Effect of Implementing Surgical Safety Guidelines for Orthopedic Nurses on Their Performance at Operating Room

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Abstract

Background: Surgical Safety in Orthopedic operating room is one of the major alarms for intraoperative teams as adverse events may occur and be the cause of disability and death. **Aim:** To evaluate the effect of implementing surgical safety guidelines for orthopedic nurses on their Performance at operating room. **Subject and Methods: Design;** A quasi-experimental study was carried out. **Setting;** the study was conducted in orthopedic operating room, at Tanta International Educational Hospital. **Sample;** All nurses (40) worked in Orthopedic Department Operating Room was involved. Tools**:** two tools were used for data collection; **Tool (I);** Operating Room Nurses Interview Questionnaire" It consisted of two sections**:** **Part I:** Socio Demographic Characteristics of Operating Room Nurses, **Part II:** "Nurses' Knowledge Assessment about Orthopedic Surgical Safety guidelines". **Tool (II)**: Nurses' Practice toward use of surgical safety guidelines checklist. **Results;** the main results revealed a high statistically significant improvement in the level of nurses' knowledge about Orthopedic Surgical Safety Guidelines. Also, there was a high statistically significant improvement in the level of nurses 'practice. Furthermore, there were positive significant statistical correlations between both total knowledge levels and total practice level. **Conclusion**: The implementation of Orthopedic Surgical Safety Guidelines has a positive impact in improving nurse's knowledge and practice regarding Orthopedic Surgical Safety Guidelines. **Recommendations** Nurses should attend the seminars and in-services training program about Orthopedic Surgical Safety Guidelines for gaining updated knowledge and enhancing their practice.

Key words; Orthopedic Nurses, Operating Room, Surgical Safet

Introduction

Orthopedic surgery can be considered as an invasive special surgical procedure performed on all parts of the human body to diagnose or treat illness, correct deformities and defects, repair injuries and cure certain diseases **(Mohamed, Rezk, Hashem, & Ali. 2017).**

The operating room (OR) is a high-tech hospital environment where surgical, diagnostic, anesthetic, and therapeutic procedures are carried out using cutting-edge technology. The safety of the patients is of utmost importance in this high-risk medical environment **(Jung, Kim, & Kim, 2020; Hanfy, Taha, Mohamed, & Ahmed, 2021).**

In Egypt, hip fractures were expected to affect 55.19 out of every 100,000 men and 123.34 out of every 100,000 women in 2022–2023 **(El Miedany Y etal., 2024).** Additionally, based on an analysis of Tanta University Hospital's statistical records, approximately 500 orthopedic surgery patients were admitted or operated in-room throughout 2024 **(Statistical Analysis Record, Tanta University Hospital, 2024).**

WHO Safe Surgery Checklist (SSC) was created to help improve teamwork among OR staff, to reduce mortality and complications in the perioperative process, and to ensure the consistent use of procedures for safe surgery**.(O'Leary Wijeysundera & Crawford , 2016).** These checklist items intended to enhance communication between the operating team and provide a minimum standard of care that reduces complications and deaths associated with surgery. It must be checked at 3 points all the time of surgery; sign in, time out and sign out (**WHO, 2009).**

The WHO Surgical Safety Checklist is divided into three periods, to be completed at three separate times during the operative period which are routinely conducted as part of the surgical safety checklist. Checking surgeon availability, anesthetic safety, and equipment are reported to be more relevant at the start of the list, especially when there is continuity for the rest of the list **(Girma, Mude & Bekele. 2022).** The WHO Surgical Safety Checklist is divided into three sections, to be completed at three separate times during the operative period**: Sign In** – To be completed before the induction of anesthesia, in the presence of the anesthetist**, Time**

Out – To be completed before the first incision, acting as the final opportunity to identify the patient, the procedure, and the site involved, **Sign Out – during wound closure** : completed prior to the key members of the operating team leaving the operating room.(**Gillespie, Hamilton & Ball, 2023).**

First period (Sign In): During the first period members of the surgical team verify crucial safety information before anesthesia is administered. This includes verifying that the patient is properly identified, the surgical site is marked, the patient gives consent, the patient's pulse oximeter is operational, the patient is not allergic to any medications, there are no potential airway issues, and blood products are available if necessary **(Tan, etal,. 2021)**.

Second period (Time-Out); Confirmation of the correct patient, procedure, surgical site or level, appropriate antibiotic administration, availability of surgical implants, appropriate radiographic images, expected duration of surgery, blood loss, and any critical or unique surgical concerns during the procedure are all done by the surgical team just before the surgical incision **(O'Brien, Graham, & Kelly., 2017)**.

Third period (Sign-out); the checklist item that is used the least successfully is the third period (sign-out). At the end of the treatment, the anesthesia team is especially busy since they are waking up the patient, Sign Out, and other procedures. finished at the conclusion of the case, but before leaving the operating room, make sure that the procedure name is correct, label the pathology tissue specimens, count the needles, sponges, and instruments correctly, identify any issues with the surgical equipment that need to be fixed before the next case, and note any special post-operative care that may be needed **(McMullan & Thomas-Hawkins & Shirey., 2020)**.

Intraoperative Nursing Practices: -

Circulating nurse: Managing the nursing care of patients during surgical procedures is the responsibility of the circulating nurse, (a registered nurse). They oversee and manage the operations in the operating room rather than participating physically in the surgical procedure. (**Galazi., 2023)**. The role of a circulating nurse is planning and preparing the surgical suite. This includes positioning the equipment within the OR to ensure that movement within the OR can be done safely, without breaking the sterile

field. They must ensure that any equipment, instruments, accessories, and surgical supplies are needed for a specific orthopedic surgery is easily accessible. The Circulator nurse must also be adaptable as surgical procedures may change suddenly (**Galazi., 2023)**. Essential abilities for a circulating nurse include anticipating, prioritizing, problem-solving, being proactive, and being aware of urgent situations, disruptions, and distractions during surgery that raise the risk of mistakes in the operating room. During initial counts, when supplies and instruments are added or removed, and during closure counts, this is especially true **(Bubric , Biesbroek , Laberge, Martel & Litvinchuk., 2021)**.

Scrubbing nurse: A scrub nurse is a type of nurse who assists surgeons and other medical personnel in their work. Scrub nurses are also known as operating room (OR) or perioperative nurses. Depending on the institution, nurses may go by different names, but they all have the same duties. Scrub nurses use their expertise to help surgeons perform surgery **(Racal Casanova, 2021)**. Among their responsibilities are to: Ensure sterility and cleanliness during the surgical procedure; consider patient safety; set up tables with the required equipment; follow operating room protocols; and uphold the policy's requirements for surgical needles, instruments, counting, and sponges **(Hassan, Abd Elmolla, & Morsy, 2018)**.

Anesthetist nurse

Nurse Anesthetists are responsible for administering anesthesia to patients, monitors their vital signs during surgery, and ensures their comfort and safety. They also provide postoperative pain relief and collaborate with healthcare teams to ensure optimal patient care **(International Federation of Nurse Anesthetists., 2022).**

Nurses Anesthetist responsibilities assessing patients' medical histories for allergies or conditions that could affect anesthesia, assessing and preparing patients, educating them about surgery, recovery, and the potential side effects of anesthesia , determining the amount and type of anesthesia needed for the patient and the best way to administer it, preparing and administering the proper dose of anesthesia, monitoring patients' vital signs, overseeing patients' safety during anesthesia recovery, evaluating patients' progress before, during and after surgical procedures **(Saxena,**

Krombach, Nahrwold & Pirracchio., 2020; American Association of Nurse Anesthesiology, 2022).

A nurse's ability to effectively fulfill their role in patient safety is frequently influenced by the standard of their practice setting. Nursing can be a high-stress profession, and having optimal working conditions that is essential to ensure patient safety **(Vaismoradi, Tella, Logan, Khakurel&Vizcaya-., 2020).**

Significance of the study:

In Egypt their skillful staff and having a great experience in their specialized field but the lack of certain facilities and equipment as well as lack of concerns about safety care culture may reflect the need to increase nurses and OR staff perception of surgical safety, such as an operating room, the possibility for safety concerns can increase **(Auraaen, Slawomirski, & Klazinga, 2018; El-Sherbiny, Ibrahim & Abdel-Wahed 2020).**

The aim of the study is: To evaluate the effect of implementing surgical safety guidelines for orthopedic nurses ' on their Performance at operating room.

Research hypothesis:

The total level of nurses' performance is expected to improve after receiving surgical Safety Guideline.

Subjects and Method

Research Design: quasi experimental research design was used in this study.

Study settings:

The study was conducted at Tanta International Educational Hospital's at orthopedic operating room.

Subjects: sample of the study consisted of all nurses (40) worked in Orthopedic Department Operating Room at Tanta International Teaching University Hospital were included in the study and evaluated before and after the implementation of surgical safety guidelines.

Study tools: Two tools were used for data collection as:

Tool I: "Operating Room Nurses Interview Questionnaire". It consisted of two sections: **Part one :** Nurses' Socio Demographic Characteristics of Orthopedic Operating Room that include the demographic characteristics of the studied nurses as age, gender, marital status, qualification, years of experience, attendance of pervious training courses related to surgical safety and duration after training.

Part two: "Nurses' Knowledge Assessment about Orthopedic Surgical Safety guidelines".

It was developed by the researchers based on literature review (**Fadllalah & Ibrahim, 2019; Mukhtar& Ahmed, 2019.** about pre-operative nurses' knowledge, Intra-operative nurses' knowledge, and post-operative nurses' knowledge. The Scoring system as following: Correct and complete scored (2), correct and incomplete scored (1), don't know or incorrect answer scored (0). The total scoring system of the nurses' knowledge was calculated and classified as the following: High >80% of the total score Moderate from 80-60 % of the total score and Low < 60 % of the total score

Tool II: Nurses' Practice toward use of surgical safety guidelines checklist: This checklist was adapted form (**World Health Organization, 2021; Hassan, Abd Elmolla, Morsy 2018; McMillan, Thomas-Hawkins& Shirey 2020),** it was used to assess scrub, circulating and anesthesia nurse's practices regarding surgical safety guidelines and it included:

-Scrub nurses' practices at the operating room: it contained 30 items like; Makes sure of instruments/supplies sterilization, confirm patient's identity, site, procedure, and consent.

-Circulating nurses' practices at the operating room: it contained 45 items like; ensures cleanliness o operating room, check the functioning of light.

Anesthesia nurses' practices at the operating room: it contained 19 items likes; Assists the anesthesiologist in intubation, monitor patient's consciousness level until transfer to recovery room and then to surgical department or ICU. Scoring system of nurse's performance toward use of surgical safety guidelines, were categorized as

-Satisfactory if total score ≥ to 80%.

-Unsatisfactory if total score < 80 %.

Methods: permission ethical consideration: Ethical approval was obtained from Scientific Research, Ethical Committee, code number 285/8/2023; Nature of the study was not cause harm for the entire sample.

Validity of tools:

The developed tools were tested for content validity for clarity and applicability by nine experts from the Medical-Surgical Nursing field and orthopedic physicians.

A pilot study:

Before embarking actual study, a pilot was carried out on a sample (10%) of selected participants. Modifications

were done by the researcher before the main study those were excluded from the actual sample.

- **Reliability of the tools:** The reliability for the study tools was calculated by Cronbach's Alpha test. It was calculated:
- **Tool I** "Operating Room Nurses Interview Questionnaire" **was 0.906.**
- **Tool II** Nurses' practice toward use of surgical safety guidelines checklist: **was 0.878.**
- **Cronbach's Alpha** for **the sheet in total is 0.881** for 147 items applied on 40 nurses.
- **Field work:** -Data were collected over a period of 12 months, started from November - 2023 to November – 2024
- -The study was conducted through four phases (Assessment, planning, implementation, and evaluation).
- **Assessment Phase:**
- Each Orthopedic nurse was individually interviewed 2 shifts at the morning and afternoon shift during the period of stared.
- An initial assessment was carried out by the researcher for all nurses in orthopedic room to assess nurses' socio demographic data, nurses' knowledge about safety guidelines toward orthopedic surgery and performance pre-operative intra-operative post-operative by using tool I and tool II.

B- Planning phase:

- Development of surgical safety guidelines regarding orthopedic surgery based on literature review (**World Health Organization, 2021; Hassan, 2018; McMillan, 2020),** and assessment. The goal of implementing surgical safety guidelines was to improve nurse's performance after implementation of surgical safety guidelines for nurses under orthopedic surgery, and enhance orthopedic nurse's knowledge.
- The studied nurses were divided into subgroups each one contain five nurses and was attained four sessions (Two theoretical and two practical) on morning shift and every session was about (30: 45 minutes) 3 time weekly.
- Different materials for intervention were used as safety guidelines booklet and power point was used by the researcher based on literature review.
- The contents of safety guidelines were based on Anesthetic, scrub, and circulating nurses' practices at the orthopedic operating room.
- Teaching method was included: lecture, group discussion, demonstration and remonstration pre and posttest was done every session for pre- intra- post orthopedic surgery and after two months.

Implementation phase:

-Surgical safety guidelines teaching and training was applied to the nurses in 4 sessions.

-The teaching contents was designed and presented in Arabic language.

Part I: Theoretical part; was included 2 Sessions

First session; it was designed to cover all orthopedic technical items, perioperative; ideal operating room design, work place safety, Confirm patient's identity and consent, safe surgery patient safety, positioning of patients during the operation and after operation airway management; anesthesia safety, hyperthermia management

Second session; it included intraoperative scrub, circulating duties and correct processing of specimens, risks to surgical patient safety due to improper practices or poor communication among surgical team members included ; wrong site surgery, drug related events as allergic reactions, physical injuries, diathermy related burns, Mishandled specimens, inappropriate blood loss control, environmental hazards, retention of surgical items inside the wound, health care associated infection, and anesthesia related complications.

Part II: Practical part; was included 2 Sessions:

First session; it included infection prevention and control in operating room. Surgical safety measures and common supplies used in operating room.

Second session; It nclude role of anesthesia nurses; Confirm patient's identity, procedure and consent, check anesthesia machine and endoscope, connect patient to the monitor, check if patient has allergy, Insert IV cannula, provide adequate oxygen, administers medications, Assists the anesthesiologist in intubation.

D- Evaluation phase:

Orthopedic nurses were evaluated as following:

Pre intervention was evaluated for all orthopedic surgical nurses.

Post intervention of implementation of orthopedic safety guidelines was evaluated 2 times (one time immediately, second after two months) by using tool I, tool II to assess effect of implemented surgical safety guidelines for on orthopedic nurses 'on their Performance at operating Room.

Statistical analysis:

SPSS software, a statistical computer package version 30, was used to arrange, tabulate, and statistically

evaluate the data that had been gathered. The range, mean, and standard deviation were computed for quantitative data. The Chi-square test ($\chi 2$) was used to compare qualitative data. The paired samples t-test was used to compare the means of two variables within a group. The F-value of analysis of variance (ANOVA) was computed for comparison of means for variables over three intervention periods in a group or for more than two variables **(Lisa M Sullivan. 2023)**.

Results: Table (1): Distribution of the studied orthopedic operating room nurses regarding Socio-demographic Characteristics.

The table reveals that more than half (52.5. %) of the nurses were in the age group (30-< 40) years, followed by (37.5 %) of them were in the age group (20-<30) years. All of the nurses were married. The majority of them (82.5 %) were female. In relation to educational level; near to half (42.5 %) had technical nursing institute followed by (40.0 %) who had Bachelor degree. Additionally, it was found that more than half (62.5 %) of the studied nurses had (≥ 10) years of experience. Moreover, their previous training about surgical safety at operating room revealed more than half of the studied nurses (60.0 %) did not have previous training about Surgical Safety at Orthopedic Operating Room.

Figure 1: the figure illustrates mean scores of knowledge domains of the Studied Nurses about Orthopedic Surgical Safety Guidelines throughout periods of Implementation.

The figure illustrates that there was a highly statistically significant mean score improvement in the total of nurses 'knowledge about the following; pre-operative, intra-operative, post -operative, regarding Orthopedic Surgical Safety Guidelines at (p value = 0.000*).

Figure 2: Distribution of the studied nurses regarding total knowledge level about Orthopedic Surgical Safety Guidelines throughout periods of Implementation. It Depict that there was a highly statistically significant improvement in the total level of nurses 'knowledge post implementation of orthopedic surgical safety guidelines about (95 %), whereas about (90.0 %) of orthopedic nurses had moderate level of knowledge Post 2 months implementation of orthopedic surgical safety guidelines.

Figure 3: Mean scores of the studied nurses' total practice domains toward use of surgical safety guidelines throughout periods of

implementation.it shows significant improvement in the total level of nurses' practice regarding the following: **Scrub, Circulating, Anesthesia nurse's practices at operating room**: total practice (68.8) %, immediate post intervention while after two months (49.45) %,

Figure 4: Distribution of the studied nurses regarding total practice level toward use of surgical safety guidelines throughout periods of implementation.

Figure 4: showed that there was a high statistically significant improvement in the total practice level toward use of surgical safety guidelines throughout periods of implementation. Where about (95 %) of studied nurses had Unsatisfactory level of practice pre implementation of surgical safety guidelines, compared to (97.5 %) of them had satisfactory level of practice immediate post implementation of surgical safety guidelines, but post 2 month of implementation Orthopedic Surgical Safety Guidelines, was decreased to (92.5 %) of studied nurses who had satisfactory level.

Table (2): shows Correlation between total knowledge and practice level toward use of Surgical Safety Guidelines throughout periods of Implementation. It can be noticed that there was a positive significant correlations association between both total knowledge and practice level of the studies nurses, at post 2 months period of Implementation of Surgical Safety Guidelines (p 0.037).

Table (2) shows correlation between total knowledge level and practice level toward use of Surgical Safety Guidelines throughout periods of implementation, It can be noticed that there was a positive significant correlations association between both total knowledge and practice level of the studies nurses, at post 2 months period of Implementation of Surgical Safety Guidelines (p 0.037).

Table (1): Distribution of the studied orthopedic operating room nurses regarding Socio-demographic Characteristics.

Socio-demographic Characteristics	The studied nurses(n = 40)	
	N	%
Age (in years) (20-<30) (30-<40) (≥40)	15	37.5
	21	52.5
	4	10.0
Range **Mean ± SD**	**(22-43)** **32.13±5.880**	
Gender Male Female	7	17.5
	33	82.5
Level of education Nursing Diploma Technical Nursing institute Bachelor of Nursing	7	17.5
	17	42.5
	16	40.0
Marital status Married	40	100.0
Experience at the OR (in years) (1-<5) (5-<10) (≥10)	8	20.0
	7	17.5
	25	62.5
Range **Mean ± SD**	**(1-22)** **11.38±6.287**	
Pervious Training courses related to orthopedic surgical safety: None Lecture Workshop Training course	24	60.0
	7	17.5
	5	12.5
	4	10.0
Duration of training (in days) Range Mean ± SD	(1-6) 2.38±1.708	

Figure 1: shows Mean scores of knowledge domains of the Studied Nurses about Orthopedic Surgical Safety Guidelines throughout periods of Implementation.

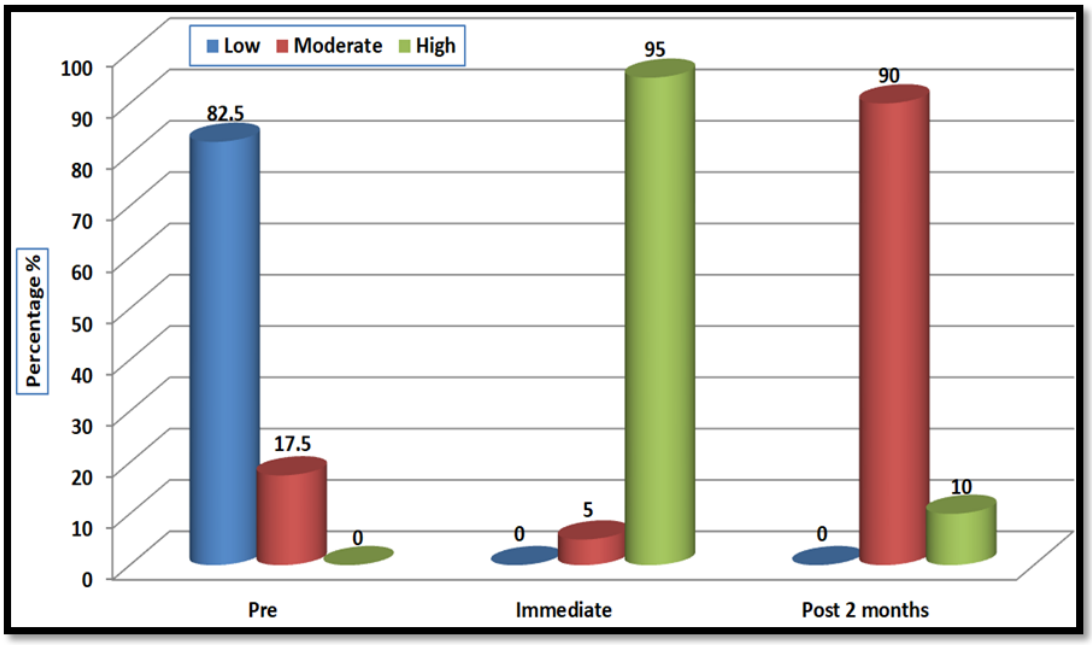

Figure 2: Distribution of the studied nurses regarding total knowledge level about Orthopedic Surgical Safety Guidelines throughout periods of Implementation.

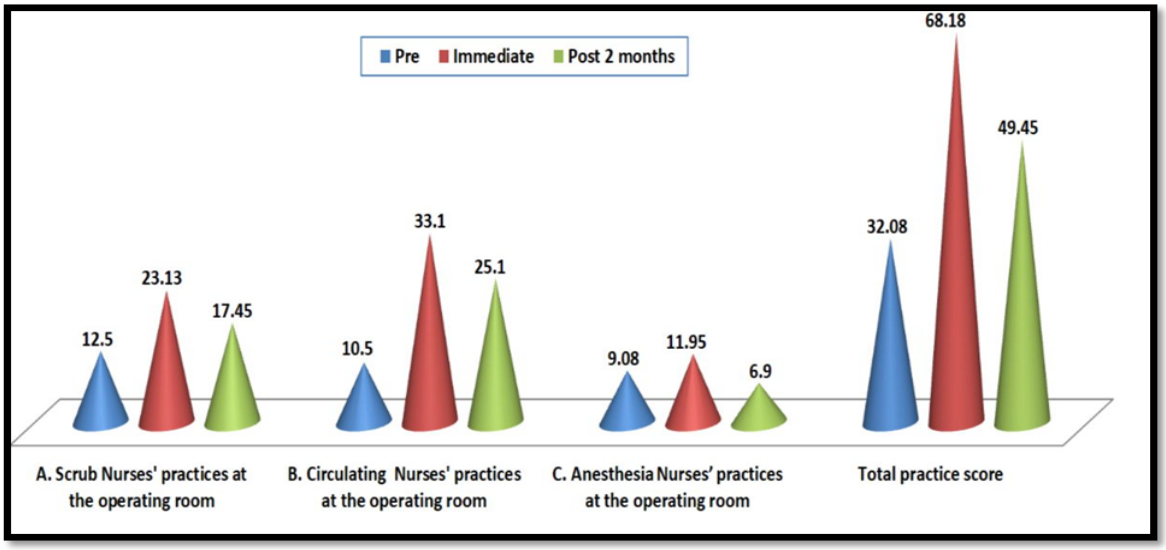

Figure 3: Mean scores of the studied nurses' total practice domains toward use of surgical safety guidelines throughout periods of implementation.

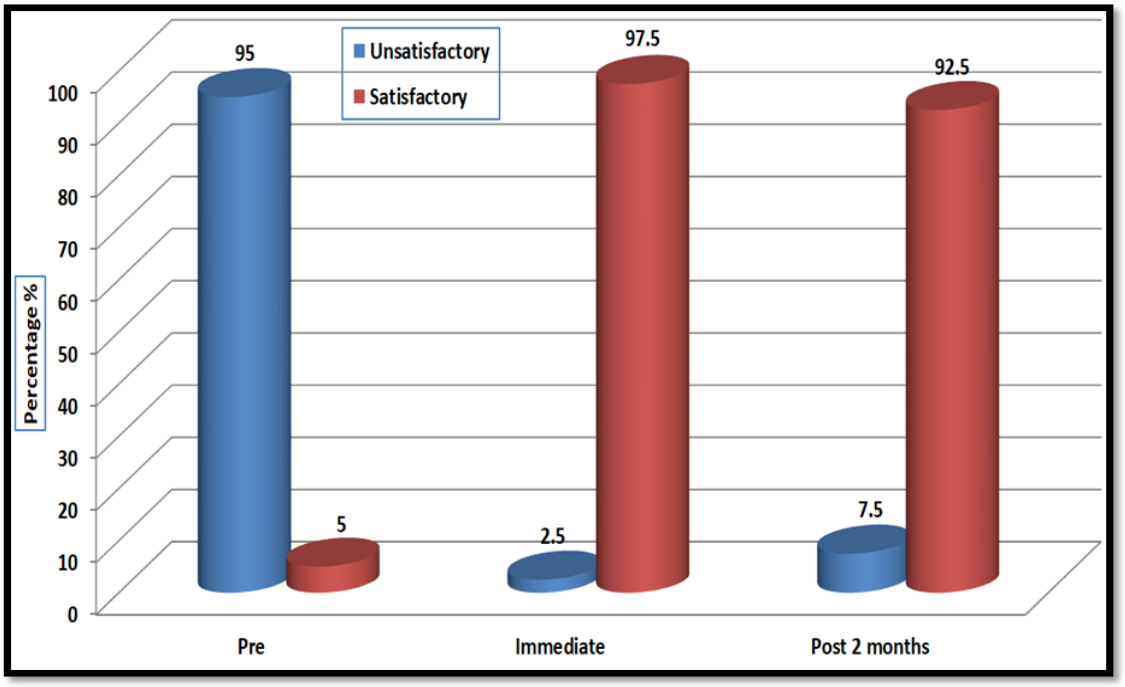

Figure 4: Distribution of the studied nurses regarding total practice level toward use of surgical safety guidelines throughout periods of implementation.

Table (2): Correlation between total knowledge and practice level toward use of Surgical Safety Guidelines throughout periods of Implementation.

Total knowledge level	The studied nurses (n=40) Total practice level				χ^2 P
	Unsatisfactory		Satisfactory		
	N	%	N	%	
Pre					
Low	40	100.0	0	0.0	-
r , P	0.103 , 0.528				
Immediate					
Moderate.	5	12.5	2	5.0	**FE**
High.	22	55.0	11	27.5	**1.00**
r , P	0.242 , 0.132				
Post 2 months					
Moderate.	11	27.5	3	7.5	**FE**
High.	26	65.0	0	0.0	**0.037***
r , P	0.084 , 0.605				

Discussion

Surgical Patient safety remains one of the core indicators for estimating quality and level of health care services globally. By improving patient safety systematically, it has been shown reduction of spending approximately 28 billion of total health care resulting from developed patient safety monitoring systems as well as forceful patient safety culture. **(Amiri & Solankallio-Vahteri & Tuomi., 2019**).

The finding of the present study revealed that nearly more than half of the nurses were in the age group (Thirty – Forty) years, with a mean age of **32.13±5.88** This finding was in agreement with (**El-Shafei et al., 2019)**, who reported that the mean age of the studied nurses was 31±9 years.

In relation to educational level of studied nurses, the present study revealed that one half of nurses had nursing diploma, were less half of the nurses had Bachelor of nursing and about half had technical nursing institute**.** This finding is consistent with **(Zhu et al., 2021)**, who discovered that more than half of nurses had nursing institute qualification, might be due to nursing institute qualification were more practiced than other in Egypt.

In the current study Years of experience, more than half of the studied nurses had more than ten years of experience. The fact that OR nurses should have experience may be the cause of this result. This result in contrary to the study conducted by **Hassan, Abd Elmolla, Morsy., (2018) & Zhu et al., 2021)**, who reported that two thirds of the studied nurses had experience ranging from one to five years. **As regarded to their previous training,** the results of the present study showed that more than half of studied nurses did not have previous training. This result was **congruent with** a study done by **Mukhtar & Ahmed, (2019)** who denoted that most of the studied nurses didn't receive any training course about patient safety

Concerning to the level of nurses 'knowledge, regarding their pre-operative, intra operative, post-operative' role about orthopedic surgical safety guidelines throughout periods of implementation, a highly statistically significant increase in nurses' overall level of knowledge about pre, intra, post-operative' knowledge for orthopedic surgical safety guidelines throughout periods of implementation. This finding was consistent with (**Fadllalah &**

Ibrahim., 2019), In their study on the "Effect of proposed program of patient safety on nurse's knowledge and quality of care at Kosti and Rabak teaching hospitals-Sudan," they found that implementation of the training program improved nurses' knowledge mean scores with high statistically significant differences.

Concerning to level of practices of OR nurses, According to the current study's findings, nurses' level of "practice about immediately post-operative" practices about orthopedic surgical safety recommendations improved significantly during the implementation periods. This finding was consistent with (**Abo el-Seoud El-Sabbagh, Zakaria, Ibrahim., 2018),** who demonstrated that the WHO Surgical Safety Checklist items had significantly enhanced the level of practice of operating room nurses during the sign-in, time-out, and sign-out phases. These findings also aligned with those of (**Eshun & Hollanti 2023)** who found that most nurses considered their practice to be at a satisfactory level in accordance with surgical patient safety criteria.

As regarded to scrub nurses' practical level, according to the current study's findings, nurses' practice of using surgical safety guidelines regarding their scrub role in the operating room during operations improved at a high statistically significant rate during the implementation periods.

This finding is congruent with **(Labarge, Arteche, Yboa, & Pacolor ., 2020),** who stated that, majority of studied nurses 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.

As regarded to circulating nurses' practical level, the results of the present study showed that there was a high statistically significant improvement in the level of nurses 'practice regarding their practice toward use of surgical safety guidelines about their circulated role at the operating room during operation throughout periods of implementation.

According to **(Association of Registered Nurses., 2020),** the perioperative nurse education has a positive effect on preventing positioning injuries by anticipating the required positioning equipment based on the patient's identified

needs, applying the principles of proper body mechanics, conducting continuous evaluations during the perioperative period, and coordinating with the entire perioperative team.

Related to total level of practices of the scrub and circulating nurses according to their circulating duties, the present study revealed that more than half of the studied nurses had total competent level of practices at the operating room. This result is inconsistent with study done **by (Shin &Kim., 2021),** who found that the OR nurses' perioperative competencies were the highest.

According to the anesthesia nurses' total level of practices, according to the current findings, the majority of the anesthesia nurses in the study had total less level of practices at operating room. This result **is congruent with (Jeon & Choi., 2021),** who stated that the patient's level of care and anesthesia knowledge were both rated as low. Insufficient training programs, a lack of job descriptions for anesthesia nurses, a lack of anesthetic nursing experience, and less than a year of experience could all be contributing factors.

Concerning the correlation between total knowledge level and total level of nurses 'practice toward use of surgical safety guidelines, the current study's findings demonstrated strong positive significant correlations associations between both total knowledge and practice level of the studied nurses. This finding supported by **(Mohamed, Ragheb, Ali, & Ali, 2020):** This conclusion was backed up by someone who explained that the practice of operating room nurses enhanced their theoretical knowledge, which in turn increased their capacity to prioritize treatments. Professionally safe practice of the discipline requires the use of all types of knowledge.

Conclusion: Based on the findings of the current study, it can be concluded that the implementation of Orthopedic Surgical Safety Guidelines the use of guidelines helps nurses become more knowledgeable and proficient regarding Orthopedic Surgical Safety Guidelines.

Recommendations

Based on the findings of the current study, these following recommendations are derived and suggested:

1- Recommendation for nurses:

- Attending seminars and in-service training programs regarding Orthopedic Surgical Safety Guidelines for gaining update knowledge and enhancing their practice periodically.

-Nurses should be expert in applying Orthopedic Surgical Safety Guidelines that is the basic element of the care of patients undergoing Orthopedic Surgery.

-Nurses should have enough experience about how to prevent and to manage postoperative complications.

2-Recommendation for administration:

-Ongoing deigning seminars, continuous educational and in-services training program about Orthopedic Surgical Safety Guidelines that should be organized according to nurse's need.

-Availability of educational center in the surgical department for nursing continuing education.

-Nursing participation in the scientific meeting and conference is required for updating nurse's knowledge and practice.

-Applying updates and evidence-based protocols instead of a routine care in the nursing management of patients undergoing Orthopedic Surgery.

-Periodical evaluation of nurses to identify the strength and weakness point in the nursing management of patients undergoing Orthopedic Surgery.

-Availability of supplies and facilities that allow for a high quality of Care.

-Distribution of booklet that is including standard of techniques to all nurses who were working in the orthopedic surgery department.

3- Recommendation for research:

-It's recommended that replication of the study in different settings.

References

American Association of Nurse Anesthesiology. (2022). Become a CRNA. Chicago: (cited 2022 Jan 13). [Internet] c. Available from: https://www.aana.com/membership/become-a-crna.

Association of Registered Nurses AORN. (2020). AORN Position Statement on Perioperative Registered Nurse Residency Programs. AORN, Inc. https://aorn.org/guidelines/clinical-resources/position-statements.

Aboel-Seoud, A,. El-Sabbagh, F., Zakaria,Y. and Ibrahim ,M. (2018). Is implementation of who surgical safety checklist (266.) will reduce the rate of major

post-operative complications at zagazig university hospital? (An intervention study), *zagazig university medical journal, 21*, :1-15.

Amiri A., Solankallio-Vahteri. T& Tuomi S. (2019). Role of nurses in improving patient safety: Evidence from surgical complications in 21 countries. Int J Nurs Sci. May 23; 6(3):239-46. doi: 10.1016/j.ijnss.2019.05.003. PMID: 31508441;

Auraaen, A., Slawomirski, L., & Klazinga, N. (2018). The economics of patient safety in primary and ambulatory care. Organization for Economic Cooperation and Development (OECD) Health Working Paper No. 106. Available at: http://www.oecd.org/els/health-systems/healthworking-papers.htm.Last access: 1/10/2021. 9 AM.

Bubric K., Biesbroek S., Laberge J., Martel J.& Litvinchuk S. (2021). Prevalence and characteristics of interruptions and distractions during surgical counts. *The Joint Commission Journal on Quality and Patient Safety. 47: 556-562.*

El Miedany Y., El Gaafary, M., Gadallah, N, Mahran, S, Fathi N, Abu Zaid M, Tabra, S, Hassan W, Elwakil W. (2024). Incidence and geographic characteristics of the population with osteoporotic hip fracture in Egypt- by the Egyptian Academy of Bone Health. Arch Osteoporosis. Sep 9; 18(1):115. doi:10.1007/s11657-023-013258.

El-Shafei A., Ibrahim S. & Tawfik A. (2019). World Health Organization Surgical Safety Checklist with Addition of Infection Control Items: Intervention study in Egypt. *Open Access Macedonian Journal of Medical Sciences, 7(21): 3691.*

El-Sherbiny N., Ibrahim E., & Abdel-Wahed W. (2020). Assessment of patient safety culture among paramedical personnel at general and district hospitals, Fayoum Governorate, Egypt. *Journal of the Egyptian Public Health Association, 95(1), 1-8.*

Eshun, O., & Hollanti, H. (2023). Effect of nurses' implementation of surgical safety guidelines on their performance and post-operative complications. *Assiut Scientific Nursing Journal, 10(33), 54–63.*

https://doi.org/10.21608/asnj.2022.167782.1443

Fadllalah, H. & Ibrahim, M. (2019): "Effect of proposed program of patient safety on nurse"s knowledge and quality of care at kosti and rabak teaching hospitals-sudan." *International journal of research - granthaalayah, 2(2), 16-12.*Https://doi.org/1605201/zenodo.252.0610.

Galazi A. (2023). The Critical Role of a Circulating Nurse in Surgical Procedures. J Perioper Crit Intensive Care Nurs. 9:220. https://doi.org/10.35248/2471-9870.23.9.220.

Girma T., Mude L. & Bekele A. (2022). Utilization and Completeness of Surgical Safety Checklist with Associated Factors in Surgical Units of Jimma University Medical Center, Ethiopia. Int J Gen Med. Oct 12; 15: 7781-88. doi: 10.2147/IJGM.S378260. PMID: 36258800; PMCID: PMC9572490.

Gillespie B., Hamilton K. & Ball D, et al (2023). Unlocking the "black box" of practice improvement strategies to implement surgical safety checklists: a process evaluation. J Multidiscip Healthc. 10: 157-66.

Hanfy, E., Taha, N., Mohamed, F., & Ahmed, Z. (2021). Factors affecting Nurses Performance Regarding Patient Safety in Emergency Operating Rooms. Annals of R.S.C.B; 25(6): 18986 – 1899.https://www.aana.com/membership/become-a-crna

Hassan O, Abd Elmolla M, Morsy N (2018). Quality of nursing care provided to patient in the operating room. *Medical Journal of Cairo University, 86 (4):2001 2010.*

International Federation of Nurse Anesthetists IFNA. (2022). International Federation of Nurse Anesthetists. [Cited 2020 Mar 20]. [Internet] c. Available from: http://ifna.site/about-ifna

Jeon, Y., & Choi, H. (2021). A systematic review of communication programs for nurses working in hospitals. *Korean Journal of Stress Research, 29(2), 69–79.* https://doi.org/10.17547/kjsr.2021.29.2.69

Jung, J., Kim, H., & Kim J. (2020). Comparison of nursing performance competencies and practical education needs based

on clinical careers of operating room nurses: a cross-sectional study. Healthcare; 8(136): 1-9.

Labrague, L., Arteche, D., Yboa, B. and Pacolor, N(2020): Operating Room Nurses‟ Knowledge and Practice of Sterile Technique. *Nursing &Care Journal, 11.*

Lisa M Sullivan. (2023). Essentials of biostatistics in public health, 4th edition. Jones and Bartlet Learning, Burlington.https://books.google.com/books/about/Essentials_of_Biostatistics_for_Public_H.html?id=o4WjzgEACAAJ

McMullan S., Thomas-Hawkins C. & Shirey M. (2020). Certified registered nurse anesthetist perceptions of factors impacting patient safety. Nurs Adm Q. 2020; 41 (1): 56-69.

Mohamed, N., Ragheb, M., Ali, H., & Ali, M. (2020). Effect of Implementing an Educational Program on Nurses' Performance Regarding Intraoperative Surgical Patient Safety. Available at: https://fnur.stafpu.bu.edu.eg › publications. Last access: 1/7/2021. 9: 50 AM Mohamed, N., Rezk, M., H.

Mohamed, N., Rezk, M., Hashem, H., & Ali, M. (2017). Intraoperative nurses' safety practices: its effect on postoperative adverse events among surgical patients undergoing general anesthesia. *Egyptian Journal of Health Care; 8 (3): 114-129.*

Mukhtar, H., & Ahmed, M. (2019). Effect of proposed program of patient safety on nurse's performance and quality of care at kosti and rabak teaching hospitals-sudan. *Donnish Journal of Nursing and Midwifery; 4 (1): 1- 6.*

O'Brien, B., Graham, M. & Kelly, M. (2017). Exploring nurses' use of the WHO safety checklist in the perioperative setting. *J Nurs Manag. 25(6): 468-76).*

O'Leary J., Wijeysundera D. & Crawford M. (2016). Effect of surgical safety checklists on pediatric surgical complications in Ontario. *Can Med Assoc J. 188(9):E191–98.* doi:10.1503/cmaj.151333. [PMC free article] [PubMed] [Google Scholar].

Racel Casanova, Jo. (2021)."Ever thought about being a scrub nurse?" Nursing Standard 36, no. 12 71–72.

http://dx.doi.org/10.7748/ns.36.12.71.s24

Saxena S., Krombach J., Nahrwold D. & Pirracchio R. (2020). Anaesthesia-specific checklists: a systematic review of impact. Anaesth Crit Care Pain Med. 2020; 39: 65–73. doi: 10.1016/j.accpm.2019.07.011.

Shin Y. & Kim S. (2021). Operating room nurses want differentiated education for perioperative competencies based on the clinical ladder. *International Journal of Environmental Research and Public Health, 18(19): 10290.* doi: 10.3390/ijerph181910290.

Statistical Analysis Record, Tanta University Hospital, 2024.

Tan J., Ngwayi J., Ding Z., Zhou Y., Li M., Chen Y., Hu B., Liu J. &Porter D. (2021). Attitudes and compliance with the WHO surgical safety checklist: a survey among surgeons and operating room staff in 138 hospitals in China. Patient Saf Surg. Jan 6; 15 (1):3. doi: 10.1186/s13037-020-00276-0.

Vaismoradi M., Tella S., A Logan P., Khakurel J., &Vizcaya-Moreno F. (2020). Nurses' Adherence to Patient Safety Principles: A Systematic Review. *Int J Environ Res Public Health. Mar 19; 17 (6):2028.*

WHO (World Health Organization) (2009). WHO Lives. Patient safety, a World Alliance for Safer Health Care. http://www.who.int/patientsafety/safesurgery/tools.

World Health Organization, (2021). Safe surgery. available at: https://www.who.int/teams/integratedhealth-services/patient safety/research/safe-surgery. Last access: 30/9/2021. 7.0 PM.

Zhu Q, Deng Y, Chen J, Luo, W., Ciesielski, P. Fang, Z.,Zhu, J. Henriksson, G, (2021). Preoperative fasting guidelines: Where are we now? Findings from current practices in a tertiary hospital. *Journal of Peri Anesthesia Nursing, 36(4): 388-92.*