score at (P≤0.001). In agreement with **Rabea et al. (2022)** who studied **"**Effect of pre-operative and intra-operative nursing intervention on surgical wound infection among surgical patients**"** and showed that using the nursing intervention as

appropriate fluid management and good nutritional support decreased surgical wound infection rates in the study group compared to patients who didn't receive it (the control group).

Surgical site care is a specific clinical area that contains multidisciplinary teamwork in which pediatric nurses play a vital role. Hence, the current study focused on demonstrating different multimedia content on surgical site assessment and care that improved the mean score of surgical site assessment and management in the preprogram assessment (2.50±0.87, 11.4±8.96 respectively) than in the post-test (5.70±1.06, 25.7±4.21) respectively), with highly statistically significant differences after the program implementation (P≤0.001). These findings are compatible with **Elsharkawy et al. (2019),** who concluded that "the educational module might significantly enhance nurses' practices on assessment and management of cesarean section-surgical site, and this will reduce the infection prevalence in their health care setting."

Surveillance plays an essential role in surgical-site infections (SSIs) prevention through monitoring changes in infection rates and evaluating the effectiveness of intervention strategies. Therefore, the current study demonstrated through the educational program the importance of performing frequent PICU Surveillance for detecting any type of SSI. This finding is supported by two studies **(Rabea et al., 2022; Uchino et al., 2019)** who studied "Efficacy of Preoperative Oral Antibiotic Prophylaxis for the Prevention of Surgical Site Infections "and demonstrated that "there was a significant alteration amongst both study groups as regards postoperative wound surveillance."

In accordance with the established guidelines and protocols, it is essential for caregivers of patients to obtain clear and consistent guidance throughout all phases of their children's care. **(Meoli et al., 2022)**. Therefore, the current study highlighted caregivers' education towards appropriate wound care using a multimedia approach, which revealed a highly significant improvement in the nurses' practice at the post-program score (23.45±3.43) compared to the pre-program score (12.23±7.43) at (P≤0.001). This significant finding agreed with the results of **Kaseje et al. (2018)** who studied **"**Health system assessment for safe surgical care in rural Nicaragua: a retrospective survey" that pointed out the importance of providing caregivers education on how to care for wounds of their children after discharge as a factor in preventing surgical site infections.

Regarding the correlation between the total nurses' knowledge and observed practice level, a statistically significant positive correlation was found regarding surgical site infection prevention before and immediately after the multimedia education implementation. This finding is matched with the results of **(Elsharkawy et al., 2019; El-soudany, 2018)** who studied **"**Effect of training program on nurses' performance regarding infection control measures in caring for patient with post-operative wound" and indicated a strong positive correlation between the total knowledge scores and practice scores of the participants.

For answering the study hypotheses, this study showed highly statistically significant improvements in the overall nurses' knowledge and observed practice score from the pre-phase to the post-implementation phase at ***(P≤0.001)***. This significant finding is supported by **Elsharkawy et al. (2019),** who stated that "the educational module might significantly enhance nurses' knowledge and practices regarding the prevention of CS-SSI." Additionally, there is a worthy harmonious study by **El-soudany, (2018),** which showed statistically significant increase in total knowledge and practice results in the post-implementation phase.

Limitations:

The small sample size and convenience sample recruited at PICU and only from single hospital restricted the generalization of the results to other hospitals in Egypt.

Conclusion:

From the present study, it can be concluded the multimedia educational program significantly improve the performance of the participant nurses on the prevention of surgical

site infection in PICU and had a positive effect that will reduce the infection prevalence in their PICUs.

Recommendations:

- Conducting additional randomized controlled trials within the pediatric and neonatal populations to enhance the understanding of their management.
- Further research should also assess the best teaching strategies, other than the multimedia approach, to improve nurses' SSI prevention performance.
- Continuing education courses for nurses to demonstrate competency in implementing multi-modal SSI prevention protocols and guidelines.

References:

Alshaya, M. A., Almutairi, N. S., Shaath, G. A., Aldosari, R. A., Alnami, S. K., Althubaiti, A., & Abu-Sulaiman, R. M. (2021). Original Article--Surgical site infections following pediatric cardiac surgery in a tertiary care hospital: Rate and risk factors. *Journal of the Saudi Heart Association*, *33*(1), 1–8.

Arafat, M. A., Mahdy, A. Y. & El-Kashif, M. M. (2018). The Effect of Evidence-Based Guidelines on Nurses, Performance in Respect to Nosocomial Infection at Medical-Surgical and Obstetrician Departments. American Journal of Nursing Research, 6(6), 507-514.

Ayed, M., Ismail, M., Hegazy, A., & Magor, N. (2022). Effect of using mind mapping about infection control on pediatric nurses' performance at Neonatal Intensive Care Units. *Tanta Scientific Nursing Journal*, *27*(44), 251–270.

Belal, S., Ahmed, S., Almessaid, Y., Mohamed Abobaker, R., Blesilda B. Llaguno, M., Mohammed Sanad, H., & Alkahtany, M. (2020). In-services education program for improving nurses' performance regarding infection control measures in a rural hospital. *Egyptian Journal of Health Care*, *11*(2), 702–718.

Butt, S. Z., Ahmad, M., Saeed, H., Saleem, Z., & Javaid, Z. (2019). Post-surgical antibiotic prophylaxis: Impact of pharmacist's educational intervention on appropriate use of antibiotics. *Journal of Infection and Public Health*, *12*(6), 854–860.

Catania, V. D., Boscarelli, A., Lauriti, G., Morini, F., & Zani, A. (2019). Risk Factors for Surgical Site Infection in Neonates: A Systematic Review of the Literature and Meta-Analysis. *Frontiers in pediatrics*, *7*, 101.

Elsharkawy, N., Badawy, A., Atia, G., & Hasaneen, N. (2019). Effect of Educational Module on Nurses Knowledge and Practices Regarding Prevention of Cesarean Section Surgical Site Infection (CS-SSI). Sylwan, 163, 201-221.

El-soudany, E. (2018). Effect of training program on nurses' performance regarding infection control measures in caring for patient with post-operative wound. *Port Said Scientific Journal of Nursing*, *5*(1), 1–26.

Gomarverdi, S., Khatiban, M., Bikmoradi, A., & Soltanian, A. R. (2019). Effects of a multi-component educational intervention on nurses' knowledge and adherence to standard precautions in intensive care units. *Journal of infection prevention*, *20*(2), 83–90.

Goyal, M., & Chaudhry, D. (2019). Impact of Educational and Training Programs on Knowledge of Healthcare Students Regarding Nosocomial Infections, Standard Precautions and Hand Hygiene: A Study at Tertiary Care Hospital. Indian J Crit Care Med, 23(2), 227–231.

Hassan, A. H., & Roudsary, D. M. (2023). Nurses' knowledge and practice regarding prevention of surgical site infection at governmental hospitals in Wasit City, Iraq 2022. *Pakistan Journal of Medical and Health Sciences*, *17*(1), 581–584.

Hassan, A., Athbi, A., & Widad, M. (2018). Effect of Infection Control Education Program on Nurses Staff's Knowledge in

Hemodialysis Units in Baghdad Teaching Hospitals.

Hrynyshyn, A., Simões, M., & Borges, A. (2022). Biofilms in Surgical Site Infections: Recent Advances and Novel Prevention and Eradication Strategies. *Antibiotics (Basel, Switzerland)*, *11*(1), 69.

Kaseje, N., Pinard, J., Louis, W.F., MacLee, J.L., Jeudy, A.P., & Ford, H. (2018). A multi-model intervention including an occlusive dressing and parental engagement to prevent pediatric surgical site infections for elective ambulatory procedures in a resource-constrained setting: An observational retrospective study from a tertiary center in Central Haiti. Pediatr. Surg. Int, 34, 891–895.

Khalafallha, H.D., Mohammed, S.A., & Bahnsawy, N.S. (2018). Effect of Designed Wound Care Guidelines for Pediatric Nurses on Occurrence of Surgical Site Complications. American Journal of Nursing Science, 7(6), 239-249.

Mehta, A., Gupta, A., Tripath, K., & Bansal, H. (2022). Impact of educational interventions on the awareness regarding hospital infection control practices among the medical students. *Medicina Moderna - Modern Medicine*, *29*(3), 227–234.

Meng, L., Li, J., He, Y., Xiong, Y., Li, J., Wang, J., Shi, Y., & Liu, Y. (2020). The risk factors analysis and establishment of an early warning model for healthcare-associated infections after pediatric cardiac surgery: A STROBE-compliant observational study. *Medicine*, *99*(49).

Mengesha, A., Tewfik, N., Argaw, Z., Beletew, B., & Wudu, M. (2020). Practice of and associated factors regarding prevention of surgical site infection among nurses working in the surgical units of public hospitals in Addis Ababa city, Ethiopia: A cross-sectional study. PLoS ONE 15(4).

Meoli, A., Ciavola, L., Rahman, S., Masetti, M., Toschetti, T., Morini, R., Dal Canto, G., Auriti, C., Caminiti, C., Castagnola, E., Conti, G., Donà, D., Galli, L., La Grutta, S., Lancella, L., Lima, M., Lo Vecchio, A., Pelizzo, G., Petrosillo, N., & Simonini, A. (2022). Prevention of Surgical Site Infections in Neonates and Children: Non-Pharmacological Measures of Prevention. *Antibiotics (Basel, Switzerland)*, *11*(7), 863.

Mohamed, A. (2021). effect of bundled interventions to reduce site infection after gynecologic cancer surgery; 5(2), 108

Nicolazzo, D., Rusin, E., Varese, A., & Galassi, M. (2023). Negative Pressure Wound Therapy and Traditional Dressing: An Italian Health Technology Assessment Evaluation. *International Journal of Environmental Research and Public Health*, 20(3), 2400.

Rabea, E., EL-Sheikh, A., Henedy, W., & Alabassy, M. (2022). Effect of pre-operative and intra-operative nursing intervention on surgical wound infection among surgical patients. *Menoufia Nursing Journal*, *7*(2), 53–72.

Tesfaye, T., Dheresa, M., Worku, T., Dechasa, D. B., Asfaw, H., & Bune, A. J. (2022). Surgical site infection prevention practice and associated factors among nurses working at public hospitals of the western part of southern nation, nationalities, and peoples' region, Ethiopia: A cross-sectional study. *Frontiers in surgery*, *9*, 1013726.

Uchino, M., Ikeuchi, H., Bando, T., Chohno, T., Sasaki, H., Horio, Y., Nakajima, K., Takesue, Y. (2019). Efficacy of Preoperative Oral Antibiotic Prophylaxis for the Prevention of Surgical Site Infections, 269(3), 420-426.

Woldegioris, T., Bantie, G., & Getachew, H. (2019). Nurses' knowledge and practice regarding prevention of surgical site infection in Bahir Dar, Northwest Ethiopia. *Surgical Infections*, *20*(1), 71–77.

Zukowska, A., & Zukowski, M. (2022). Surgical Site Infection in Cardiac Surgery. *Journal of clinical medicine*, *11*(23), 6991.