

Nurses' Performance Regarding Patient Safety in Operating Room at Zagazig University Hospitals

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Abstract

Background: The patient safety is a fundamental principle of health care. It has been defined as reduction of risk of unnecessary harm associated with delivery of health care to a minimum as well as the prevention of errors and avoidable adverse events, to protect patients from injury. **Aim:** This study was conducted to assess nurses' performance regarding patient safety in operating room. **Design:** A descriptive research design was utilized to meet the aim of the study. **Setting:** The study was carried out in the General operating rooms at Zagazig University hospitals. **Study subject:** A Purposive sample included all available nurses working in general operating room, (50 nurses) at zagazig university hospital and agree to participate were recruited in this study. **Tools:** three tools were used including: **I-** Self-administered questionnaire. **II-** Nurses' level of practice observational checklist. **III-** Nurses' attitude Likert scale. **Results:** 74% of studied nurses under the study had unsatisfactory level of knowledge regarding patient safety in operating room, 54% of studied nurses had unsatisfactory level of practice regarding patient safety in operating room and 96% of studied nurses had positive attitude regarding patient safety in operating room. **Conclusion:** about three quarters of studied nurses had unsatisfactory level of knowledge regarding patient safety in operating room. More than half of studied nurses had unsatisfactory level of practice regarding patient safety in operating room. While, the most of studied nurses had a positive attitude regarding patient safety in operating room. **Recommendations:** On-going and regular in-service educational programs regarding evidence-based guidelines about application of patient safety checklist in the operating room.

Keywords: Nurses' performance -Patient safety-Operating room.

Introduction

The operating room is a facility within a hospital where surgical operations are carried out in an aseptic environment. It is a very critical area and has great importance in the hospital among other health care setting. The operating room environment is basically a closed, isolated, restricted, yet flexible environment charged with multiple inherent risks and hazards and the number of patients undergoing surgery may come across various hazards that can be classified as: physical, accidental hazards, chemical hazards, biological hazards, fire hazards and other hazards (Markel, Gormley & Greeley, 2017).

The patient safety is a fundamental principle of health care. It has been defined as reduction of risk of unnecessary harm associated with delivery of health care to a minimum as well as the prevention of errors and avoidable adverse events, to protect patients from injury (Russo, Sittig and Murphy, 2016).

Surgical care has been an essential component of health care worldwide for over a century. Each year 4% of the world's population is going under surgery. Although surgery represents a mainstay of medical treatment, the rate of death directly due to inpatient surgery has been estimated at 0.4–0.8%, and the rate of major complications has been estimated at 3–17% (WHO, 2016).

An annual estimated rate of surgical site infection (39%), bleeding and hematoma (23%), injuries by physical or chemical hazards (22%), and other functional disorders (16.5%). Other studies report technique-related complications as the most frequent injury in 24-30% of their patients (*Kumer & Raina, 2017*).

The operating room nurses play an important role in the caring of patients undergoing surgery to prevent hazards that may occur and maintain patient safety. Patient safety should be an area of focus in basic nursing care. A strategy for ensuring patient safety in operating room should include equipment safety, electrical safety, radiational safety and chemical safety. Proper positioning for ensuring patient comfort and safety in addition to providing access to the surgical site, airway, intravenous lines, and all monitoring devices (*Valdez & Navine, 2013; Willassen, Lise & Jacobsen, 2018*).

Safe transfers of the patient to or from the operating room bed with all tubes are visible, maintaining body temperature, achievement of safe anesthesia, infection prevention, safe handling of equipment, aseptic technology appliance, effective communication and correct use of the surgical safety checklist (SSC). These measures tend to prevent hazards and avoid postoperative complication. Less morbidity and mortality, improved quality and greater efficiency are potential benefits of surgery that is safe for the patient (*Banguti, Paulin & Mvukiyehe, 2018*).

Hopefully, this study this study aimed to assess the nurses' performance (knowledge, practice and attitude) regarding patient safety in operating room.

Aim of the study

The aim of this study was to assess the nurses' performance regarding patient safety in operating room through the followings:

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

- Assess the nurses' level of practice regarding patient safety in operating room.
- Assess the nurses' attitude regarding patient safety in operating room

Research questions

What are the nurses' performance regarding patient safety in operating room?

Subject and Methods:

Research design:

A descriptive research design was utilized to fulfill the aim of the study, and answer the research question.

Setting:

The study was carried out in the General operating rooms at Zagazig University Hospitals.

Subjects:

A purposive sample included all available nurses working in general operating room, (50 nurses) at Zagazig University Hospitals and agree to participate were recruited in this study.

Tools for data collection: Three tools were used to collect data of the study as following:

I- Nurses self-administered questionnaire (Appendix I):

It was developed by the researcher based on reviewing current and relevant literatures. (*Sen & Sen , 2013; Fairchild, o'shea and Robin, 2017 & Terrace, 2017*). It was translated into simple Arabic language to suit the level of the subjects, it is consisted of two parts:

A - The first part: concerned with the **demographic characteristics** of the nurses under study as: age, gender, marital status, level of educations, occupation, years of experience, training courses regarding operating room safety.

B- The second part: Nurses' level of Knowledge: - It was used to assess nurses'

knowledge regarding patient safety in operating room, and it is consisted of 27 items. Each item was given 0 for incorrect response and 1 for correct response. A subtotal & total mean for nurses' knowledge was categorized into unsatisfactory or satisfactory knowledge level as follows:-

- $\geq 90\%$ (≥ 24 marks) was considered satisfactory.
- $< 90\%$ (< 24 marks) was considered unsatisfactory.

II- Nurses' level of practice observational checklists (Appendix II): It was used to assess nurses' practice regarding patient safety in operating room; it was adapted by the researcher using the most recent and relevant literature

Alaa-Eldeen, Saad and Elrefae, 2012; Smelzer & Bare, 2016 & World Health Organization, 2016) and modified by the researcher included 118 steps, each step was given (0) for not done or done incorrectly and (1) for done correctly. A subtotal & total mean for nurses practice was categorized into satisfactory or unsatisfactory practice as following:

- $\geq 90\%$ (≥ 106 marks) was consider satisfactory.
- $< 90\%$ (< 106 marks) was consider unsatisfactory.

III- Nurses' attitude Likert scale (Appendix III): It was developed based on reviewing of the present related literature guided by **(Brasaitte, Kaunonen & Suominen, 2015; Norton, Singer & Sparks, 2016)**. It was modified by the researcher, to assess nurses' attitude regarding patient safety in operating room, and it was consisted of (11) statement, the responses was ranged from 2 (agree), 1 (neutral), and 0 (disagree) with total score = 22. The higher the score, the higher negative attitudes of the nurses under study. The total score was categorized into two categories as following:

- $\geq 80\%$ (≥ 17.6 marks) had a positive attitude.
- $< 80\%$ (< 17.6 marks) had a negative attitude.

II- Operational design:

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

1- Preparatory phase: - It includes reviewing of current and more recent national and international literature concerning nurses' performance regarding patient safety in operating room issue of various aspects of this issue in order to develop the data collecting tools.

2- Tools validity & reliability (Appendix V):

Testing validity of the proposed tools by using face and content validity. Face validity aimed to inspect the items to determine whether the tools measure what it supposed to measure. While content validity was conducted to determine whether the tool cover the aim. Validity was tested through a jury of (7) experts from Medical Surgical Nursing Department, Ain Shams University, (3) professor, (3) assistant professor and (1) lecturer. The expertise reviewed tools for clarity, relevance, comprehensiveness, simplicity and applicability minor modifications were done.

Testing reliability: It was done by Cronbach's alpha test which used to examine whether the tools had internal consistency. The knowledge and practice tools had a good internal consistency and tests reached ($r=0.87, 0.74, 0.73$) for nurses' questionnaire, nurses' practice and nurses' attitude respectively indicating acceptable reliability.

Pilot study: was conducted on 10% (3) of nurses under the study in order to test the applicability of the developed study tools, the clarity of included questions as well as the average time needed to complete tools. Results obtained were studied and analyzed accordingly. Modifications were made for the final development of the tools, the study nurses who shared in pilot study were excluded from the study subjects.

Field work: The researcher interviewed with studied nurses in the previously mentioned setting before started of data collection to explain the aim of the study and take their approval to participate in the study prior to any data collection. Data collection was done 3 days per week, started in May 2017 for 3 months in the previously mentioned setting in morning & afternoon shifts as the following:

- The researcher filled the observational check list in the morning and afternoon shifts during nurses' actual work. Nurses were observed while working.
- Then self-administer questionnaire tool was filled by the nurses, it took about 30-40 minutes for each nurse.
- The nurses' attitude likert scale was filled by the nurses, it took about 15 minutes for each nurse.

Administrative design:

The study started with letter indicating the aim of the study sent from the Faculty of Nursing Ain Shams University to the hospital director, and also to nursing director of emergency department to obtain the permission and help to conduct the study in their facilities. The nurses included in the study were informed about the aim of the study, an oral permission was obtained from them, and confidentiality was assured.

Ethical consideration:

Ethical approval was obtained from the scientific ethical committee of Faculty of Nursing, Ain Shams University. The purpose of the study was explained to the nurses before conducting the study and oral consent was obtained from them to participate in the study. They were given an opportunity to withdraw from the study without reason and they were assured that anonymity and confidentiality of information was protected. Ethics, values, culture and belief were respected.

Statistical design:

Data obtained were organized, categorized and analyzed using SPSS (Statistical Program for Social Science). Data were presented using descriptive statistics in the form of frequencies and percentages; description of qualitative variables as mean, standard deviation (SD) and range, statistical significant was considered at $P < 0.05$, no statistically significant at $P > 0.05$ and high statistically significant at $P < 0.001$.

Results:

Table (1): shows that, 42% of studied nurses were aged from 20 to less than 30 years old and 42% of them were aged from 30 to less than 40 years old, with mean age (32.5 ± 4.1) , 92% of them were females, 82% of them were married, 56% of nurses had nursing diploma, 78% of them were occupied as staff nurses, 46% of them had experience more than 15 years of experience, with mean \pm SD (11.5 ± 2.6) and 88% of them did not attend training courses regarding operating safety.

Figure (1): shows that 34% of total studied nurses had satisfactory level of knowledge regarding hazards in operating room. While 78% of them had unsatisfactory level of knowledge regarding role of the nurse regarding patient safety in operating room.

Figure (2): shows that 42% of studied nurses had satisfactory level of practice regarding mechanical safety. While 64% of studied nurses had unsatisfactory level of practice regarding biological safety.

Figure (3): shows that 46% of total studied nurses had satisfactory level of practice regarding environmental safety. While 62% of them had unsatisfactory level of practice regarding phase I

Figure (4): shows that 74% of studied nurses under the study had unsatisfactory level of knowledge regarding patient safety in

operating room, while 54% of studied nurses had unsatisfactory level of practice regarding patient safety in operating room and 96% of studied nurses have positive attitude regarding patient safety in operating room

Table (3): shows that there is no statistically significant difference between nurses satisfactory knowledge and their age, gender, marital status, level of education, occupation, years of experience and attendance of training courses regarding OR safety at $p > 0.05$.

Table (4): shows that there is statistically significant difference between total satisfactory practice of nurses under the study

and their gender at $p < 0.05$ and there is also no statistically significant difference between nurses satisfactory practice and their age, marital status, qualification, occupation, years of experience and attendance of training courses regarding operating room safety at $p > 0.05$

Table (5): shows that there is no statistically significant difference between nurse total attitude level and their age, gender, marital status, occupation and attendance of training courses regarding operating room safety at $p > 0.05$. While there is highly statistically significant difference between nurse total attitude level and their level of education and their years of experiences at $p < 0.001$.

Table (1): Frequency distribution of demographic characteristics of studied nurses (n=50).

| Item | No | % |
|---|------------|-------|
| Age group (years) | | |
| 20- > 30 | 21 | 42.0% |
| 30- > 40 | 21 | 42.0% |
| ≥40 | 8 | 16.0% |
| Mean ± SD | 32.5 ± 4.1 | |
| gender | | |
| Male | 4 | 8.0% |
| Female | 46 | 92.0% |
| Marital status | | |
| Married | 41 | 82.0% |
| Single | 9 | 18.0% |
| Level of education | | |
| Nursing Diploma | 28 | 56.0% |
| Technical health Institution | 11 | 22.0% |
| Nursing bachelory | 9 | 18.0% |
| Master degree in nursing | 2 | 4.0% |
| Occupation | | |
| Staff Nurse | 39 | 78% |
| Nurse Specialist | 11 | 22% |
| experience | | |
| < 5 | 13 | 26.0% |
| 5 - 10 | 7 | 14.0% |
| 10 - 15 | 7 | 14.0% |
| >15 | 23 | 46.0% |
| Mean ± SD | 11.5 ± 2.6 | |
| Attendance of training courses regarding operating room safety | | |
| Yes | 6 | 12% |
| NO | 44 | 88% |

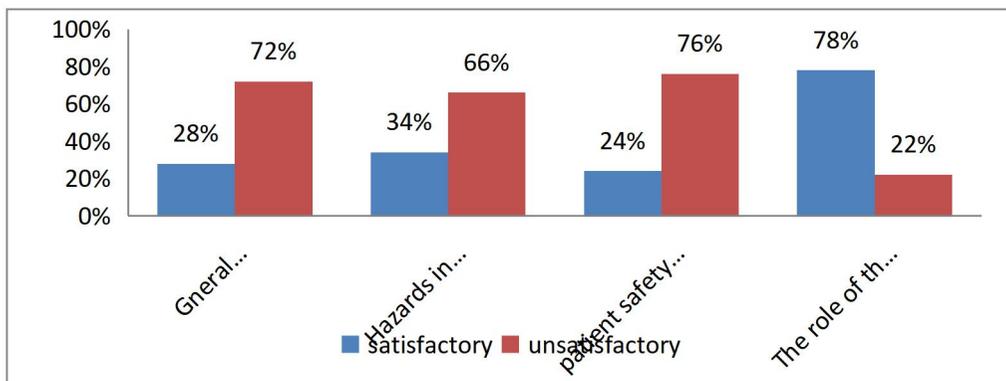


Figure (1): Frequency distribution of nurses' level of knowledge regarding patient safety measures in operating room (n=50).

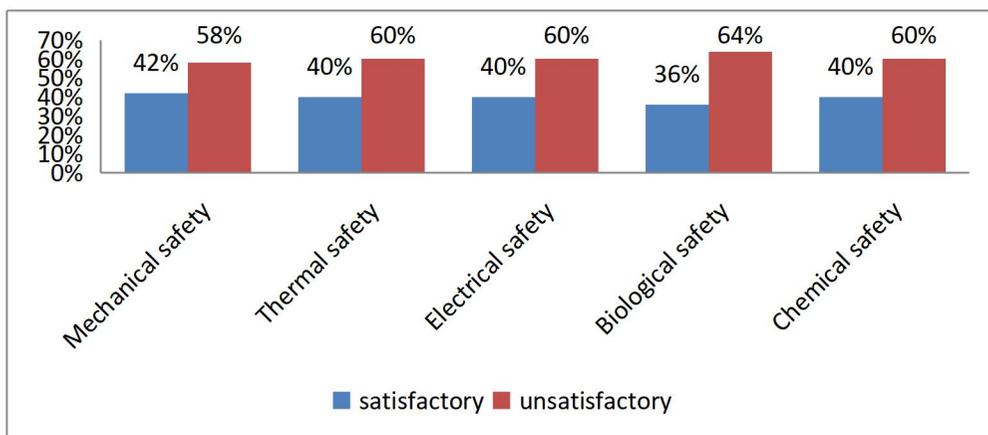


Figure (2): Frequency distribution of nurses' level of practice regarding environmental safety in OR (n=50).

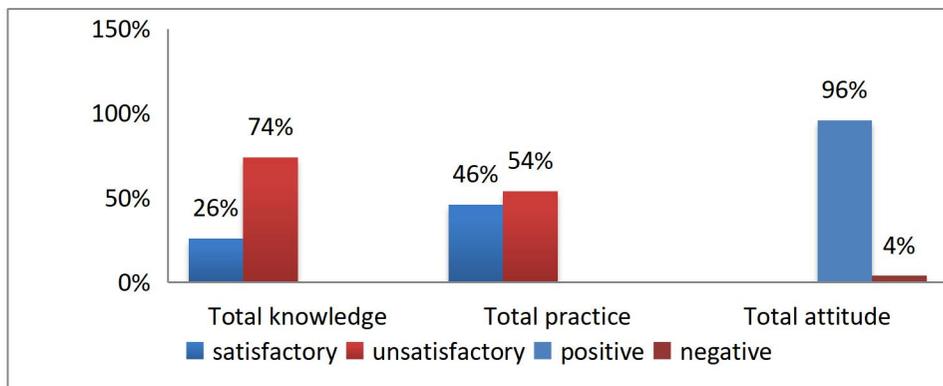


Figure (3): Frequency distribution of nurses' level of practice regarding patient safety in operating room according to WHO checklist (n=50).

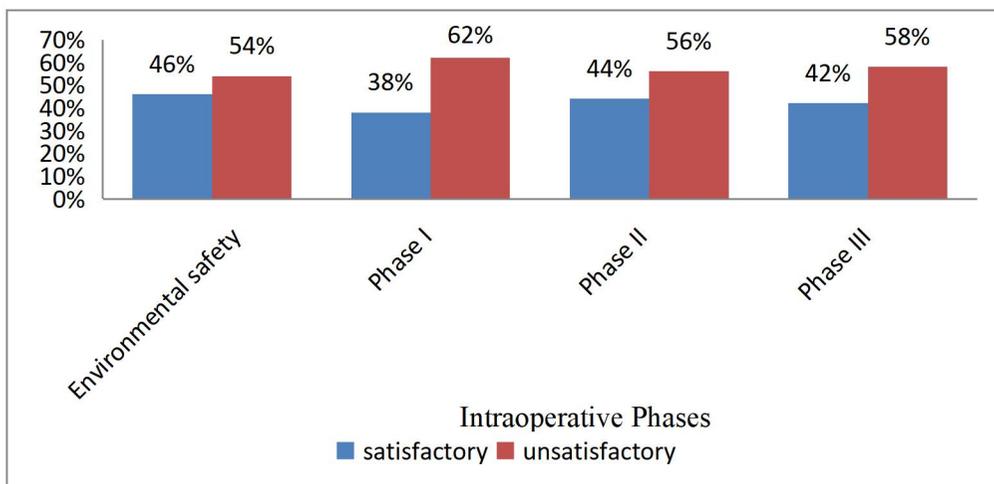


Figure (4): Frequency distribution of total nurses' level of knowledge, practice and attitude regarding patient safety in operating room (n=50).

Table (2): Relation between studied nurses' level of knowledge regarding their demographic characteristics.

| Demographic | Knowledge | | | | Chi-square | | |
|---|-----------------|----------------|-------------------|------------------|----------------|-------|-----|
| | Satisfactory No | Satisfactory % | Unsatisfactory No | Unsatisfactory % | X ² | P | Sig |
| Age | | | | | | | |
| 20 > 30 | 3 | 6.0% | 18 | 36.0% | 3.098 | 0.212 | NS |
| 30 > 40 | 8 | 16.0% | 13 | 26.0% | | | |
| ≥40 | 2 | 4.0% | 6 | 12.0% | | | |
| Gender | | | | | | | |
| Male | 1 | 2.0% | 3 | 6.0% | 1.301 | 0.253 | NS |
| Female | 12 | 24.0% | 34 | 68.0% | | | |
| Marital status | | | | | | | |
| married | 12 | 24.0% | 29 | 58.0% | 1.264 | 0.260 | NS |
| single | 1 | 2.0% | 8 | 16.0% | | | |
| Level of education | | | | | | | |
| Nursing Diploma | 6 | 12.0% | 22 | 44.0% | 1.163 | 0.761 | NS |
| Technical health Institution | 3 | 6.0% | 8 | 16.0% | | | |
| Bachelor of nursing | 3 | 6.0% | 6 | 12.0% | | | |
| Master degree in nursing | 1 | 2.0% | 1 | 2.0% | | | |
| Occupation | | | | | | | |
| Staff Nurse | 9 | 18.0% | 30 | 60.0% | 0.7872 | 0.375 | NS |
| Nurse Specialist | 4 | 8.0% | 7 | 14.0% | | | |
| Years of experience | | | | | | | |
| < 5 | 0 | 0.0% | 13 | 26.0% | 6.547 | 0.087 | NS |
| 5 - 10 | 2 | 4.0% | 5 | 10.0% | | | |
| 10 - 15 | 3 | 6.0% | 4 | 8.0% | | | |
| >15 | 8 | 16.0% | 15 | 30.0% | | | |
| Attendance of training courses regarding operating room safety | | | | | | | |
| yes | 0 | 0.0% | 6 | 13.0% | 2.395 | 0.121 | NS |
| No | 13 | 23.0% | 31 | 62.0% | | | |

Non Significant > 0.05 Significant < 0.05 High Significant < 0.001

Table (3):Relation between studied nurses' level of practice regarding their demographic characteristics.

| Demographic | Practice | | | | X ² | Chi-square P | Sig |
|---|--------------|-------|----------------|-------|----------------|--------------|-----|
| | Satisfactory | | Unsatisfactory | | | | |
| | No | % | No | % | | | |
| Age | | | | | | | |
| 20 > 30 | 9 | 18.0% | 12 | 24.0% | 5.137 | 0.0766 | NS |
| 30 > 40 | 6 | 12.0% | 15 | 30.0% | | | |
| ≥40 | 6 | 12.0% | 2 | 4.0% | | | |
| Gender | | | | | | | |
| Male | 4 | 8.0% | 0 | 0.0% | 6.004 | 0.0142** | S |
| Female | 17 | 34.0% | 29 | 58.0% | | | |
| Marital status | | | | | | | |
| Married | 16 | 32.0% | 25 | 50.0% | 0.827 | 0.362 | NS |
| Single | 5 | 10.0% | 4 | 8.0% | | | |
| Level of education | | | | | | | |
| Nursing Diploma | 12 | 24.0% | 16 | 32.0% | 5.699 | 0.127 | NS |
| Technical health Institution | 7 | 14.0% | 4 | 8.0% | | | |
| Bachelor of nursing | 1 | 2.0% | 8 | 16.0% | | | |
| Master degree in nursing | 1 | 2.0% | 1 | 2.0% | | | |
| Occupation | | | | | | | |
| Staff Nurse | 15 | 30.0% | 24 | 48.0% | 0.911 | 0.339 | NS |
| Nurse Specialist | 6 | 12.0% | 5 | 10.0% | | | |
| Years of experience | | | | | | | |
| < 5 | 6 | 12.0% | 7 | 14.0% | 1.346 | 0.718 | NS |
| 5 - 10 | 2 | 4.0% | 5 | 10.0% | | | |
| 10 - 15 | 4 | 8.0% | 3 | 6.0% | | | |
| >15 | 9 | 18.0% | 14 | 28.0% | | | |
| Attendance of training courses regarding operating room safety | | | | | | | |
| Yes | 1 | 2.0% | 5 | 10.0% | 1.796 | 0.180 | NS |
| No | 20 | 40.0% | 2 | 48.0% | | | |

Non Significant >0.05 Significant <0.05 High Significant <0.001

Table (4): Relation between studied nurses' level of attitude regarding their demographic characteristics.

| Demographic | Attitude | | Negative | | X ² Test | | Sig |
|------------------------------|----------------|-------|----------|------|---------------------|---------|-----|
| | Positive No | % | No | % | X ² | P | |
| Age | | | | | | | |
| 20> 30 | 20 | 40.0% | 1 | 2.0% | 2.4 | 0.299 | NS |
| 30 > 40 | 21 | 42.0% | 0 | 0.0% | | | |
| ≥40 | 7 | 14.0% | 1 | 2.0% | | | |
| Gender | | | | | 0.18 | 0.67 | NS |
| Male | 4 | 8.0% | 0 | 0.0% | | | |
| Female | 44 | 88.0% | 2 | 4.0% | | | |
| Marital status | | | | | 0.457 | 0.498 | NS |
| Married | 39 | 78.0% | 2 | 4.0% | | | |
| Single | 9 | 18.0% | 0 | 0.0% | | | |
| Level of education | | | | | 0.000 | 0.000** | HS |
| Nursing Diploma | 28 | 56.0% | 0 | 0.0% | | | |
| Technical health Institution | 11 | 22.0% | 0 | 0.0% | | | |
| Bachelor of nursing | 7 | 14.0% | 2 | 4.0% | | | |
| Master degree in nursing | 2 | 4.0% | 0 | 0.0% | | | |
| Occupation | | | | | 0.588 | 0.443 | NS |
| Staff Nurse | 37 | 74.0% | 2 | 4.0% | | | |
| Nurse Specialist | 11 | 22.0% | 0 | 0.0% | | | |
| Years of experience | | | | | 0.000 | 0.000** | HS |
| < 5 | 13 | 26.0% | 0 | 0.0% | | | |
| 5 - 10 | 5 | 10.0% | 2 | 4.0% | | | |
| 10 - 15 | 7 | 14.0% | 0 | 0.0% | | | |
| >15 | 23 | 46.0% | 0 | 0.0% | | | |
| Training courses | | | | | 15.27 | 9.280 | NS |
| Yes | 4 | 8.0% | 2 | 4.0% | | | |
| No | 44 | 88.0% | 0 | 0.0% | | | |

Non Significant>0.05 Significant<0.05 High Significant<0.001

Discussion:

Regarding demographic characteristics of the studied nurses; the present study showed that about less than half of nurses were at the age group 20->30 years old and less than half of studied nurses at the age group 30->40years old with mean age (32.5±4.1). This could be explained in the light nature of operating room unit as area of specialty necessitates a young qualified nurse for better quality of nursing care offered and ability to tolerate the working load. This result agreed with **Bergs, Lambrechts and Simons (2015)** in a study titled "Barriers and facilitators related to the implementation of Surgical Safety Checklists: A systematic review of the qualitative evidence" that less than half of nurses' ages in operating room unit were less than 40 years old.

Regarding gender, the present study showed that, most of the studied nurses were

females. It might be related to nursing schools graduate large number of females than males. This finding in the same line with **Secanell, Orrego, and Vila (2014)** in a study titled "A surgical safety checklist implementation: experience of a start-up phase of a collaborative project in hospitals of Catalonia, Spain" that the most of nurses were females.

While the study is inconsistent with **Mitchell, Flin and Yule (2012)** in a study titled "Evaluation of the Scrub Practitioners' List of Intra-operative Non-Technical Skills (SPLINTS) system" who stated that most of their studied group were males.

As regard to marital status, the present study showed that most of nurses were married. This may be related to majority of nurses were female at the age 20->40 years old and this age considered the age of marriage. This finding

agreed with **Schelkun (2014)** in a study titled "Lessons from aviation safety: plan your operation - and operate your plan" who stated that more than two thirds of his studied nurses were married.

Concerning level of education and occupation, the present study showed that, about more than half of the studied nurses were diploma nurses and about three quarters of the studied nurses were occupied as staff nurses, this might elaborate the current condition of nursing qualification and occupation on emergency departments. This finding is consistent with **Willassen, Lise and Jacobsen (2018)** in a study titled "Safe Surgery Checklist, Patient Safety, Teamwork, and Responsibility Coequal Demands? A Focus Group Study" who stated that the largest numbers of nurses were recruited as staff nurses in the majority of clinical nursing position in the hospital.

Concerning years of experiences, the present study showed that slightly less than half of studied nurses had more than fifteen years of experiences in operating room unit. This could 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.

This finding is consistent with **Aveling, McCulloch and woods (2013)** in a study titled "A qualitative study comparing experiences of the Surgical Safety Checklist in hospitals in high-income and low-income countries" who stated that half of studied nurses had experience more than 10 years.

As regard to training courses, the present study showed that, the majority of studied nurses didn't attend training courses regarding operating room safety, this might be due to lack of in-service training programs regarding this 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.

Regarding total nurses' knowledge about patient safety in operating room, the present study showed that more than three quarters of total studied nurses had unsatisfactory level of total knowledge regarding role of the nurse regarding patient safety in operating room. This might be related to absence of guidelines, operating room checklist regarding patient safety in addition to lack of educational training courses about the role of the nurses regarding patient safety in operating room.

This finding was in agreement with **Rauta, Salanter and Nivalainen (2013)** in a study titled "Validation of the core elements of perioperative nursing" Who stated that insufficient knowledge has been attributed to deficiency in orientation or training and high turnover of nurses

Concerning to total nurses' practice regarding environmental safety, the present study showed that nearly two third of total studied nurses had unsatisfactory level of practice regarding biological safety. This result might be related to lack of nurses' knowledge and unavailable of courses about environmental safety and infection control practices and lack of supervision and evaluation.

The study was consistent with **Danjuma, et al (2016)** in a study titled " Rates and Patterns of Operating Room Hazards among Nigerian Perioperative Nurses", who stated that the moderate percentage of bacterial contamination found in the general operating theaters of the target hospitals leads to development of post-operative surgical-site infections and stated that potential hazards can be avoided with the appropriate safety precautions.

Concerning the total nurses' level of practice regarding patient safety in operating room according operating room checklist, the study results showed that nearly two thirds of total studied nurses had an unsatisfactory level of practice regarding phase I (sign in: before induction of anesthesia).It might be related to lack of awareness about the importance of these practices in addition to lack of policy and operating room standardized checklist regarding patient safety in operating room.

This was agreed with **Paul, White, and Matthew (2013)** in a study titled "Intravenous Anesthetics. In: Clinical Anesthesia " who stated that more than three quarter of total studied nurses had incorrect practice regarding preparing patients before induction of anesthesia that may be attributed to deficiency in nurses' knowledge, absence of training courses and nurses are occupied with a large number of patients' operations that may result in incompetent performance.

Concerning nurses' total level of knowledge, the present study revealed that about three quarters of studied nurses had total unsatisfactory level of knowledge 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 room.

This finding is in the same lines with **Torner, Eklof and Larsman (2013)** in a paper titled " Safety climate in health care. underlying factors and the importance of staff safety and patient safety. In Swedish " who stated that all of studied nurses had unsatisfactory level of knowledge regarding patient safety and stated that success in patient safety depends on several factors that include identification, revision of systems, education, and training to address known patient safety issues.

Concerning nurses' total level of practice, the present study revealed that more than half of studied nurses had total unsatisfactory level of practice regarding patient safety in operating room. This might be related to lack of supervision and evaluation from senior staff and lack of knowledge and training courses regarding patient safety in operating room. This finding is inconsistent with **Fuchshuber and Jones (2013)** in a paper titled " Ensuring Safety in the Operating Room" and mentioned that overall practice of staff nurses regarding patient safety in operating room was at good level.

Concerning the nurses' total level of attitude regarding patient safety in operating room, the study results revealed that most of the studied

nurses had a positive total level of attitude regarding patient safety in operating room. This might be related to a visible effective action of this attitude in improving their performance and quality of care delivered and reduction of hazard that may occur.

This present result was agreed with **Norton, et al (2016)** in a study titled "Operating room clinicians' attitudes and perceptions of a pediatric surgical safety checklist at institution", that most of his study sample had positive attitude regarding patient safety in operating room.

Concerning the relation between nurses' knowledge and their demographic characteristic, the present study findings showed that there were no statistically significant difference between nurses' knowledge and their demographic characteristics. This result was consistent with **Brasaite, etal (2015)** in a study titled "Healthcare professionals' knowledge, attitudes and skills regarding patient safety", that there was no significant relation between nurses' knowledge and their age, experience, qualification and attending training courses.

Also, the present finding is in agreement with **Secanell, et al., (2017)** who mentioned in a study titled "A surgical safety checklist implementation: experience of a start-up phase of a collaborative project in hospitals of Catalonia, Spain ", who stated that there is no significant relation between marital status and gender and total nurses' level of knowledge.

Regarding the relation between nurses' demographic characteristic and their practice. The present study findings showed that there is statistically significant difference between total satisfactory level of practice of nurses under the study and their gender. This results was consistent with **Chen, Rosen and Amirfarzan (2018)** who mentioned in a study titled "Improving Detection of Intraoperative medical errors and adverse event contribution to postoperative outcomes", who stated that there is statistically significant difference between nurses' practice and their gender, level of education and attending training courses.'

While, the present study findings showed that there were no statistically significant difference between nurses' practice and their age and years of experience, level of education, occupation, marital status and attending training courses. This results was consistent with **Weld, Stringer and Kelly (2016)** in a study titled "Team Steps Improving Operating Room efficiency and patient safety", that there was no statistically significant relation between nurses' practice and their age, occupation and years of experience.

Regarding the relation between nurses' demographic characteristic and their attitude. The present study the present result showed that there is no statistically significant difference between nurses' total attitude level and their age, gender, marital status, occupation and attendance of training courses, that is not reflected the strong relation between their demographic characteristics and attitude improvement.

This results were supported with **Durgun (2014)** who mentioned in a study titled "The attitude of emergency department nurses toward patient safety" that there was no correlation between nurses attitude and there demographic characteristics.

While the present study showed that there is highly statistically significant difference between nurses' total attitude level and their level of education and years of experiences. This may be related to the nurses with high level of education and more years of experience have mastering their skills and affect in their attitude, this results was consistent with **Urbach and Govindarajan (2014)** who mentioned in a study titled "Introduction of surgical safety checklists in Ontario" that age and years of experience are very important for nurses to increases their knowledge confidence and skills and improve their attitude.

In summary; results of the present study revealed that there is a need to focus on the development of nursing staff knowledge and practice and attitude regarding patient safety in operating room, so the effort should be directed towards enhancing creativity among nurses. The nurses must have access to update information,

learning resources and continuous educational opportunities.

Conclusion:

Based on the findings of the present study, it can be concluded that about three quarters of studied nurses had unsatisfactory level of knowledge regarding patient safety in operating room. More than half of studied nurses had unsatisfactory level of practice regarding patient safety in operating room. While, the most of them had a positive attitude regarding patient safety in operating room.

Recommendations:

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

Education:

- On-going and regular in-service educational programs regarding evidence-based guidelines about application of patient safety checklist in the operating room.

Practice:

- Continuous evaluation of nurses' knowledge, practice and attitude is essential to identify nurses' needs and factors affecting their performance in operating room units.

Research:

- Replication of the study on a large probability sample and different geographical areas to generalize the results.

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