Assessment of a Surgical Safety Performance among Surgical Teams and Barriers in the Operating Room and its Effect on Patient's Outcomes

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Abstract

Background: Surgery has become an integral part of global health care. Surgical complications are common and often preventable. Although surgical and anesthetic caregivers seek to deliver optimal quality in peri-operative service, surgery still carries considerable risk for the patient. **Aim of the study:** This study aimed to assess a surgical safety performance among surgical teams and barriers in the operating room and its effect on the patient's outcomes. **Study design:** Descriptive exploratory research design was utilized to achieve the aim of this study. **Research setting**: The study was conducted in all operating rooms of both general and special surgical departments at Benha University Hospital, Qalyubia Governorate, Egypt. **Study subjects:** A convenience sample of available surgical teams of physician (200), of nurses (200) in the operating room and patients (200)**. Tools of data collection:** Four tools were used to collect data: **Tool (I)** A Structured Interview Questionnaire included two parts: Demographic data and Facilities and Resources Assessment, **Tool (II)** Observational Surgical Safety Checklist practice assessment, **Tool (III)** Intrusive Barrier of a Surgical Safety Checklist Assessment **and Tool (IV)** Patients' health outcome assessment. **Results:** The nurse, anesthetists and surgeons were compliance with all phases of World Health Organization (WHO) surgical safety checklist performance with mean score 88.5%, 88.9% and 87.9% of total score respectively, and 46.5 % of the studied patients had no postoperative problems, while 9.5 % had life threatening problems. **Conclusion:** There was highly significant negative correlation between the total nurses, surgeon and anesthetists' practice compliance with WHO surgical safety checklist and postoperative patients' outcomes and there was a positive and insignificant correlation between patients' outcomes and the barriers. **Recommendations:** Providing training programs to health care workers to enhance compliance of surgical safety checklist level and patient safety.

Keywords: *Barriers, Patients' outcomes, Operating room, safety performance, Surgical team.*

Introduction

The operating room (OR) is one of the most complex work environments in health care. It is also a common site for adverse events. Wrong–site/ wrong-procedure surgeries, retained sponges, unchecked blood transfusions and overlooked allergies are examples of potentially catastrophic events, which can be prevented by improved communication and safer hospital systems. Creating a culture of safety should be of high priority for OR teams **(Noaman, Soliman & Hasaneen, 2020).**

Postoperative complications may either be general or specific to the type of surgery undertaken and should be managed with the patient's history in mind. Common general postoperative complications include postoperative fever, hemorrhage, atelectasis, wound infection, embolism and urinary

retention. The highest incidence of postoperative complications is between one and three days after the operation. However, specific complications occur in the following distinct temporal patterns: early postoperative, several days after the operation (**Qureshi et al., 2019).**

Surgical teamwork is essential to maintain high quality healthcare and has been shown to impact safety outcomes in the operating room, particularly during non-routine incidents or moments of uncertainty. Although, little is known about the specific competencies expressed by the various team members. To understand how clinical teams function, it is important to characterize the teamwork competencies expressed by each team member **(Zajac et al., 2021).** Moreover, surgical performance is an action to perform surgical safety correctly and properly. The WHO checklist has been designed efficiently and effectively to be used by the surgical team in the operating room **(Memarbashi et al., 2020).**

Nursing is vital in all stages of the perioperative period, being considered the main team and agent of change for the transformation of the health system, in order to make it safer. In the surgical environment, nurses play a key role in ensuring that best care practices provide patient safety. Therefore, the relevance of this study about good practices for patient safety in the operating room is emphasized, based on nurses' recommendations **(Silva et al., 2018).**

The WHO Surgical Safety Checklist (SSC) was prepared to improve the safety of surgical procedures in order to execute key safety checks during important phases of perioperative care: prior to the induction of anesthesia (sign in), prior to skin incision (time out) and before the team leaves the operating room (sign out). Implementation of a surgical safety checklist caused a reduction in the number of perioperative complications and communication gap in the operation theatre **(Abbott et al., 2020).**

The most common barrier was lack of communication between the surgeon and the anesthetist at the end of the surgical procedure. The surgeon might leave the hospital before 'sign out' and the anesthetists might return during recovery after skin closure. This jeopardized the sharing of information on patient management. Staff found that the checklist took too long to complete as they already had a heavy workload, and did not perceive the added benefit. According to surgeon, 'the checklist could generate delays and conflicts' **(Chhabra et al., 2019).**

Barriers to the effective implementation of the SSCL include the duplication of checklist items with checks already in place, poor communication between team members, perception of the checklist as a time-consuming process without the addition of benefit to patient care and safety, poor timing for completion of the list, worsening of patient anxiety, uncertainty about each member's role, inappropriate nature of the set questions for different centers, and 'gaming', where items not checked are marked off as checked (**Tostesa & Galvãob, 2019)**.

Naidoo et al., (2020) identified some of these barriers. Poor teamwork between doctors and nurses, lack of support from senior healthcare workers and management and personal motivation were cited as contributing to poor implementation, embarrassment during timeout or the introduction process, hierarchical issues, timing of the checklist and duplication of checks were recognized as challenges. **Treadwell et al., (2020)** divided barriers into four categories: confusion regarding the proper use of the SSC, pragmatic changes to efficient workflow, access to resources, and individual staff beliefs and attitudes.

The outcomes of the enhanced recovery after surgery pathways were initially determined by clinicians rather than patients. However, reductions in length of hospital stay and complications associated with the enhanced recovery pathway are limited interest to patients. Patients rarely achieve normal levels of function and are usually symptomatic on discharge after major surgery, the timing of which is influenced by organizational factors **(Group, 2020).**

Surgical outcomes tend to be favorable and the treatment effect is maintained for several years after surgery. However, no consensus has been reached for defining favorable or successful surgical outcomes. Recently, the concept of Minimal Clinically Important Difference (MCID) has been used as a critical threshold to measure treatment effectiveness. However, the MCID cannot reflect overall surgical outcomes in patients and only represents successful improvements in patient-reported and observed outcomes (**Triebel et al., 2020)**.

Significant of the study:

The operating room is a fast-paced, stressful work environment, where multidisciplinary staff perform complex tasks requiring technical skills and nontechnical skills, all while responding to real-time information from the patient, coworkers, and monitors. This environment presents numerous opportunities for errors. With approximately 313 million surgeries performed worldwide every year, these errors can translate to a substantial number of adverse events **(Koleva, 2020)**.

A global pilot test of the checklist saw a 36% decline in postsurgical complications and a 47% reduction in mortality rates in 8 participating sites. These outcomes and others13–15 led to the rapid adoption of the Checklist worldwide, with at least 139 countries, or 70% of the nations of the world, currently using the tool in their ORs **(Koleva. 2020**). In developing countries, such as Egypt a total of 4.2 million post-operative deaths have been estimated annually, mortality rates are projected to be between 5–10% for major surgeries which is ten times the surgical mortality in developed countries **(Mascagni et al., 2022).**

Annually, 234 million patients undergo surgery procedures, adverse events in surgery were reported to occur in more than 14% of patients, and 55% of these adverse events are preventable. The safe surgery checklist (SSC) was introduced by WHO in 2008 to be used in operation rooms. The SSC was developed to improve teamwork, communication, and consistency of care and to prevent adverse events, strengthen safety practices, and improve the quality of care provided to the surgical patient. The SSC has been demonstrated to reduce surgical complications and deaths by 30 - 50**% (WHO, 2021)**. This study aimed to assess a surgical safety performance among surgical teams and barriers in the operating room and its effect on the patient's outcomes.

Aim of the study:

The present study aimed to assess surgical safety checklist performance among surgical teams and barriers in the operating room and its effect on the patient's health outcomes.

Research Questions:

Q1: Are the surgical teams complying and practicing the surgical safety checklist in the operating room?

Q2: Are there barriers that interfere all the surgical teams practicing the surgical safety checklist?

Q3: What is the effect of surgical safety checklist among surgical teams on post-operative patient's outcomes?

Operational definitions:

Surgical team's performance: It means compliance all surgical teams with surgical safety checklist.

Surgical Safety Checklist: Safety measures are activities and precautions should be taken

to improve patient safety and reduce risk related to human health, protect from harm or other danger and control of recognized hazards in order to achieve an acceptable level of risk.

Patients' Outcomes: Identify the actual problems and the complications of patient who undergoing a minor and major surgery within 48 hours post operatively such as fever, tachycardia, hypertension, and wound infection.

Subjects and Method:

Research Design:

Descriptive exploratory research design was utilized to achieve the aim of this study.

Settings:

The current study was conducted in all operating rooms of both general and special surgical departments at Benha University Hospital, Qalyubia Governorate, Egypt. It is located on the second floor of the surgical building, and it contains twelve rooms, ten rooms for all surgical departments such as general surgery, neurosurgery, ear, nose and throat surgery, and urology surgery, a preparation room (Induction room) to assess the patients and take vital signs before enter the operation contains seven beds. There is a recovery room for observing the patients after surgery till hemodynamic stability.

Research subjects:

1. **Surgical teams**

A convenience sample of available surgical teams of surgeons (200) and nurses (200) in the operating room who are assigned to patient care on preoperative, intraoperative, and postoperative care in the above-mentioned settings.

* 200 physicians included 68 general surgeons, 36 specialist surgeons, 20 assistant surgeons of specialized surgery, 52 anesthetists, and 24 assistant anesthetists.

* 200 nurses included 44 scrubbing nurses, 16 assistant nurses, 56 circulating nurses, 40 anesthesia technicians in operation, and 44 recovery nurses.

2-The Patient:

A purposive sample was included 200 patients from both sex who were received a minor and major operation within 6 months in the entire surgical department at the time of the study and assigned the surgical operation for study subjects of surgical team.

Inclusion criteria:

- Adult patients from 18- 65 years old
- Minor and major operation
- Local and general anesthesia
- No associated disorders as diabetes, heart disease, peripheral vascular disorders, renal …etc.

Tools for data collection:

The data were collected through the following tools:

Tool 1: A Structured Interview Questionnaire:

It was developed by the researchers through review of related literature and aimed to assess the following:

Part I: Demographic data: It was used to assess surgical teams' personal characteristics as age, gender, marital status, educational qualification, occupation role, years of work experiences and previous training course or workshop in the field of surgical patients' safety in the operation room. It composed of 8 closed ended questions for the studied nurses and 7 questions for physicians.

Part II: Facilities and Resources Assessment: It was adapted by the **WHO, (2009)** and designed by the researchers. It aimed to assess the available resources and delivery services in the operating room maintaining the safety of patients undergoing surgery and observed by the researchers. It included two sections:

First section: Facility Characteristics:

It included the total number of outpatients seen in a year for minor surgery, total number of beds in surgical departments,

total number of functioning operating rooms (major and minor), total number of post-anesthesia care beds (recovery room) and number of cases are referred to hospital for major surgery per year. It is composed of (5) open-ended questions.

Second section: General Infrastructure items available and functional:

It was divided into five items composing of (25) questions:

1- The dedicated 24-hour emergency unit included 5 questions (electricity, power generator, running water, internet, and oxygen).

2- Pharmacy for surgery included 10 questions as inhalation for general anesthesia, IV sedation anesthesia, spinal anesthesia, regional anesthesia, perioperative antibiotic, IV fluids sets, muscle relaxant, sedatives, narcotics, and vasopressor).

3-Radiology equipment included 2 questions an X-ray machine and an ultrasound machine.

4- Blood Bank included one question as availability of blood product within 2 hours.

5- Laboratories investigations included 7 questions (Hemoglobin, CBC, Blood coagulant analysis, Renal function, infectious disease analysis, Cardiac enzyme, and Blood group.

It was graded according to the items of the questionnaire, as a rate of adequacy for each item as follow**:** (0) Unavailable (Not available for everyone who needs it), (1) Inadequate (available to less than half of those who need it), (2) Limited (available to more than half, but not to everyone who needs it), or (3) Adequate (present, available to almost everyone in need, and used when needed). The total items for all questions related to the resources of safety patients undergoing surgery was represented (100%) and evaluated based on statistical analysis.

Tool II: Observational Surgical Safety Checklist practice assessment:

It aimed to assess the surgical teams' practice compliance with WHO Surgical Safety Checklist performance. It was adopted from **WHO, (2011)** and observed by the researchers. It is classified into three phases each corresponding to a specific time period of a procedure as follows:

1-The period before induction of anesthesia **(Sign in)**: It was started during the patients' preparation for surgery when they enter the operating room and before induction of the anesthesia. It included 11 items.

2-The period after induction and before surgical incision **(Time Out),** included the time of preparing the sterile field, induction of anesthesia, scrubbing, gowning, and gloving. It included 15 items.

3-The period of post-surgery during or immediately after wound closure but before removing the patient from the operating room and transferring to the recovery room **(Sign Out)**. It included 6 items.

Scoring system:

All practical compliance items of WHO safety checklist variables were weighted according to the response with (not applicable) scored as "0", and (applicable, not done) responses had a score (1), as well as (done) response had score of (2), with the total score was obtained by summing scores from all items of checklist which divided as the total nurses' compliance = 20 score, total anesthetists' compliance = 20 score and the total surgeons' compliance = 24. The total score ranged from 0–64. A higher score indicates a higher level of practice compliance.

Tool III: Intrusive Barrier of a Surgical Safety Checklist Assessment:

It aimed to determine obstacles (barriers) that interfering with appropriate utilization to surgical safety checklist. It was adapted by **Fourcade et al., (2012)**. It included 11 items answered by the studied subjects of surgical team as follow:

1. Duplication with existing check
2. Poor communication between anesthetist and surgeon

3. Time consuming.
4. Does not make sense.
5. Inappropriate timing.
6. Ambiguity.
7. Unaccounted risks.
8. Oral confirmation of items.
9. Identification of the role and responsibility of staff.
10. Patients' attitude to questions
11. Gaming.

All Intrusive barrier variables were weighted according to the response with (No) as absent answer "0", and (Yes) responses as present item (2), with the total items of 11 score was obtained by summing items from all items. The total number ranged from 0–11. A higher selected item indicates a highly affecting barrier with answer response of present.

Tool (IV): Patient' health outcome assessment:

It aimed to assess and identify the actual problems and the complications of patient who undergoing a minor and major surgery. It was adopted from **Shankar, (2018), Aravena et al., (2018)**. It started from the time of the patient's recovery till 48 hours postoperatively. It was observed by the researchers and patients' record. It included two parts.

Part I: The Surgical Patients' Data Assessment: It was developed by the researchers through review of related literature. It included 4 closed ended questions as patient's age, type of operation and anesthesia, duration of anesthetic and operation).

Part II: Postoperative Patients' Clinical Data Assessment: It aimed to assess effect of surgical teams' compliance to WHO surgical checklist performance on the patient's health outcomes. It composed 5 of clinical parameters including:

1- **Changes in vital signs.**

2-Recovery Intervention Needs: Composed 3 advanced life support modalities including cardiopulmonary resuscitation, unplanned endotracheal tube use and using a ventilator.

3-Peripheral Circulatory Assessment: Composed 3 questions included (pulsation feet, sensation of heat and cold in the feet and capillary refill) all this to right and left foot.

4-Wound infection: It included sign & symptoms of wound infection as warmth, redness, pus, blood with pus, a foul odor and tenderness.

5-Renal Problems: Included signs & symptoms of acute renal problems as decreased urine output, fluid retention, generalized edema as well as confusion and weakness**.** Laboratory investigations according to renal problem included serum creatinine, blood urea nitrogen (BUN) and serum potassium.

Scoring System :

Total score was categorized as mild, moderate, severe and life threatening according to classification of surgical complications by **Dindo et al., (2004).**

The classification consisted of 4 severity grades.

- **Grade 1 (minor complications)** included minor risk events not requiring therapy (with exceptions of analgesic, antipyretic, antiemetic, and antidiarrheal drugs or drugs required for lower urinary tract infection).
- **Grade 2 complications (Moderate complications)** were defined as potentially life-threatening complications with the need of intervention, requiring pharmacological treatment with drugs other than such allowed for Grade I complications or a hospital stay longer than twice the median hospitalization for the same procedure.

Grade 2 was divided into 2 subgroups based on the invasiveness of the therapy selected to treat the complications:

- **Grade 2a:** complications require medications only.
- **Grade 2b**: an invasive procedure.

- **Grade 3 complications (severe complications):** were defined as complications leading to lasting disability or organ resection.
- **Grade 4 complication, Life-threatening complications**: include those affect the brain requiring intensive care management.

Administrative Design:

Permission was taken from Dean of Faculty of Nursing of Benha University to carry out this study and an official approval was obtained from the director of Benha University Hospital.

Content validity:

Tools content validity was ascertained by 5 experts in the related field to check the relevancy, clarity, comprehensiveness, and applicability of the tools items. Jury experts involved three Assistant Professor of Medical Surgical Nursing at Benha University, and two Professors in Surgical Department in Faculty of Medicine at Benha University. According to these experts' opinions, minor modifications were done and the final form was developed.

Tools reliability:

Reliability had been tested using Cronbach's alpha coefficient related to intrusive barrier of surgical safety checklist tool (III) and post-operative patients' outcomes tool (IV) which were 0.691 & 0.721 respectively. While the test- retests reliability for tool (II) concerning surgical team compliance to surgical checklist performance was 0.737, indicating a satisfactory level of reliability.

Ethical considerations:

The study was approved by the Scientific Research Ethical Committee at the Faculty of Nursing/ Benha University. The researchers clarified the aim of the study to all studied surgical teams and patients during the initial interview and verbal approval was requested to participate in the current study. The studied surgical teams were assured that all information would be confidential and their participation in the study was voluntary without any costs and any observations were not required for job evaluation. Additionally, surgical teams were allowed to withdraw from the study at any time without giving any rationale. Confidentiality of the gathered data and results was secured.

Pilot study:

A pilot study was carried out on 10% of the study subjects (20 surgeons & 20 nurses) to test the applicability and clarity of the data study collection tools. Surgeons, anesthetists, and nurses involved in the pilot study were included in the total study subjects as no modifications were done. The pilot study was done two weeks before starting the study.

Field work:

Once the researchers has gained approval; the researchers met the surgical team to explain the purpose and the nature of the study in order to gain their cooperation before data collection. Data collection covered a period of 8 months starting from June 2022 to the end of January 2023. The researchers attended the setting all days of the week in accordance with the date of operating room lists.

Each interview took a time about 15-30 minutes. The precautionary practice measures for infection control due to the spread of the coronavirus were taken as maintaining physical distance, wearing facemasks, and gloves, and using alcohol aseptic solution for both the researchers and the patients included in the study. Data collection was stated as the assessment of surgical teams by structured interviewing questionnaire concerning their personal characteristics and observational surgical safety checklist performance using **tools I &II** during the perioperative phase. Determine obstacles that interfere with barriers to the appropriate utilization of

surgical safety checklist practice as reported by all studied surgical teams using **(tool III)** and assess the actual problems and the complications of patients undergoing minor and major surgery as postoperative patients' health outcomes using**.**

Statistical analysis:

Data analysis was performed using the SPSS software (version 25). Qualitative data was presented as a number and percent. Furthermore, quantitative data was described as mean or standard deviation, as appropriate. A nova test was used to examine the relation between three or more quantitative variables; student t test was used to examine the relation between two quantitative variables. Pearson correlation coefficients were used to measure how strong a relationship is between two variables. Linear regression was used for multivariate analyses on lower extremity perfusion as dependent factor A. P-value < 0.05 was considered significant, and <0.001 was considered highly significant.

Results:

Table (1) shows that, 36.0% of the studied nurses were aged from 40 to less than 50 years old, with mean age of 40.26 ± 0.93 and 64.7% were female. Regarding marital status, 86.0% of the studied nurses were married. Also, 70.0% of them had nursing diploma. In addition, 28.0% of the studied nurses were circulating nurse and 22.0% were in recovery room. As regard to their years of experience, 38.0% of them had from 5- < 10 years. Moreover, 96.0% of the studied nurses attended training courses and all of them (100%) spent 8-12 hours in this training program.

Table (2) shows that, 46.0 % of the studied physicians were aged from 40 to less than 50 years old, with mean age of 40.36 ± 0.95 and 66.0% of studied physicians were male. Regarding educational level, 60.0% of them had doctorate degree. In addition, 34.0% of the studied physicians were general surgeon. As regard to years of experience, 44.0% of them had ≥ 10 years. Moreover, 74.0% had training program or work shop and 97.3% of them spent 8-12 hours of this training program.

Figure (1) illustrates that, the nurse, anesthetists and surgeons were compliance with all phases of WHO surgical safety checklist performance with mean % score 88.5%, 88.9% and 87.9% of total score respectively.

Figure (2) illustrates that, the most barrier was reported by 72.0%, 71.1% and 71.8% among the nurses, anesthetists, and surgeons respectively concerned with identification of the role and responsibility of staff, followed by inappropriate timing as reported by 66.0%, 68.4% & 67.7%, respectively among surgical team.

Table (3) reveals that, 48.0% of the studied patients were aged from 30 to less than 40 years old, with mean age of 39.42 ± 0.80. Regarding operation type, 60.0% of the studied patients had a minor surgery and 52.0% of them received spinal anesthesia. In addition, the duration of anesthesia and operation was ≥ one hour among 72.0% of studied patients**.**

Figure (3) illustrates that, 46.5 % of studied patients had no post-operative complications, while 9.5 % had a life threatening problems. Also, it was noticed that, 30% and 14% had between mild and moderate complications (Post-operative problems) respectively.

Table (4) shows that, there was highly significant negative correlation between the total nurses, surgeon and anesthetist's compliance to WHO surgical safety checklist performance with post-operative patients' outcomes (r = -0.433, -0.626 and -0.259) and barriers (r = -0.066, -0.205 and -0.062) with p value = (0.353, 0.075 & 0.493, respectively). Also, it was noticed a positive and insignificant correlation between patients'

outcomes and the reported intrusive barriers among surgical teams (r = 0.079, 0.010, and 0.033) with p-value = (0.264, 0.890 & 0.638), respectively.

Table (1): Distribution of the studied nurses and assistants regarding their demographic characteristics (n=200)

Demographic characteristics		No.	%
Age (in year)	21 - < 30	52	26.0
	30-< 40	60	30.0
	40-<50	72	36.0
	50- 60	16	8.0
	Mean ± SD	40.26 ± 0.93	
Sex	Male	68	33.3
	Female	132	64.7
Marital status	Married	172	86.0
	Single	28	14.0
Educational qualification	Nursing diploma	140	70.0
	Nursing technical institute	48	24.0
	Bachelor of Nursing Science	12	6.0
	post graduate qualification of nursing	0	0.0
Occupation role	Scrubbing nurse	44	22.0
	Assistant nurse	16	8.0
	Circulating nurse	56	28.0
	Anesthesia technician in operation	40	20.0
	Recovery nurse	44	22.0
Years of experience	<1 year	12	6.0
	1 - < 5 years	44	22.0
	5- < 10 years	76	38.0
	≥ 10 years	68	34.0
	Mean ± SD	10.00 ± 0.89	
Attended any training courses or work shop before	Yes	192	96.0
	No	8	4.0
Training program or course period (n=192)	8-12 hours	192	100.0

Table (2): Distribution of the studied physicians regarding their demographic characteristics (n=200)

Demographic characteristics		No.	%
Age (in year)	21 - < 30	52	26.0
	30-< 40	40	20.0
	40-<50	92	46.0
	50- 60	16	8.0
	Mean ± SD	40.36 ± 0.95	
Sex	Male	132	66.0
	Female	68	34.0
Educational level	Bachelor's degree	20	10.0
	Master's degree	52	26.0
	Doctorate degree	120	60.0
	Fellowship	8	4.0
Occupational role	A general surgeon	68	34.0
	A specialist surgeon	36	18.0
	Assistant Doctor of Specialized Surgery	20	10.0
	Anesthesiologist	52	26.0
	Assistant anesthesiologist	24	12.0
Years of experience	<1 year	16	8.0
	1 - < 5 years	32	16.0
	5- < 10 years	64	32.0
	≥ 10 years	88	44.0
	Mean ± SD	9.12 ± 0.95	
Attended training program or work shop before	Yes	148	74.0
	No	52	26.0
Period of previous training program(n=148)	8-12 hours	144	97.3
	>12 hours	4	2.7

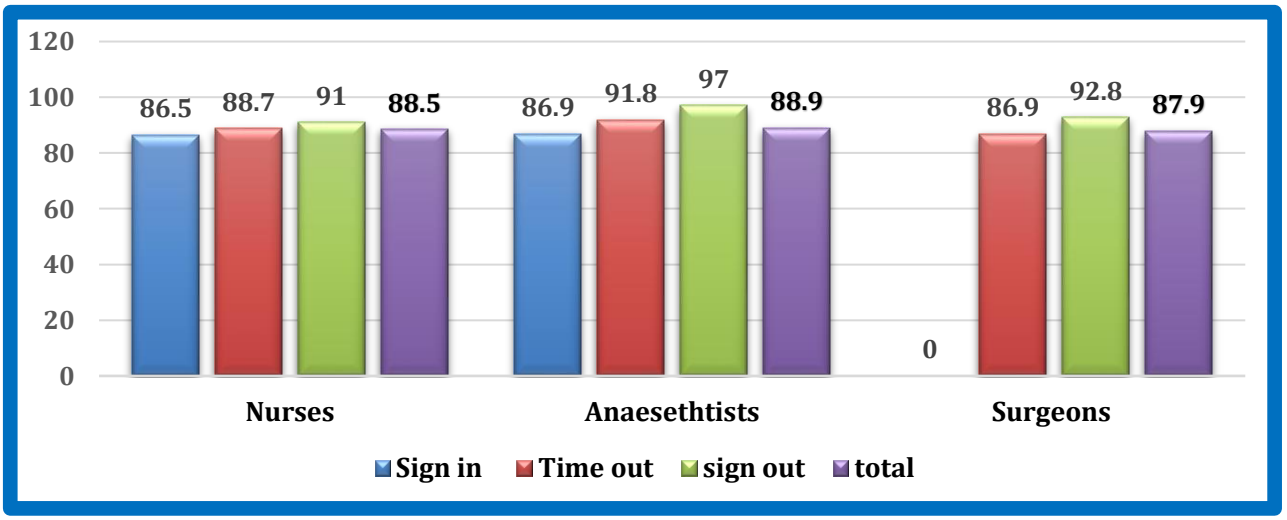

Figure (1): Mean % score of total compliance of surgical team with WHO surgical safety checklist performance throughout (sign in, time out, & sign out phases) {nurses (n=200), anesthetists (n= 76) & surgeons (n=124)

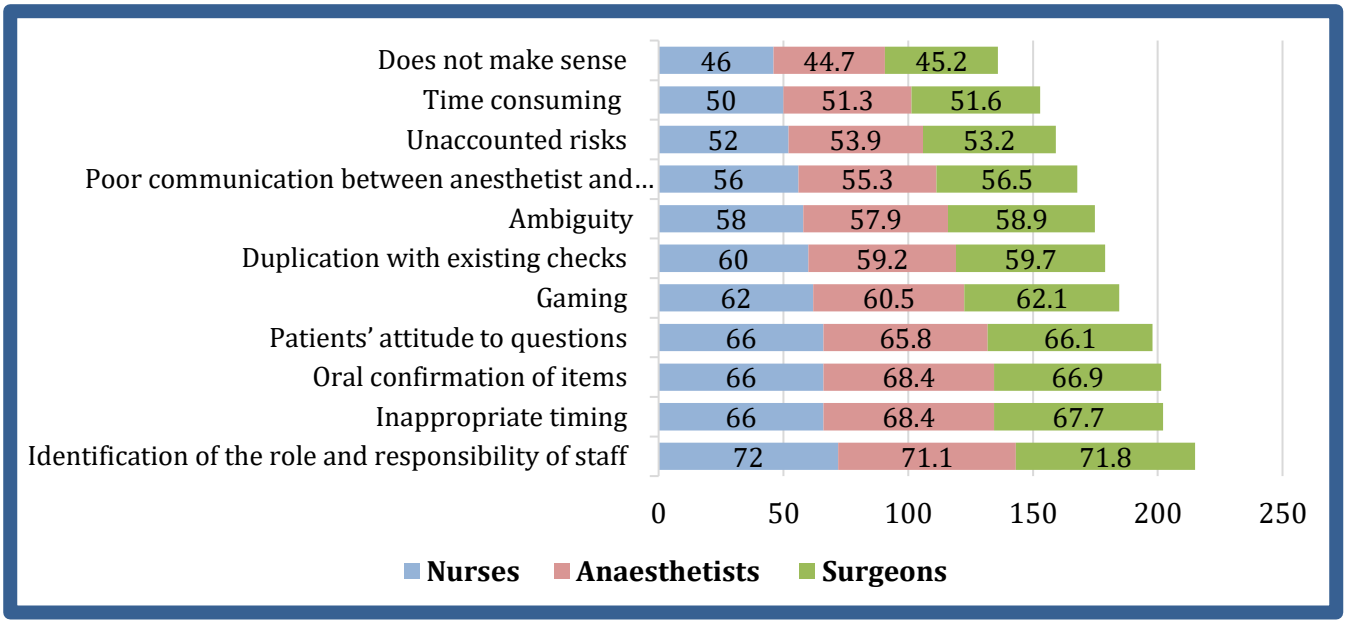

Figure (2): Ranking of intrusive barriers for compliance to WHO surgical safety checklist among the studied surgical team {nurses (n=200), anesthetists (n= 76) & surgeons (n=124)}

Table (3): Distribution of the studied patients according to their demographic and surgical data (n=200)

Patient's characteristics		No.	%
Age (in year)	21 - < 30	20	10.0
	30-< 40	96	48.0
	40-<50	64	32.0
	≥ 50	20	10.0
	Mean ± SD	39.42 ± 0.80	
Operation type	Major	80	40.0
	Minor	120	60.0
Anesthesia type	General	72	36.0
	Spinal	104	52.0
	Local	24	12.0
Duration of anesthesia and operation	< one hour	56	28.0
	≥ one hour	144	72.0

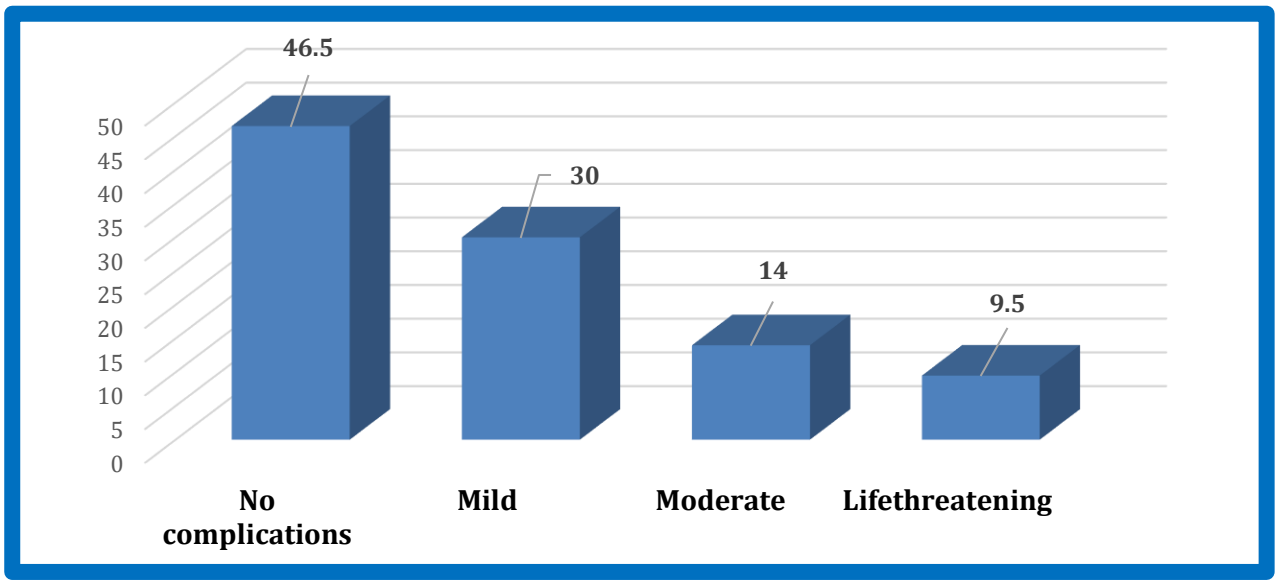

Figure (3): Distribution of post-operative complication grading among the studied patients (n=200)

Table (4): Correlation coefficient between total surgical team's compliance to WHO surgical safety checklist performance {anaesthestists (n=76)& surgeons (n=124)}, and intrussive barriers as well as patients' outcomes (n=200)

Total compliance of check list performance	Patients' outcomes (incidence of complications)		Intrusive barriers	
	R	P value	r	P value
Nurses	-0.433	<0.001**	-0.066	0.353 n.s
Anaethestist	-0.626	<0.001**	-0.205	0.075 n.s
Surgeons	-0.259	0.004*	-0.062	0.493 n.s
Intrusive barriers				
Nurses	0.079	0.264 n.s	-	-
Anaethestist	0.010	0.890 n.s	-	-
Surgeons	0.033	0.638 n.s	-	-

n.s Not Statistically significant p > 0.05 *** Statistically significant p ≤ 0.05**

****A Highly Statistical significant p ≤ 0.001**

Discussion:

Surgical service is one of the fundamental healthcare services given in the healthcare system. Surgical complications are a major cause of morbidity and mortality and also pose a major financial burden to patients and providers. But it has been estimated that at least half of the complications that occur are avoidable. The importance of a strong safety culture that enhances patient safety initiatives has been reiterated for years in the healthcare system and the safety of surgical care, therefore, is a global concern. The implementation of a checklist is intended to improve the outcome of surgical care and thus the quality of care in general (**Denisa et al., 2021**).

The surgical team of nurses, surgeons, and anesthetists as multidisciplinary team plays an important role in the caring of a patient undergoing surgery to prevent hazards that may occur and maintain patient safety **(AbdElglil., Mohamed & Ebrahim, 2020).** Therefore, the present study aimed to assess surgical safety performance among surgical teams and barriers in the operating room and its effect on the patient's outcomes.

Concerning the nursing team, the results of the present study showed that, more than one-third of studied nurses were aged from 40 to less than 50 years old, with a mean age of 40.26 ± 0.93 and about two-thirds of the studied nurses were female. Regarding marital status, the majority of them were married. The current results stated that, about three-quarters of the studied nurses had nursing diploma.

This result agrees with a study carried out by **Noaman, Soliman & Hasaneen, (2020)** discussed "Evaluating compliance to world health organization surgical safety checklist in the operating room in Egypt" and documented that, about half of the studied nurses were aged 40 - less than 50 years old and most of them were female. Regarding educational level, the majority of the studied nurses had a nursing diploma.

Also, it agrees with a study was done by **Tostes & Galvão, (2020)** about "Surgical safety checklist: benefits, facilitators, and barriers in the nurses' perspective" who mentioned that, more than one-third of studied nurses were aged from 35 to less than 50 years old and half of studied nurses were female. Regarding marital status, the majority of studied nurses were married and the majority of them had nursing diploma.

This result is inconsistent with a study was done by **Sharma et al., (2020)** about "Perioperative Nurses' Awareness and Attitude about Use of WHO Surgical Safety Checklist in India" who reported that, more than half of the studied nurses were aged 20 - 25 years and more than half of nurses were male. While two third of them had Bachelor degrees.

Concerning the occupational role, the current study revealed that, more than one-fourth of the studied nurses were circulating nurses. According to years of experience, more than one-third of studied nurses had 5 - < 10 years of experience. Regarding training courses, the most of the studied nurses attended previous training courses. This result agrees with a study was done by **Denisa et al., (2021)** entitled "Surgical Teams' Attitudes About Surgical Safety and the Surgical Safety Checklist at 10 Years in the united states", who found that about half of nurses had years of experience from 5- < 10 years and most of them had training courses about the implementation of surgical safety checklist.

While another study was done by **Abdel Mowla & Awad, (2020)** entitled "The Impact of Development and Implementation of Surgical Safety Checklist Educational Program on the Surgical Team Compliance during Major Operations in Egypt" who documented that more than one-third of studied nurses had years of experience from 5- < 10 and most of the studied nurses had training courses in the field of patient safety in the operating room during surgery.

The results of the present study showed that, about half of the studied physicians were aged from 40 - less than 50 years old, with a mean age of 40.36 ± 0.95, and two-thirds of the studied physicians were male. Regarding their educational level, about two-thirds of studied physicians had a doctorate. In addition, one-third of them were general surgeons and more than two-fifths of the studied physicians had ≥ 10 years of experience. As well as about three-quarters of them had training courses in the field of patient safety in the operating room during surgery. It may be related to the physicians are specialized in the field of surgery, they

need a period to obtain a doctorate, and their age ranges from 40 to less than 50 years, and this makes them have good experience to be qualified surgeons and continuous update their knowledge in the field of surgery that need to continue the training courses**.**

This result is in line with a study carried out by **Aboel-Seoud et al., (2020)** about "Is Implementation of WHO Surgical Safety Checklist (2009) Will Reduce the Rate of Major Postoperative Complications at Zagazig University Hospital" who documented that, half of the studied surgeons and anesthetists were aged from 40 to less than 50 years old and two-thirds of studied physicians were male. Regarding educational level, about half of the studied physicians had a doctoral degree, and two-fifths of studied physicians had ≥ 10 years of experience.

In addition, this result is in the same line with a study was done by **Lingard et al., (2019)** about "Evaluation of a preoperative checklist and team briefing among surgeons, nurses, and anesthesiologists to reduce failures in communication", who reported that half of the studied physicians were aged from 40 to 50 years old and more than one-third of them was a general surgeon and one-third of studied physicians had ≥ 10 years of experience. While the majority of them had training courses in the field of patient safety in the operating room during surgery.

The current study illustrated that the highest mean % scores of anesthetists, nurses, and surgeons were compliant with all phases of WHO surgical safety checklist performance throughout (sign-in, time-out & sign-out phases). It may be related to the surgeons and anesthetists who had more than 10 years of experience and attended training courses about surgical safety performance. This result is in the same line with on study done by **Noaman, Soliman & Hasaneen, (2020)** who reported that, the most percentage of total mean scores of anesthetists and surgeons' compliance with the WHO surgical safety checklist among surgical teams throughout sign-in, time-out & sign out phases.

The current study revealed that about three-quarters of the surgical team studied nurses, studied surgeons, and studied anesthetists had reported the highest barriers were "identification of the role and responsibility of staff respectively. While, about half of the surgical team (studied nurses, studied surgeons, and studied anesthetists) reported that, the lowest barrier was regarding "does not make sense". The main contributing reasons were mentioned to be the absence of surgeon in the operating room after surgery or the existence of reluctant and tired personnel not believing in patient safety.

This result may be related to two reasons. The first relates to work organization; a checklist is often put across as a tool to enhance communication and as a reminder in stressful circumstances but, like other operational tools, it impacts the work of organization. The second reason relates to professional relationships and cultural habits in clinical practice; verbal communication among health professionals' surgeons, anesthetists, and nurses have to be egalitarian for checklist use to be effective but the findings suggest that operating room staff practices are rooted in a time-honored hierarchy.

These results were supported by **Russ et al., (2020)** about "A qualitative evaluation of the barriers and facilitators toward implementation of the WHO surgical safety checklist across hospitals in England" and documented that, half of the surgical teams have present barriers in the identification of the role and responsibility of staff and does not make sense.

This result agrees with another study done by **Noaman, Soliman & Hasaneen,**

(2020) who found that about half of surgical teams doesn't make sense, duplication with an existing checklist, poor communication between the operating team, and two third of surgical team present barrier in the identification of the role and responsibility of staff.

Regarding patients' demographic data, the present study revealed that about half of the studied patients were aged from 30 to less than 40 years old, with a mean age of 39.42 ± 0.80. Regarding operation type, about two-thirds of the studied patients have a minor operation and more than half of them take spinal anesthesia. It may be attributed to that patients were taken spinal anesthesia to reduce post-operative complications and due to the danger of general anesthesia for some patients.

These results are in agreement with a study done by **Eslam et al., (2022)** about "Effect of Pre-operative and Intra-Operative Nursing Intervention on Surgical Wound Infection among Surgical Patients" and documented that, nearly half of studied patients were aged from 30 to 39 years old, with mean age of 42.4±2.3 and two fifths of patients had minor operation and more than half of them took spinal anesthesia.

This result disagrees with a study done by **Espinosa & Sawyer, (2020)** about" Surgical site infections. In: Cameron" and found that, half of the studied patients were aged from 40- 50 years old and three quarters of them had major operation and two fifths of patients took general anesthesia.

The present study revealed that nearly half of the studied patients had no postoperative complications. Also, about one-third and a fifth had mild and moderate complications, respectively. Otherwise, few of them had life-threatening complications. It may be related to compliance with surgical checklist performances by the majority of the surgical team was associated with a significant reduction in the complications and the adequacy of related resources noticed by the researchers.

These results are supported by **De Vries et al., (2020)** about "Effect of a comprehensive surgical safety system on patient outcomes" and documented that, half of patients had no postoperative complications and little of them had life threatening complication. On the other hand, this result disagrees with a study was done by **McAleese & Odling-Smee, (2019)** who studied about "The effect of complications on length of stay" and reported that, more than half of patients had moderate postoperative complication and one thirds of them had sever postoperative complication and stay for long time in hospitals.

The current study showed that, there was a highly significant negative correlation between the total nurses, surgeons, and anesthetists' practice compliance with WHO surgical safety checklist and postoperative patients' outcomes, although it insignificantly correlated with the barriers as reported by them. It may be related to the rate of compliance by surgeons, anesthesiologists, and nurses with the WHO surgical safety checklist for the patient is high and reduce the level of postoperative complications. Although, barriers for all surgical team do not hinder them from implementing the surgical safety checklist for the patient.

This result is in line with a study carried out by **Aboel-Seoud et al., (2020)** who studied "Assessment of Surgical Site Infections from Signs & Symptoms of the Wound and Associated Factors in Public Hospitals of Hodeidah City, Yemen" and documented that, there was a high statistical significant negative correlation between surgeons, anesthetists and nurses' coordination with patients' outcome.

This result disagrees with a study conducted by **Haynes, (2019)** entitled "Safe Surgery Saves Lives Study Group: A Surgical Safety Checklist to reduce morbidity and

Mortality in a global population" who showed that, there was an insignificant correlation between physician and nurse coordination and occurrence of postoperative complications. Also, there was no statistically significant correlation between other safety attitude items of the surgical team and postoperative complications.

Conclusion:

The most of total mean percent scores of the nurses, anesthetists, and surgeons were compliance with all phases of the WHO surgical safety checklist performance. Also, there was a highly significant negative correlation between the total nurses, surgeons, and anesthetists' compliance with WHO surgical safety checklist performance concerning sign in and time out phases and postoperative patients' outcomes. Moreover, few of the patients had life-threatening problems and needed advanced life support such as cardiopulmonary resuscitation, ventilator, and unplanned endotracheal intubation. On the other hand, nearly half of them had no complications, although the reported barriers. Obviously, the surgical team faces a great challenge in their compliance with unplanned WHO surgical checklist performance and maintaining patient safety, and minimizing postoperative complications as possible.

Recommendations:

For Surgical teams:

- Hospitals should consider implementing operating room precautions as a strategy to improve operations efficiency and clinical and economic outcomes for surgical patients.
- Nurses and surgeons must be committed and continue to the common goals of patient safety to ensure safe surgery.
- Nurses should use the checklist for each surgery which can prevent uncommon and serious errors by reminding the surgery team members about patient identity, surgical site, comorbidity, and other unforeseen complications.
- In-service education should be conducted for perioperative nursing staff regarding how to use WHO surgical safety checklist.

For patients:

- Simplified handout guidelines in all phases of perioperative preparation should be available for patients and their families.
- All health care instructions regarding preoperative care as general preparation and recommendations should be followed by patients.

For further research:

- The study should be replicated in all health settings to validate and generalize the findings.
- The study should be replicated and compared among different surgical departments.

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تقييم أداء السلامة الجراحية بين فريق الجراحة و المعوقات في غرفة العمليات وتأثيرها على مخرجات المرضي

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أصبحت الجراحة جزءًا لا يتجزأ من الرعاية الصحية العالمية، والمضاعفات الجراحية شائعة ويمكن الوقاية منها غالبًا. وعلى الرغم من أن مقدمي الرعاية الجراحية والتخديرية يسعون إلى تقديم جودة مثالية في الخدمة الجراحية، إلا أن الجراحة لا تزال تحمل مخاطر كبيرة للمريض. **الهدف من الدراسة**: تقييم أداء السلامة الجراحية بين الفريق الجراحي والمعوقات في غرفة العمليات وتأثيرها على مخرجات المرضي. **تصميم البحث**: تم استخدام تصميم البحث الاستكشافي الوصفي لتحقيق هدف هذه الدراسة. **مكان البحث**: أجريت الدراسة في جميع غرف العمليات في كل من أقسام الجراحة العامة والخاصة في مستشفى جامعة بنها بمحافظة القليوبية، مصر. **عينة الدراسة**: عينة ملائمة من الفرق الجراحية المتاحة من الأطباء (٢٠٠) والممرضات (٢٠٠) في غرفة العمليات والمرضى (٢٠٠). **أدوات جمع البيانات**: تم استخدام أربع أدوات لجمع البيانات: **الأداة الأولى**: استبيان المقابلة المنظمة الذي تضمن جزأين: البيانات الديموغرافية وتقييم المرافق والموارد **الأداة الثانية:** تقييم ممارسة قائمة مراجعة السلامة الجراحية، **الأداة الثالثة:** تقييم العوائق التدخلية لقائمة مراجعة السلامة الجراحي، **الأداة الرابعة:** تقييم النتائج الصحية للمرضى. **النتائج:** أظهرت الدراسة أن الممرضات وأطباء التخدير والجراحين ملتزمون بجميع مراحل أداء قائمة التحقق من السلامة الجراحية لمنظمة الصحة العالمية بمتوسط درجات ٨٨,٥٪ و٨٨,٩٪ و٨٧,٩٪ من إجمالي الدرجات على التوالي، وأن ٤٦,٥٪ من المرضى الذين تمت دراستهم لم يكن لديهم مشاكل بعد الجراحة، بينما كان ٩,٥٪ يعانون من مشاكل تهدد حياتهم. **الاستنتاج:** كان هناك ارتباط سلبي وذو دلالة إحصائية عالية بين امتثال إجمالي الممرضات والجراحين وأطباء التخدير لقائمة التحقق من السلامة الجراحية لمنظمة الصحة العالمية ونتائج المرضى بعد الجراحة وعدم وجود ارتباط ذي دلالة إحصائية مع الحواجز. **التوصيات:** توفير برامج تدريبية للعاملين في مجال الرعاية الصحية لتعزيز مستوى الامتثال لقائمة التحقق من السلامة الجراحية وسلامة المرضى.