

Nurses' Knowledge and Practice Regarding Patient Safety in Operating Room

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Abstract

Background: Patient safety in the operating room (OR) has always been a major public health concern. Improving patient safety in OR is an increasing priority for nurses as sentinel events can be catastrophic for patients, caregivers, and institutions. **Aim:** the study aims to assess the nurses' knowledge and practice regarding patient safety in operating room. **Research design:** An exploratory descriptive design was utilized to achieve the aim of the study. **Setting:** the study was carried out in the general operating rooms at Zagazig university hospital. **Study subject:** A convenient sample of 40 nurses who are working in the previous mentioned setting **Tools:** **Tool (I) Nurses' Self-administered Questionnaire: the first part:** it was concerned with demographic data of the studied nurses. **The second part:** it was used to assess nurses' knowledge regarding patient safety in operating room. **Tool (II) Nurses' observational Checklist:** It was concerned with assessment of nurses' level of practice regarding patient safety in operating room. **Results:** the result revealed that, 55% of studied nurses had unsatisfactory level of knowledge regarding patient safety in operating room. As well, 43 % of studied nurses had incompetent level of practice regarding patient safety in operating room. **Conclusion:** the current study concluded that more than half of studied nurses had unsatisfactory level of knowledge regarding patient safety in operating room. As well, less than half of them had incompetent level of practice regarding patient safety in operating room. **Recommendations:** The study recommended On-going and regular in-service training courses regarding evidence-based guidelines should include patient safety checklist in the operating room.

Keywords: Nurses' Knowledge and Practice, Patient safety, Operating room

Introduction

The operating room (OR) is the unit of the hospital environment where anesthetic-surgical, diagnostic and therapeutic procedures are performed, both elective and emergency. It is a specialized world where ignorance or inadequate safety measures may cause many hazards that can affect the patient and the operating team as well. The operating room environment is charged with various hazards that can be classified as: physical hazards,

accidental hazards, chemical hazards, biological hazards and other hazards, such as organizational, psychological, and atmospheric. Also, recognition of these potential hazards through awareness and constant vigilance can control the OR environment and make it a safe haven for the patient as well as for the theater team (Chowbey, 2023).

Patient safety is an integral part of quality healthcare; it has become vital component for the decision makings of policymaker, healthcare

providers, educators, and top managers. It is the avoidance of unintended or unexpected harm to people during the provision of health care. Efforts done to support the providers to minimize patient safety incidents and drive improvements in safety and quality. Patients should be treated in a safe environment and protected from avoidable harm (**Kuriakose et al., 2020**).

Safety in the operating room (OR) has always been a major public health concern. It refers to the safety of both the patient and the working personnel. Improving patient safety in OR is an increasing priority for nurses as sentinel events can be catastrophic for patients, caregivers, and institutions (**El-sayed et al., 2021**).

The operating room nurses are a special type of practicing nurses directed toward caring with patient undergoing general surgery to prevent complications and maintain patient safety. They are specially trained to handle the fast phasing environment with accuracy while maintaining professional approach towards patient care. These nurses are packed with complete existence in all corners of the operating room. Their knowledge and skills are constantly challenged depending on the demands of the procedure and their surgical team (**Singh et al., 2023**).

The intra operative nursing safety practices can be performed during three phases of operation which are sign in, time out and sign out according to WHO surgical safety checklist which established to decrease most commonly occurring but avoidable risks that endanger the health and well-being of surgical patients. Efforts to improve safety and overall quality focus on improving practices during three phases of operation according to WHO surgical safety checklist identified practice checks for defined time points during operations. The included items are aimed at preventing uncommon but serious errors by reminding the surgical team to confirm patient identity, surgical site, and other important characteristics such as allergies or anticipated complications (**Ali et al., 2022**).

Significance of the study

Over 300 million surgical procedures are performed each year worldwide. Despite awareness of adverse effects, surgical errors continue to occur at a high rate and approximately 10% of preventable patient harm in health care was reported in surgical settings. The report states that unexpected, major complications arise in 3–22% of surgical procedures, that the death rate is estimated as 0.4–0.8% and that a large proportion of these complications may be prevented. Progress has been made regarding patient safety in the OR in recent decades, but the rates of complications and mortality remain too high (**WHO, 2023**).

According to annual statistical report of Zagazig university hospital, it was shown that total number of major surgeries performed was 10881 patients and its mortality rate was 4% of the total number of patients during the year 2022. Most of the complications were associated with surgical site infection has been estimated at 4–8% and few directly related to anesthesia complications has been estimated at 2–3% (**Zagazig university hospital statistical office, 2022**).

Nurses play an important role to enhance the quality of care across the continuum by improving outcome, promoting safety and increasing satisfaction for such group of patients. It is important to develop nurses' knowledge and skills regarding patient safety measures in operating room, so efforts should be directed towards enhancing creativity among nurses and access to update information and continuous educational opportunities, therefore, the study will be conducted to assess nurses' knowledge and practice regarding patient safety in operating room

Aim Of The Study

This study aims to assess the nurses' knowledge and practice regarding patient safety in operating room through the following;

- Assessing nurses' level of knowledge regarding patient safety in operating room.

- Assessing nurses' level of practice regarding patient safety in operating room.

and agree to participate were recruited in this study.

Research questions

- What is the nurses' level of knowledge regarding patient safety in operating room?
- What is the nurses' level of practice regarding patient safety in operating room?

SUBJECT AND METHODS

- **Technical design.**
- **Operational design.**
- **Administrative design.**
- **Statistical design.**

Technical design:

The technical design includes research design, setting, subjects and tools for data collection.

Research design: A descriptive exploratory research design was utilized to meet the aim of the study. Exploratory research is as the name implies, intends merely to explore the research questions and does not intend to offer final and conclusive solutions to existing problems. This type of research is usually conducted to study a problem that has not been clearly defined yet and it helps to have a better understanding of the problem (Olawale et al., 2023).

Setting: The study was carried out in the general operating rooms at Zagazig university hospital. The selection of this hospital will be based on the residence of the researcher as it will facilitate the data collection of the study. The General operating rooms contain six equipped rooms, each room contains one operating room table, the anesthesia machine, the anesthesia cart, emergency kit, DC shock machine, sterile surgical instruments, stainless steel table, an electronic monitor, the pulse oximeter machine, automated blood pressure and an electro cautery machine.

Subjects: A convenient sample included all available nurses working in general operating room, (40 nurses) at Zagazig university hospital

Tools for data collection:

Data were collected using the following tools:

1-Nurses' Self-administered Questionnaire:

It was developed by the researcher, based on reviewing of related literature; it was translated, retranslated and written in simple Arabic language and consists of the following parts:

The first part was concerned with demographic data that include (age, gender, marital status, educational level, years of experience, attendance of training courses regarding patient safety measures in operating room and availability of manual guide regarding patient safety measures in operating room).

The second part was used to assess nurses' knowledge regarding patient safety in operating room, it was developed by the researcher guided by Sen and Sen, (2013); Fairchild et al., (2017); Mohammed et al., (2019); Mohammed et al. (2020); Wahr et al. (2022). It included 56 questions in the form of multiple choice, matching and true and false questions. It was categorized into five sections as follows; **section (1):** it was concerned with assessment of nurses' knowledge regarding general concepts about surgery. It included (6 questions); **Section (2):** it was concerned with assessment of nurses' knowledge about general concepts regarding patient safety measures in operating room. It included (5 question); **Section (3):** it was concerned with assessment of nurses' knowledge about potential hazards that hinder patient safety in operating room. It included (4 question); **Section (4):** it was concerned with assessment of nurses' knowledge about patient's safety precaution measures to prevent hazards in operating room. It included (17 question); **Section (5):** it was concerned with assessment of nurses' knowledge regarding the role of the nurses according to WHO surgical patient safety checklist. It included (24 questions).

Scoring system:

Answers were either correct or incorrect with total score 56 grades, one score was given when the response was correct and zero when it was incorrect. The level of knowledge was considered satisfactory if the percentage was $\geq 90\%$ (≥ 50 grades) and the level of knowledge was considered unsatisfactory if the percentage was $< 90\%$ (< 50 grades).

II. Nurses' observational Checklist:

It was concerned with assessment of nurses' practice regarding patient safety in operating room. It was adapted from **Alaa-Eldeen et al., (2012); Christensen and Kockrow, (2014); Phillips, (2016); WHO, (2017); Hanfy et al., (2021) and WHO, (2021)**. It included 170 steps divided into (2) parts as the following:

The first part was concerned with checklist regarding environmental safety of operating room that included mechanical safety, thermal safety, electrical safety, chemical safety and biological safety **(16 steps)**.

The second part was concerned with surgical patient safety checklist that included sections as the following: Phase I: Sign In (Before induction of anesthesia). It included **(64 steps)**; Phase II: Time Out (Before skin incision). It included **(32 steps)**; Phase III: Sign Out (At the completion of the procedure). It included **(58 steps)**.

Scoring system:

One grade was given to the step which was done correctly and zero was given to step which was done incorrectly or not done. The total scores were 170 grades, it was calculated and categorized as the following: the level of practice was considered competent if the percentage was $\geq 90\%$ (≥ 153 grades) and the level of practice was considered incompetent if the percentage was $< 90\%$ (< 153 grades).

II-Operational design:

The operational design includes preparatory phase, validity & reliability, pilot study, and field work.

1- Preparatory phase:

It will include reviewing of related literature, and theoretical knowledge of various aspects of the study using books, articles, internet, periodicals and magazines to develop tools for data collection.

2- Tools validity & reliability

Testing the validity: the validity of the developed tools was tested using (face and content validity). Face validity aimed to inspect the items to determine whether the tools measure was appropriate, while content validity was done to determine what it supposed to measure whether the tool achieve the study aim.

The validity was tested through a jury of seven experts (5 professors and 2 assistant professors) in the field of medical surgical nursing, faculty of nursing, Ain Shams University who reviewed the content of the tools for comprehensiveness, accuracy, clarity and relevance and necessary modifications was done accordingly. The validity of the study for self-administered questionnaire was (90% to 100 %) and for nurses' observational checklist tool was (100%).

Testing reliability: Reliability of the study tools was tested statistically using Cronbach's Alpha / Coefficient test. They were for self-administered questionnaire, nurses' observational checklist regarding patient safety in operating room (0.908 and 0.888 respectively).

Pilot study: It was carried out on (10%) of the total sample of the studied nurses to test applicability, clarity and efficiency of the tool, and to estimate time need to fill in the study tools. According to the results obtained from analysis of pilot study, minimal modifications were done, so the nurses' who included in the pilot study were included in the sample.

3- Field work:

Field work was included:

An approval was obtained from hospital directors and nursing directors. The aim of the study was explained by interviewing the

nurses in the previously mentioned setting who agreed to participate in the study prior to data collection. The actual work of this study took about 2 months, started from the beginning of November 2022 to the beginning of January 2023. The data were collected by the researcher through 3 days/week (Monday, Wednesday and Thursday) during morning and afternoon shift in the previous mentioned setting.

Assessment phase was included assessment of nurses' knowledge, practice regarding patient safety in operating room by using self-administered questionnaire, observational checklist as the following:

- Observational checklists were used to observe nurses' practice regarding patient safety in operating room filled by researcher. The researcher observed the performance of each nurse regarding patient safety in operating room by in direct observation according to the type and time of surgery to ensure the maximal realistic observations of nurses' practice and minimize the possibility of bias.

- Self-administered questionnaire was administered to all the nurses to assess their knowledge. The researcher explained the self-administered questionnaire sheets. Then, it was distributed to all nurses individually to assess their knowledge.

- The average time needed for the completion of it by each nurse took about 30-40 minutes to be accomplished by each nurse and usually it was assessed by the researcher in Thursday in the morning and afternoon shift as it was the day of inventory of surgical instruments. So, it was easy for data collection.

III-Administrative design:

An official permission for conducting the study in general operating room at Zagazig University Hospitals will be obtained from the hospital administration by the submission of a formal letter from the Dean of the Faculty of Nursing Ain Shams University and also, approval from ethical committee of faculty. Meeting and discussion will be held between the researcher and the nurses under the study to make them aware about aims and

objectives of the study, as well as, to get better cooperation during the implementation phase of the study.

Ethical consideration:

The ethical considerations in the current study were considered the research approval from the research ethical committee in the faculty of nursing Ain Shams University before starting the study. The researcher clarified the aim, objectives of the study to the nurses included in the study prior to data collection. Maintaining anonymity and confidentiality had been guaranteed. Nurses were informed that they allowed choosing to participate or not in the study and that, they had the right to withdraw from the study at any time. Ethics, values, culture, and beliefs were respected during study period.

Ethical code: 23.10.135

V- Statistical design:

The data obtained was synthesized, analyzed, and presented in numbers, percentage, in the form of tables and figures. Recorded data were analyzed using the Statistical Package for Social Sciences (SPSS), version (20.0). Quantitative data were expressed as mean and standard deviation (SD). Qualitative data were expressed as frequency and percentage. As well, significance of quantitative variables was measured through paired t test and correlation coefficient was used for quantitative variables that were normally distributed or when one of the variables is qualitative. These tests were applied to test the study hypothesis. Cronbach's Alpha was used to assess the study tools' reliability. The significance level was categorized into significant when P -value < 0.05 , a highly significant when $P \leq 0.001$ and no statistical significance difference when $p > 0.05$.

Results

Table (1): this table shows that 40% of studied nurses were aged from 20 to less than 30 years old, 50% of studied nurses were aged from 30 to less than 40 years old with mean age 33.10 ± 6.83 . Also, 95% of the studied nurses

were females and 85% of them were married. Moreover, 45% of studied nurses were nursing diploma and 62.5% of them were had experience more than 10 years with mean = 13.95 ± 8.61 . In addition, 67.5% of the studied nurses didn't attend any training courses regarding patient safety measures in operating room and all of them 100% didn't have manual guide regarding nurses' performance related to patient safety in operating room.

Table (2): this table shows that, 62.5% had satisfactory level of knowledge regarding general concepts about patient safety measures in operating room, and the role of the nurses about patient safety in the operating room according to WHO surgical patient safety checklist. While, 65% had satisfactory level of knowledge regarding Patient's safety precaution measures to prevent hazards in operating room.

Figure (1): this figure shows that 45 % of the studied nurses had total satisfactory level of knowledge regarding patient safety in operating room. While, 55 % of them had total unsatisfactory level of knowledge regarding patient safety in operating room.

Table (3): this table shows that 55% of the studied nurses had competent level of practice regarding environmental safety in

operating room, WHO surgical patient safety checklist (Phase I: Sign in) and 62% had competent level of practice regarding WHO surgical patient safety checklist (Phase III: Sign out). As well, 57 % had total competent level of practice regarding WHO surgical patient safety checklist.

Figure (2): this figure shows that 57 % of the studied nurses had total competent level of practice regarding patient safety in operating. While, 43 % of them had total incompetent level of practice regarding patient safety in operating.

Table (4): this table shows that there was statistical significant correlation between nurses' level of knowledge and their level of practice regarding patient safety in operating room ($r=0.371$ at $p \leq 0.05^*$) respectively.

Table (5): this table shows that, there was no statistically significant difference between total nurses' knowledge and their socio demographic characteristics (age, educational qualification and experience) at ($p > 0.05$).

Table (6): this table shows that, there was no statistically significant difference between total nurses' practice and their socio demographic characteristics (age, educational qualification and experience) at ($p > 0.05$).

Table (1): number and percentage distribution of demographic characteristics among nurses under study (n=40).

Item	No	%
Age group (years)		
20- > 30	16	40.0
30- > 40	20	50.0
≥40	4	10.0
Mean ± SD (Min-max)	33.10±6.83 24-50	
Gender		
Male	2	5.0
Female	38	95.0
Marital status		
Married	34	85.0
Single	6	15.0
Level of education		
Nursing Diploma	18	45.0
Technical health Institution	14	35.0
Nursing bachelory	8	20.0
Experience		
< 5	5	12.5
5- < 10	10	25.0
10 +	25	62.5
Mean ± SD (min-max)	13.95±8.61 1-32	
Attendance of training courses regarding patient safety measures in operating room.		
Yes	13	32.5
NO	27	67.5
Availability of manual guide regarding nurses' role related to patient safety measures in operating room.		
Yes	0	0.0
No	40	100.0

Table (2): percentage distribution of the studied nurses regarding their satisfactory level of knowledge regarding patient safety in operating room (n=40).

Satisfactory level of knowledge	satisfactor y	
	N o	%
General concepts about surgical operation	24	60
General concepts regarding patient safety measures in operating room	25	62.5. %
Hazards in operating room that hinder patient safety	23	57.5 %
Patient's safety precaution measures to prevent hazards in operating room	26	65.0 %
The role of the nurses about patient safety in the operating room according to WHO surgical patient safety checklist	25	62.5 %

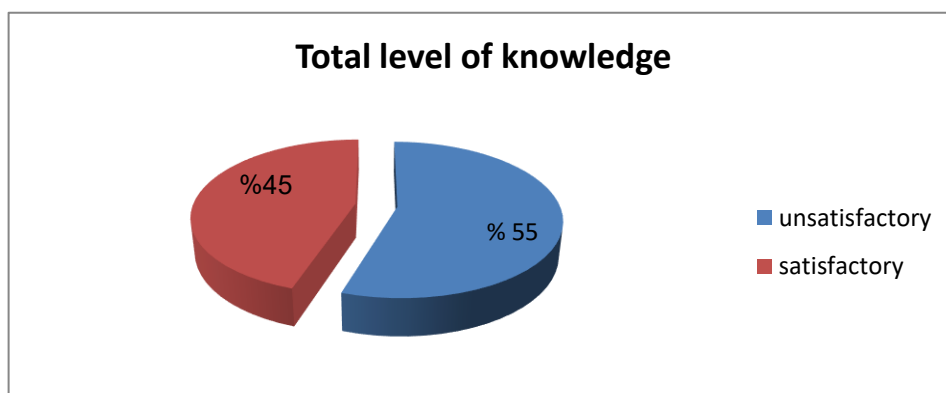


Figure (1): percentage distribution of the studied nurses regarding their total level of knowledge regarding patient safety in operating room (n=40).

Table (3): percentage distribution of the studied nurses regarding their competent level of practice regarding patient safety in operating room (n=40).

Competent level of practice	Competent	
	No	%
Environmental safety in operating room	22	55.0%
WHO surgical patient safety checklist		
(Phase I: Sign in)	22	55.0%
(Phase II: Time out)	21	52.5%
(Phase III: Sign out)	25	62.5%

Figure (2): percentage distribution of the studied nurses regarding their level of practice regarding patient safety in operating room (n=40).

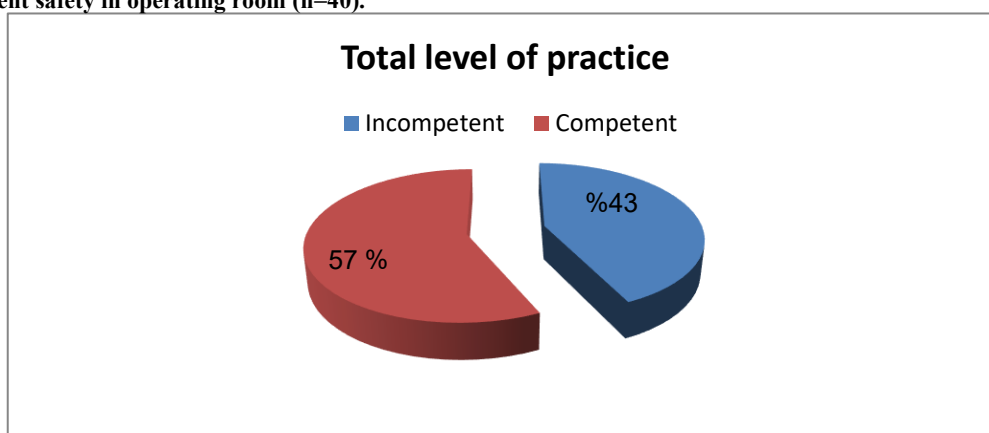


Table (4): correlation between total score of nurses' knowledge and practice regarding patient safety in operating room (n=40).

Items	Knowledge	
	r	p-value
Practice	0.371	0.018*

** Highly statistically significance $p \leq 0.001$

* Statistically significance $p \leq 0.05$

No statistically significance $p > 0.05$

Table (5): Relation between total nurses' level of knowledge and their demographic characteristics (n=40).

Demographic characteristics	Total nurses' level of knowledge				
	Satisfactory (n=18)		Unsatisfactory (n=22)		χ^2 (P-Value)
	No.	%	No.	%	
Age group (years)					
- 20- > 30	9	50.0	7	31.8	1.667
- 30- > 40	7	38.9	13	59.1	0.435
- ≥40	2	11.1	2	9.1	
Educational qualification					
- Nursing Diploma	9	50.0	9	40.9	0.390
- Technical health Institution	3	16.7	5	22.7	0.823
- Nursing bachelory	6	33.3	8	36.4	
Experience					
- < 5	3	16.7	2	9.1	0.808
- 5- < 10	5	27.8	5	22.7	0.668
- 10 +	10	55.5	15	68.2	

** Highly statistically significance $p \leq 0.001$ * Statistically significance $p \leq 0.05$
No statistically significance $p > 0.05$

Table (6): Relation between total nurses' level of practice and their demographic characteristics (n=40).

Demographic characteristics	Total nurses' level of practice				
	Satisfactory (n=23)		Unsatisfactory (n=17)		χ^2 (P-Value)
	No.	%	No.	%	
Age group (years)					
- 20- > 30	11	47.8	5	29.5	2.609 0.271
- 30- > 40	11	47.8	9	52.8	
- ≥40	1	4.4	3	17.7	
Educational qualification					
- Nursing Diploma	9	39.1	9	52.8	1.710 0.425
- Technical health Institution	4	17.4	4	23.6	
- Nursing bachelory	10	43.5	4	23.6	
Experience					
- < 5	3	13.1	2	11.8	0.962 0.618
- 5- < 10	7	30.4	3	17.6	
- 10 +	13	56.5	12	70.6	

** Highly statistically significance $p \leq 0.001$ * Statistically significance $p \leq 0.05$
No statistically significance $p > 0.05$

Discussion

Concerning demographic characteristics of the studied nurses, the results of the current study revealed that, two fifths of the studied nurses were aged from Twenty to less than Thirty years old and half of them aged from Thirty to less than Forty years old with the mean age 33.10 ± 6.83 years old. This finding could be clarified in the light nature of operating room unit as area of

specialty necessitates young qualified and adult nurses were aware enough for better quality of nursing care offered and abled to tolerate the working load and need of active personnel in operating room usually at the age less than Forty years .

The previous findings were consistent with **Yavuz. (2023)** in the study entitled " Patient Safety Culture Perception Among Surgical Nurses " who mentioned that the

majority of the studied nurses', their ages were between 18 to 49 years with the mean age 29.08 ± 6.60 years. While, the previous findings were inconsistent with **Seo & Lee. (2023)** in the study entitled " Effects of Nurses' Perceptions of Patient Safety Rules and Procedures on Their Patient Safety Performance: The Mediating Roles of Communication about Errors and Coworker Support" who mentioned that the majority of the studied nurses were aged from 20 to 29 years old.

Regarding gender, the current study showed that, the majority of the studied nurses were females. It might be related to the greater fraction of the nurses in Egypt was females and might be also related to the studying of nursing in Egypt was exclusive for female only till few years ago nursing schools graduate large number of females than males. This finding in the same line with **Khong et al., (2020)** in the study titled "Operating room nurse self-reported knowledge and attitude on perioperative pressure injury" who found that most of the studied nurses were females.

Meanwhile, the previous findings were inconsistent with **El-Shafei et al. (2019)** in the study titled "World Health Organization Surgical Safety Checklist with Addition of Infection Control Items: Intervention study in Egypt" and showed that the majority of the studied participants were male.

In relation to marital status, the current study revealed that most of nurses were married. This may be related to the majority of the studied nurses were in marriage phase according to Egyptian culture. This finding agreed with **Lemos et al., 2022** in the study titled " Role of perioperative nursing in anesthesia: a national overview" who stated that the majority of the studied nurses were women, with a mean age of 41.09 years and were married.

Concerning level of education, the present study revealed that, about less than half of the studied nurses were diploma nurses. This finding may be due to the shortage of number of bachelor nurses who working in the operating room units as the highly qualified nurses recruited as supervisors and perform administrative work. So, the largest numbers of

nurses graduated from nursing schools were recruited as staff nurses there to cover the activities needed the OR units.

This findings were in agreement with **Gouda et al. (2019)** in the study titled " Factors affecting postoperative nursing performance in the surgical units" who stated that half of the studied nurses were secondary diploma nurses.

Concerning experiences, the present study revealed that about two thirds of studied nurses had experiences more than ten years old in operating room unit with mean = 13.95 ± 8.61 years. This might be explained in the light of nature of operating room unit as area of specialty necessitates that safety and maintenance of procedures are crucially dependent on experienced nursing care, with constant observation to ensure monitoring and immediate detection of any problems so that they can be rapidly assessed and treated.

The previous findings were inconsistent with **El-Sherbiny et al., (2020)** in the study titled "Assessment of patient safety culture among paramedical personnel at general and district hospitals" who stated that the largest percentage of participants had between 6 to 10 years of experience.

As regard to training courses, the present study showed that, more than two third of studied nurses didn't attend training courses regarding patient safety measures in operating room and all of them didn't have manual guide regarding nurses' role related to patient safety in operating room. This might be due to shortage of training programs regarding these issues to improve their performance, the staff nurses did not aware about the importance of operating room safety and its effect on patient safety positively in addition to there is no time for attending any extra training courses as a result of work overload.

The previous results were inconsistent with **Fathy et al. (2022)** in a paper titled " Nurses ' Performance Regarding the Patients ' Safety Measures in Operating Theater" who stated that more than three quarters of the studied nurses attended training courses related to patients' safety measures in operating theater,

however, this reflected positively on their performance.

Concerning nurses' satisfactory level of knowledge regarding patient safety in operating room, the present study showed that about two third had satisfactory level of knowledge regarding general concepts about surgical operation, general concepts about patient safety measures in operating room, the role of the nurses about patient safety in the operating room according to WHO surgical patient safety checklist, and patient's safety precaution measures to prevent hazards in operating room. As well, more than half of them had satisfactory knowledge regarding hazards in operating room that hinder patient safety. The adequacy of the knowledge might be related to about two third of studied nurses had experience more than ten years old. The previous findings were inconsistent with **Mohammed et al. (2020)** in a paper titled " Effect of Implementing an Educational Program on Nurses' Performance Regarding Intraoperative Surgical Patient Safety " who stated that more than three quarter of studied nurses had unsatisfactory level of knowledge regarding definition and phases of surgery at pre-program implementation phase. Also, the previous findings were inconsistent with **Alwhab, et al. (2023)** in a paper titled " Effect National Patient Safety Goals on Nurses Performance and Patients outcomes" who stated that about one third had satisfactory level of knowledge regarding the concept of patient safety and patient safety goals pre implementation phase.

As well, the previous findings were inconsistent with **Ramadan et al. (2021)** in the study titled " Safety Measures Program for Prevention of Occupational Hazards Among New Graduate Bachelor Nurses" who stated that about three quarter of the of the new graduate bachelor nurse had un satisfactory level of knowledge regarding safety precaution measures to prevent occupational hazards in operating room. In addition, the previous findings were inconsistent with **Ahmed & Awad. (2020)** in a paper titled" The Impact of Development and Implementation of Surgical Safety Checklist Educational Program on the Surgical Team Compliance during Major Operations" who stated that almost all of

surgical team had un satisfactory knowledge regarding knowledge about surgical teams' role according to WHO surgical patient safety checklist pre-program implementation phase.

Moreover, the previous findings were inconsistent with **Rayan et al. (2021)** in a paper titled " Effect of Training Program Regarding Occupational Health Hazards on Nurse Interns' Knowledge and Practice " who stated that, more than three quarter of studied nurses had unsatisfactory level of knowledge regarding occupational health hazards pre- program phase

Concerning nurses' total level of knowledge regarding patient safety in operating room, the present study showed that more than half of the studied nurses had total unsatisfactory level of knowledge regarding patient safety in operating room. This might be related to unavailability of training courses regarding patient safety in operating room and lack of direct supervisors in the hospital to refresh the nurses' knowledge, It might be due to a mix of circumstances, including a lack of hospital management oversight and focus to provide nurses with this expertise. The previous finding agreed with **Nauri & Susanto. (2020)** in the study titled" Implementation Of Surgical Patient Safety By Nurses In Hospital" who stated that more than half of the studied nurses had total unsatisfactory level of knowledge regarding surgical patient safety.

Concerning nurses' competent level of practice, the present study revealed that more than half had competent level of practice regarding environmental safety in operating room, WHO surgical patient safety checklist (Phase I: Sign in) and WHO surgical patient safety checklist (Phase II: Time out). While, about two third of them had competent level of practice regarding WHO surgical patient safety checklist (Phase III: Sign out). This might be related to due to adequacy of the staff, available of supplies and equipment and good job description.

The previous findings were disagreed with **Ahn & Lee. (2021)** in a paper titled" Development and Evaluation of a Teamwork Improvement Program for Perioperative Patient Safety" who stated that the majority of

teamwork had incompetent level of practice about patient safety measures in surgical environment at pre-program implementation phase. Moreover, the previous findings were inconsistent with **Arimbi & Dhamanti. (2023)** in a paper titled "Impact Of Implementing A surgical Safety Checklist in Hospital " who stated that the majority of the studied groups had incompetent level of practice regarding the implementation of surgical safety checklist during sign-in, time out and sign out at pre implementation of the training program phase.

Concerning nurses' total level of practice, the present study revealed that less than half of studied nurses had total incompetent level of practice regarding patient safety in operating room. This might be related to absence of safety guidelines or operating room safety checklist and low level of education in addition to unavailability of training courses regarding patient safety in operating. The previous findings were inconsistent with **Hassan et al., 2022** in the study titled "Nurses' Adherence to Surgical Safety Guidelines for Patients Undergoing Abdominal Surgery " who stated that more than half of the studied nurses had total incompetent level of practices in the operating room.

Regarding the correlation between the total nurses' level of knowledge level and their level of practice regarding patient safety in operating room, there was statistical significant correlation between nurses' level of knowledge and their level of practice. From the researcher point of view, this indicated that while nurses have a theoretical knowledge of the issue, proper education can help them understand the nuances of the issue and why it is important to put their knowledge into practice. The previous results were consistent with **Fathy et al. (2022)** who stated that there was statistically significant relation regarding nurses' total level of knowledge and total level of practice. In addition, the previous study result was consistent with **Alwhab et al. (2023)** who stated that there was statistically significant relation regarding nurses' total level of knowledge and total level of practice at pre-program implementation phase.

Regarding the relation between total nurses' level of knowledge and their demographic characteristics, the current study revealed that, there was no statistically significant relation between total nurses' level of knowledge and their demographic characteristics at pre self -learning package implementation. The previous results were in agreement with **Khorammakan et al. (2023)** in the study titled "Continuous training based on the needs of operating room nurses using web application: a new approach to improve their knowledge " who stated that there was no statistically significant relation between total nurses' knowledge and personal data (age, job title, education level and experience) at pre-program implementation phase.

Regarding the relation between total nurses' level of practice and their demographic characteristics, the current study revealed that, there was no statistically significant relation between total nurses' level of practice and their demographic characteristics (age, educational qualification and experience). The previous results were consistent with **Feng et al. (2022)** in the study titled "Knowledge, attitude, and practice of surgical site infection prevention among operating room nurses in southwest China" who stated that there was no significant correlation between nurses' level of practice and their demographic characteristics.

Conclusion

Based on the findings of the present study, it can be concluded that about more than half of studied nurses had unsatisfactory level of knowledge regarding patient safety in operating room. As well, less than half of them had incompetent level of practice regarding patient safety in operating room. Moreover, there was statistically significant correlation between nurses' level of knowledge and their level of practice regarding patient safety in operating room.

Recommendations

Based on finding of the present study, the following are recommended:

Regarding nursing practice:

- Workshops, seminars and conferences aiming to update nurses' knowledge, skills and attitude regarding patient safety in operating room should be arranged periodically in operating room units
- Manual guide booklet including nursing guidelines regarding nurses' performance related to patient safety measures in operating room should be available in operating room units.

Regarding research:

- The study should be applied on large sample and in different hospitals setting in order to generalize the results.
- Further studies determine the barriers that are hindering the nurses' application of patient safety measures in operating room.

Regarding nursing education:

- On-going and regular in-service training courses regarding evidence-based guidelines should include patient safety checklist in the operating room.
- Orientation programs for newly recruited nurses regarding patient safety in operating room should be performed prior to start dealing for such group of patients.

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