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## Abstract

Background: Improving nursing knowledge and practice regarding patient safety is very essential that can be achieved through developing standards of intraoperative nursing interventions, clear identification of deficiencies in provision of care, and increasing nurses' awareness regarding their vital role in saving patient life through safe practice. Therefore, the study aimed to evaluate the effect of implementing a designed educational program on nurses' performance regarding intraoperative surgical patient safety. To fulfill the aim of the study the following **two research hypothesis** was formulated: )) there was a significant improvement in nurses' knowledge and practice regarding intraoperative surgical patient safety after implementing the educational program. Y) There was a significant and positive correlation between nurses' knowledge and practice after implementation of the program. Quasi-**Experimental research design** was utilized to achieve the aim of the study. **Setting:** this study conducted in specified surgical departments involving (general surgery, orthopedic, urology, and neurology departments) at Benha University Hospital. Convenient Sample of *i*, operating room nurses who were actually working in previously mentioned departments had been recruited in the study. Two tools were used to collect data: I: observational checklist (adapted by investigator to assess nurses' practice) II: Structured interviewing questionnaire sheet (developed by investigator to assess nurses' knowledge). The **Results** revealed that there is statistically significant positive improvement in nurses' performance (knowledge and practice) after program implementation as (p-value at  $\leq \cdot, \cdot^{\circ}$ ). **Conclusion:** on the light of the study' findings, it can be concluded that nurses' knowledge and practice were poor at pre-program while it had been improved at post program phase (immediate & after <sup>r</sup> months) which reflects that educational program was effective and improve nurses' performance regarding patient safety at three phases of operation (sign in , time out, sign out). The study recommended that creating ongoing educational sessions for operating room nurses and periodic refresher training courses should be provided for updating nursing knowledge and practice regarding surgical patient safety.

#### Key words: knowledge, patient safety, program, practice.

#### Introduction

Surgery can be considered as an invasive special medical procedure performed on all parts of the human body to diagnose or treat illness, correct deformities and defects, repair injuries and cure certain diseases. General surgery is the basis for all surgical specialties that emerged as a result of understanding the etiology of various disease processes and using treatment for various parts of the body. Each specialty involves specific surgical procedures to perform (*Mohamed et al.*,  $7 \cdot 17$ ).

Patient safety refers to is the reduction of risk of unnecessary harm associated with health care team; it covers both absence of harm to patient and actions taken for harm prevention, and also includes structuring of care processes

that eliminate known causes of common errors (**Ingvarsdottir & Halldorsdottir**, (1,1)). It is considered the cornerstone of healthcare quality and providing safe patient care is one of the significant challenges in operating theatre because half of all surgery related iatrogenic events and complications are preventable (**Alhabahbeh et al.**, (1,1)).

Perioperative period extends from the moment when the patient enters the operating theatre doors until the moment when leaves through those same doors post-procedure. Intra operative phase can be classified into three phases which are: sign in (before induction of anesthesia), time out (since anesthesia induction until skin closure), sign out (after completion of procedure). During each phase certain practices should applied by surgical team to provide safe care for each patient (*Whitlock*,  $f \cdot 1A$ ).

However, operating theatre is a place where highly complex care is provided and several factors contribute to human mistakes than in other hospital departments as; different team compositions from day to day, complex surgery, high-risk medication, time pressure, high patient turnover and need for rapid intervention in the case of emergency surgery. Each member of surgical team (consisting of the surgeon, anesthetist, and perioperative nurses) should act under the principle of "no harm or errors" (*Wacker*,  $f \cdot f \eta$ ).

Threats of surgical patient safety due to improper practices ineffective or communication among surgical team members include: wrong site surgery, drug related events as allergic reactions or skin rashes, physical injuries, diathermy related burns, surgical specimen mishandling, improper blood loss management, environmental hazards, retention of surgical items inside the wound, health care associated infection, and anesthesia related complications as cardiac arrythmiasis, cardiac arrest, intra or post-operative patient death (Townsend et al., f. 10).

The role of operating room nurses to achieve national patient safety goals depends on

following specific guidelines and polices including: identify patient and site marked correctly, use anesthetic agents safely, specify patient safety risks as blood loss and airway difficulty or aspiration, minimize the risk for surgical site infection, proper diathermy grounding padding, accurate labeling of surgical specimen, accurate counting of surgical items(before, during, after operation), following principles of aseptic technique, control of environmental potential hazards , and improve interpersonal communication (*Heideveld et al.*,  $Y \cdot 1A$ ).

#### Significance of the study

Improving nursing knowledge and practice regarding patient safety is very essential that can be achieved through developing standards of intraoperative nursing interventions, clear identification of deficiencies in provision of care, and increasing nurses' awareness regarding their vital role in saving patient life through safe practice (Abd Elaty et al., Y. 12). Training has been shown to decrease error and increase the ability to solve problems, particularly for inexperienced professionals, whereas failure of training is often attributed as a major cause of complications and incidents (Cynthia & Danko, 7.19).

According to annual statistical report of Benha University Hospital, there is a significant increase in number of operations of major surgeries performed was  $\gamma \cdot \Lambda \xi$  while in  $f \cdot f \cdot f$  the number increased into  $f \cdot f \cdot f$ operation. While reached into ££877 in 7.1A with increased demands of quality of care provided and "no patient harm". Furthermore, a systematic review revealed that \ in every *vo.* patients admitted to a hospital dies due to adverse event, and almost two-thirds were related to surgical care. The majority of these events were preventable and not caused by technical problems but a failure of teamwork skills, leadership, communication, decisionmaking and situational awareness (Aboel-Seoud et al., T. 10).

In addition, current reports suggested that among  $\forall \pi^{*}$  million surgeries that performed all over the world every year, two million deaths occur and  $\vee$  million patients were victims of post-surgical complications, half of them were preventable. Complication rates in developed countries ranged between  $\pi$  and  $\neg \gamma$  and, for every  $\pi \cdot \cdot$  patients admitted, one dies (*Haissa, et al., \uparrow \cdot \uparrow \uparrow*).

Moreover, a study which done in surgical departments at Benha university hospital by Mohamed et al., *r*.*tv* revealed that intraoperative nurses' safety practices regarding surgical patients was unsatisfactory along three phases of surgery (sign in, time out, sign out) so, those patients had experienced adverse events and harm in postoperative departments. Therefore, a designed educational program is chosen for operating room nurses to improve their knowledge and practice regarding intraoperative surgical patient safety.

## Aim of the study

The study aimed to evaluate the effect of implementing a designed educational program on nurses' performance regarding intraoperative surgical patient safety.

### **Research hypothesis:**

The following research hypotheses were formulated to be tested in this study:-

**H':** There will be a significant improvement in nurses' knowledge and practice regarding intraoperative surgical patient safety after implementing the educational program.

**H**<sup>**\cent**</sup>: There will be a significant and positive correlation between nurses' knowledge and practice after implementation of the program.

#### Subjects and method

**Research Design:** Quasi-Experimental design (pre-test, immediate post-test, follow

up after r months) was utilized to fulfill the aim of this study.

**Setting:** The study was conducted in specified surgical departments involving (general surgery, orthopedic, urology, and neurology departments) at Benha University Hospital.

**Sample:** Convenience sample of  $\neg$ . operating room nurses were participated in the current study who were actually working in the previously mentioned surgical departments and distributed into: ( $\uparrow \neg$ anesthesia nurses,  $\uparrow \uparrow$  scrub nurses,  $\uparrow \uparrow$ circulator nurses).

### Tools of data collection

## Tool I - Structured interviewing questionnaire sheet :( *Appendix I*):

It was developed by the researcher to assess nurses' knowledge regarding intra operative surgical patient safety. It comprised of two parts;

Part one: Socio demographic characteristics of nurses as age, sex, marital status, level of education, current position, role, years of experience, and attendance of pervious training programs.

#### Part two: Self-administered nurses' knowledge assessment sheet including:

- Definition and phases of surgery

- Threats of patient safety in operating theatre.

- Nursing role to maintain patient safety during operative time

-Nursing role to maintain patient safety during anesthesia.

Scoring system: - Correct answer was given score (1) - Incorrect answer was given score (1)

Tool II- Intraoperative Nurses' Safety Practices Observational Checklist (Appendix II) (WHO  $\rarthinspace{1}{'}$  & Alaaa-Eldeen, et al.,  $\rarthinspace{1}{'}$ ): It was modified by the researcher to evaluate practical level of each nurse regarding surgical patients' safety throughout three phases of operation (Sign in, Timeout and Sign Out) including:

- ۱\_ **Circulator nurses' practices regarding** patient safety as; ensuring environmental safety. ensuring availability of anesthesia equipment and needed supplies, confirmation of patient identity, type of operation, site marked, and written consent, preparations of patient for surgery and anesthesia, bleeding assessment, safe risk positioning of patient, diathermv padding, assessing the patient for the risk of allergy, repeat counting of instrument with scrub nurse, Safe handling with surgical specimen, and environmental hygiene and disinfection).
- ۲\_ Scrub nurses' practices regarding patient including; safety Hand scrubbing, gowning, gloving, Skin antisepsis, draping the patient, counting instruments (before, during, after) operation, handling surgical equipment to surgeon aseptically ,cleansing, disinfection, and sterilization instruments.
- ۳- Anesthesia nurses' practices regarding patient safety as; Patient preparations for anesthesia, frequent Monitoring and evaluation of anesthetized patient condition. prophylactic antibiotics administration, immediate post-anesthesia care (during recovery from general anesthesia), and

safe transferring of patient to post anesthesia care unit.

### Scoring system:

- Done correctly was scored as (<sup>Y</sup>)
- Done incorrectly was scored as (1)
- Not done was scored as (•)

#### Method

<sup>1</sup>. Approval to conduct the study was obtained from the responsible authorities of Benha University Hospital after providing an explanation of the study aim.

<sup>Y</sup>. The tools were developed by the researcher based on the recent relevant literature. Content Validity was tested by ° (professors) experts in the field of medical surgical nursing (two professors from Mansoura University and three assistant professors from Benha University). Accordingly, all necessary modifications were done.

 $\degree$ -Nurses'knowledge questionnaire & Observational Checklist were tested for its reliability using **Cronbach's Alpha Coefficient Statistical test** which revealed that the reliability of the tools were (•.٩°, •.^Y respectively) indicating high reliability

 $\xi$ . A pilot study was conducted on 1.% of study' subjects (3nurses) to test feasibility of the study, as well as objectivity of the tools. Modifications were done accordingly and the subjects who shared in the pilot study were excluded from the actual sample.

•. The investigator explained the purpose of the study to nurses and obtain formal consent to participate in the study, and every nurse informed that confidentiality would be assured. <sup>1</sup>- The researcher started to collect data from *the beginning of September*  $f \cdot 1/4$  *to the end of august*  $f \cdot 1/4$  in the following sequence:

A- Assessment Phase (*pre -test*): aims to assess nurses' performance (knowledge and practice) before implementing the program. Data were collected within ^weeks *using Tool I & Tool II* through:

- Knowledge questionnaire was introduced by the researcher to nurses either individually or in groups in their work place. Then, explanation of content was done by the researcher so each nurse could be able to fulfill it. The average time taken to fill the tool was <sup>r</sup>·-<sup>£</sup>· minutes.
- Direct observation was conducted by the researcher to appraise practical skills of each nurse regarding patient safety along (sign in, time out, sign out) phases. The researcher evaluated each skill and filled out checklist.

B-The designed program was implemented over 17 weeks. The participated nurses divided into 17 subgroups and each group was (°nurses/session). Each group was attended program sessions separately during morning and afternoon shift .They received four sessions (one theoretical session and three practical sessions) within four days ("weeks /area). The duration of each session was about <sup>£</sup>° minutes including periods of discussion according to nurses' progress and feedback; they were divided into groups. During <sup>st</sup> session small (theoretical session), the researcher explained aim of the program to participated nurses and gave them booklet as a guide. Its content involved general knowledge as (surgery phases, patient anesthesia types, safety definition, threats of patient safety, and

role maintain patient nursing to safety).the researcher utilized lecture and printed materials for knowledge provision. While during three practical demonstration sessions, and redemonstration were utilized and training videos concerning patient safety skills were displayed on lab top. During each session, simple words and Arabic language were used to suit nurses' level of understanding. At the end of each session the researcher, close the session by summary for the main points and each nurse was encouraged to ask questions and interject their own experiences. Post- test was done at the end of the  $\xi^{\text{th}}$  session using tool I, II.

#### C- Post Test (immediate & follow up):

Aims to evaluate nurses' performance regarding intraoperative surgical patient safety after implementing the program to identify progress in term of differences in nurses' knowledge and practice level, it was done two times; immediate posttest and follow up after r months of program implementation using *tool I* and tool II.

## Statistical analysis:

- The collected data were scored; tabulated and analyzed using statistical package for the social science (SPSS) Program version YY.
- Descriptive as well as parametric inferential statistics was utilized to analyze data pertinent to the study.
- Quantitative variables were expressed as mean & standard deviation (SD).
- Number (N) and percent (%) were used for presenting qualitative variables.

4	Chi-square test $(X^{T})$ was used to examine the relation between qualitative variables.	4	The observed difference, associated was considered as following:
∢	Correlation (r) test was used. Probable P	•	$P > \cdot \cdot \circ - \dots - Not$ Significant
1	error should not exceed °/.	•	$P \leq \cdot \cdot \circ$ Significant
4	score of knowledge.	•	$P \leq \cdot, \cdot, \cdot$ High Significant
Res	sults:		

Table (1): Distribution of operating room nurses according to their socio-demographic characteristics (n=3.)

Demographic characteristics		n= 、					
	No	%					
Age ( years)							
$\gamma \cdot - < \gamma \cdot$ years	۲۸	٤٦٫٧					
$r \cdot - < \epsilon \cdot$ years	10	۲۰٫۰					
$\geq \mathfrak{t} \cdot \text{years}$	17	۳_۸۲					
Mean $\pm$ SD $\gamma \gamma$ . $\gamma \lambda \pm \gamma \gamma$ . $\gamma \lambda$	,						
Gender							
Male	1 £	٢٣_٣					
Female	٤٦	v1 <u>.</u> v					
Qualification Attainment							
Diploma nurse	٣٥	٥٨٫٣					
Technical institute nurse	۲.	٣٣_٣					
Bachelor nurse	٥	٨.٤					
Years of experience							
< ° years	۲۱	۳۰.۰					
$\circ - < \circ$ years	١٣	Y 1 Y					
$1 \cdot - < 1^{\circ}$ years	٩	10					
$\geq$ 1° years	1 Y	۳_۸۲					
Mean $\pm$ SD $\gamma \pi$ . $\pi \circ \pm$	1.75						
Attendance of training programs related to intraoperative care and patient safety							
Yes	14	۳۰.۰					
No	٤٢	٧٠.٠					

The characteristics of the study subjects are described in table (1), revealing that, less than one half of studied subjects  $(\xi_1, V_1')$  within age group that ranged from  $\tau$  to less than  $\tau$ , years with the mean age  $\tau\tau_1 \tau_1 \pm \tau_1 \cdot V_1'$  years old. More than three fourths  $(V_1, V_1')$  were female. more than one half of studied nurses  $(\circ \Lambda, \tau_1')$  were diploma nurse and the majority  $(\Lambda^{\intercal}, \tau_1')$  of them were nurse. Also, more than one third  $(\tau \circ \lambda')$  had experience ranged from  $\circ$  to less than  $\gamma$ , years with the mean

years of experience  $\gamma, \gamma \circ \pm \gamma, \gamma \gamma$  years. More than two thirds  $(\gamma, \gamma)$  of studied nurses didn't attend any pervious training programs related to patient safety.

Table ( $\uparrow$ ): Distribution of total knowledge score level of studied nurses regarding intraoperative surgical patient safety at different three phases of program implementation  $(n=\uparrow \cdot)$ 

Phases of the	Total knowledge score level								
program	<b>Poor</b> (< ۲۰٪)		Average (۲۰٪ to <۷۰٪)		Good (≥ ∀ ≎ ٪)		X	P-value	
	N	%	N	%	N	%			
Pre – program	٤٩	A1.Y	٧	11.4	٤	٦.٦	۱٤٧ ٤٩	<• •• 1	
Immediate post	١	١.٧	١	١.٧	01		• • •	**	
program						٩٦ <u>,</u> ٦			
Follow up <sup>r</sup>	١٣	۲۱٫۷	۲۷	٤٥	۲.	٣٣.٣			
months									

(\*\*) Highly statistical significant difference ( $P \leq \cdots$ )

This table shows that there was highly statistical difference in nurses' total knowledge score level at pre, immediate post and follow up of program implementation as p-value is  $< \cdots$ .

Table ( $\mathcal{T}$ ): Distribution of total practice score satisfaction level of anesthesia nurses regarding surgical patient safety at different phases of program implementation (n=1,1)

	Total practice score level							
Phases of the program	$(\text{Score} \leq \sharp  \sharp)$		(Score > f f)		X	P- value		
	Ν	%	Ν	%				
Pre – program	١٤	۸۷.٥	٢	17.0		.••\**		
Immediate post – program	٤	۲۰.۰	١٢	۷٥	۹			
Follow up (after <sup>r</sup> months)	٧	٤٣٨	٩	07 <u>.</u> 7				

(\*\*)Highly statistical significant difference ( $P \leq \cdots$ )

**Table** (*"*) shows that the majority of anesthesia nurses ( $\wedge \vee \circ \%$ ) had unsatisfactory level of practice regarding surgical patient safety at pre-program phase while it became satisfactory among ( $\vee \circ \cdot \%$ ,  $\circ \neg \cdot \%$ ,  $\circ \neg \cdot \%$ , respectively) of them at post program and follow up periods of program implementation with highly significant statistical difference as p value at ( $\cdot \cdot \cdot \uparrow$ ).

Table ( $\mathfrak{t}$ ): Distribution of total practice score satisfaction level of circulator nurses regarding surgical patient safety at different phases of program implementation (n= $\mathfrak{t}\mathfrak{t}$ )

	Total practice score level						
Phases of the program	Unsatisfactory (Score $\leq AA$ )		Satisfactory (Score $> AA$ )		X	P-value	
	(	, ,	()	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,			
	No	%	No	%			
Pre – program	۲.	٩٠.٩	٢	۹.۱			
Immediate post - program	١	٤.٦	۲۱	٩٥.٤	۳۳.۰۹۱	< •.•• )**	
Follow up after <b>*</b> months	۱.	٤0.0	17	٥٤.٥			

(\*\*)Highly statistical significant difference ( $P \le \cdots$ )

*Table ( f) reveals that* the most of circulator nurses  $({}^{\bullet}, {}^{\bullet}, {}^{\circ})$  had unsatisfactory level of practice prior to program implementation. Whereas, they had satisfactory level during immediate post program and follow up periods of program implementation  $({}^{\circ}, {}^{\epsilon}), {}^{\circ}, {}^{\circ}, {}^{\circ}$  respectively).

Table (°): Total practice score level of scrub nurses regarding surgical patient safety at different phases of program implementation  $(n=\gamma\gamma)$ 

	Total practice score level							
Phases of the program	Unsatisfactory ( Score ≤ ^٦)		Satisfactory (Score > ^٦)		X۲	P-value		
	No	%	No	%				
Pre – intervention	١٧	۷۷٫۳	٥	٧.77	۱۸ <sub>.</sub> ۷۳۳	< •.•• )**		
Immediate post - intervention	٣	۱۳٫٦	١٩	٨٦.٤				
Follow up after $$ <sup><math> au</math></sup> months	٨	٣٦.٤	۱ ٤	٦٣.٦				

(\*\*)Highly statistical significant difference ( $P \leq \dots$ )

From the findings of the pervious table, it was shown that more than three fourths of scrub nurses  $(\forall \vee, \forall')$  had unsatisfactory level of practice regarding surgical patient safety at preprogram phase. on the other hand, their practice improved to be satisfied among  $(\land \forall, \pounds, \%)$ ,  $\forall \forall, \forall \%$  respectively) immediately post program implementation and follow up.

## Table ( $^{1}$ ): Distribution of practice satisfaction level of studied nurses regarding surgical patient safety different phases of program implementation (n= $^{1}$ .)

Phases of the program	Total practice score level						
F9	Unsatisfactory		Satisfactory		X۲	P-value	
	No	%	No	%			
Pre – program	٥١	٨٥.٠	٩	10			
Immediate post - program	٨	١٣.٣	ہ ۲	٨٦٧	٦٢٣٤	< •.•• )**	
Follow up after <sup>r</sup> months	۲۷	٤٥. •	٣	00.*			

(\*\*)Highly statistical significant difference  $(P \leq \cdots)$ 

From the findings of the pervious table, it was shown that there is highly statistical difference and improvement in operating room nurses' (circulator, scrub, and anesthesia) practices regarding surgical patient safety as p value was  $\leq \cdots$ ).

Table ( $^{\vee}$ ): Correlation between total nurses' knowledge and practice scores pre and post program implementation (n =  $^{\vee}$ ).

Total knowledge score	r	P -value
Total practice score		
Pre program	.770	.• £1*
Immediately post program	۳٤٨.	. •
Follow up (post <sup>r</sup> months)	<sub>.</sub> ٧٤٦	<•.••)**

This table shows, there were highly a statistical significant positive correlation between nurses' total knowledge and practice immediately post program implementation and follow up observed as  $(r = ., \forall \xi \land with P value < ... \lor \& r = ., \forall \xi \land with P value < ... \lor ).$ 

#### Discussion

The current study findings revealed that less than one half of subjects were within age group that ranged from  $\checkmark \cdot$  to less than  $\urcorner \cdot$  years with the mean age  $\urcorner \urcorner \land \land \pm \land \cdot \land \lor$  years old. This is in agreement with that of (**Bohomol & de Abreu**,  $\urcorner \cdot \urcorner \urcorner$ ) who revealed that the average age of studied nurses was  $\urcorner \circ$  years old. While, there is disagreement with that of (**Yuh Ang et al.**,  $\urcorner \cdot \imath \urcorner$ ) who stated that most of studied nurses were less than  $\urcorner \circ$  years of age. This may be due to newly graduated nursing personnel in surgical departments.

Concerning years of experience, the study findings revealed that more than one third of studied nurses had experience ranged from  $\circ$  to less than  $\cdot \cdot$  years with the mean years of experience  $\cdot \uparrow \cdot \uparrow \circ \pm \cdot \cdot \uparrow \uparrow$ years. This comes in agreement with (Hemmat et al.,  $\uparrow \cdot \uparrow \circ$ ), who approved that work experience of studied subjects was less than  $\lor$  years. In addition, (Labrague et al.,  $\uparrow \cdot \uparrow \uparrow$ ) clarified that length of clinical experience of most of nurses had rendered  $\cdot$  to  $\circ$  years. As regards to qualification and the current position, the current study results clarified that more than one half of studied nurses were diploma nurse and the majority of them were nurse. This finding is consistent with the study done by **Brasaité et al.**,  $(\uparrow \cdot \uparrow \uparrow)$  who explained that most of studied operating room nurses were medical school graduate and the main base-qualifications were a non-university bachelor. In addition, this is supported by **Adejumo and Olatunji**  $(\uparrow \cdot \uparrow \uparrow)$  when they reported that above sixty percent of nurses had diploma certificates. This may due to nursing management system which doesn't support surgical wards with bachelor graduated nurses.

Regarding pervious attendance of training programs, the study findings clarified that more than two thirds of studied nurses didn't attend any pervious training programs related to patient safety. This is in agreement with that of (*Alaaa-Eldeen, Saad & Elrefaee,*  $f \cdot f$ ) who stated that most of the studied nurses had no training programs related to anesthesia and patient safety. This may be due to lack of relevant training chances provided by nursing authorities and availability of other sorts of training programs.

The current study revealed an obvious improvement in the total knowledge scores of nurses post program implementation as compared to pre its implementation with highly statistically significant difference. This finding is congruent with *Fadllalah & Ibrahim*,  $(I \cdot I f)$  who found an improvement in nurses' knowledge mean score after implementing of training program with highly statistically significant differences (P =  $\dots$ ) as the mean of nurse's knowledge in pretest  $(I' \cdot I' t)$  to be  $(\xi \cdot \xi \xi \pm \cdot I' \cdot )$  in posttest which get better to be  $(\xi \cdot I' \xi \pm \cdot I' \cdot )$  at post-test II.

As regards to circulator nurses' practical *level*, the current study revealed that there was significant statistical difference in subtotal scores regarding surgical patient safety at pre, immediate post, and follow up after three months of program implementation. This finding is congruent with that of Shoemaker, Rieker and Sparkman (*r*.*i*.), who stated that preoperative assessment, ensuring the patient identity, and applying electrosurgical grounding, pads, tourniquets, and monitors are core responsibilities of circulator nurses. In addition, Association of Registered (AORN), ۲.۱۹ approved Nurses that perioperative nurses' training had a good impact on prevention of positioning injury through anticipation of the positioning equipment necessary based on the patient's identified needs, application of correct body mechanics principles, ongoing assessment throughout perioperative period, and coordination with the entire perioperative team.

As regards to scrub nurses' practical level, the current study revealed that there was significant statistical difference in their scores regarding aseptic technique practices at pre, immediate post, and follow up after three months of program implementation. This finding is congruent with that of *Labrague* et al., (*f*.*f*) who stated that, majority of studied nurses  $(\circ \vee, \vee \in \mathcal{X})$  had a competent level of practice regarding principles of sterile technique and demonstrated it in " a great extent " regardless their age, gender, years of experience, position or educational qualification. In addition, Gates & **Rose**,  $(\gamma, \gamma)$  revealed that structured training program for scrub nurses had been significantly improved their practical performance regarding patient safety and minimize occurrence of adverse events ( $p = \cdot \cdot \cdot )$ ).

The current study revealed that there was a great improvement in studied nurses (scrub, circulator, anesthesia) nurses' practices regarding patient safety along three phases of operation (sign time out, sign out) after program in implementation . This finding is consistent with that of Aboel-Seoud et al., (Y. 10) who showed that operating room nurses ' level of practice during sign in, time out, and sign out phases had been greatly improved after implementation of WHO Surgical Safety Checklist items. Similarly, these results were consistent with Eshun et al..  $(\mathbf{r}, \mathbf{r})$  who reported that majority of nurses (>٩٣%) viewed satisfactory level of practice after guidelines protocol for surgical patient safety.

This table shows, there were highly a statistical significant positive correlation between nurses' total knowledge and practice immediately post program implementation and follow up observed as  $(r = . \forall \xi \land with P value < . \cdot \cdot \forall \& r =$  $.^{\forall \xi \forall}$  with p value  $< \cdots$ ). This finding supported by Fekry and Ali, (1.1.) who clarified that the practice of operating room nursing improved thorough theoretical knowledge that increase nurses' ability to prioritize interventions and all kinds of knowledge must be used in order to ensure professionally safe practice of the discipline. In addition, study done by Suominen et al., (7.17) who showed that the more nurses' knowledge about patient safety, the better skills regarding safe patient' care ( $p = \cdot \cdot \cdot \cdot$ ). On the same line, Gaffney et al., (7.17) showed that total mean scores of nurses' knowledge and practice were positively related and minimize risk of patient' harm ( $p = \dots$ ). Also, *The American* Association of Colleges of Nursing, (Y. ), recommended that improving nurses' practice mainly depends upon improving knowledge regarding patient' safety principles.

#### Conclusion:

The program was effective as evident by great improvement in nurses' performance (knowledge and practice) at immediate and follow up observed as (p value at  $\leq \dots \leq \dots > 1$ ).

#### **Recommendations:**

Based on the results of the present study the following recommendations can be suggested:

- Continuous training courses should be implemented for operating room nurses to update their knowledge and practice regarding patient' safety.
- Developing Arabic version of "WHO surgical safety checklist' as guidance for patient' safety strategy during (sign in, time out, sign-out) phases..
- Application of patient's safety concepts course in the nursing student curriculum

#### For further research:

• The study should be replicated on large sample & different hospitals setting in order to detect and generalize the results.

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