



## **Assessment of Effectiveness of Surgical Safety Checklist through Education Program among Nurses: An Observational Study**

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### **Abstract**

**Background:** In low income countries the compliance rate of surgical safety checklist is badly decreased due to multiple factor that hindered its implementation. Negligence of health care providers in operating room leads to a number of death worldwide. Which can be minimize through administration of SSCL via education session.

**Material and Method:** To assess the effectiveness of SSCL through education a quasi experimental study was conducted. Target population was OR nurses that have working experience more than three month in OR. A convenient sample of 160 surgeries was selected for research purpose. Data was collected and pre and post intervene through educational meeting with selected Nurses. Collected data was analysis using SPSS version 25 through descriptive analysis and paired sample t test.

**Results:** In general outcome was positive, proposed research proves that the educational trainings are extremely efficient to enhance the compliance and effectiveness of SSCL. The results were highly significant with p value of 0.000.

**Conclusion:** Effectual teaching is important to uphold secure quantifiable surgical practices inside operating room as well as in whole surgical unit. Teaching techniques that are comprehensive will make it more useful and effective and will surely minimize the error occurring in hospital setting especially in OR.

**Keywords:** Surgical safety checklist, assessment of SSCL, effect of education over surgical safety checklist, WHO recommended surgical safety checklist, an observational study on surgical safety checklist, effectiveness of surgical safety checklist.

### **Introduction**

“Safe Surgery Save Lives” was initiated by the World Health Organization (WHO) in

2008 with an aim to reduce the number of surgical deaths across the world. To accomplish the target of improving patient safety without additional resource utilization, the WHO

surgical safety checklist was introduced in 2009 (Urbach et al., 2016).

Each operation has numerous steps that must be performed in the approved manner every time: surgical team ought to utilize the accurate equipment, all required tools have to be accessible and arranged properly, required drugs must be administered in a suitable and proper method. Patient's safety might be compromised if any error occurs. Communication between surgical team members is extremely important during surgery to avoid any complication.

The WHO 19-item checklist program emphasizes on performing safety checks and good team communication at various stages in the preoperative period to reduce the complication rates during the surgical process. It has played an essential role in decreasing the surgical morbidity and mortality globally (World Health Organization, *Safe Surgery Saves Lives.*, 2016). Despite substantial evidence advocating the need of the WHO checklist in reducing the infection rate and morbidity, the hesitancy among many health-care providers to implement it in everyday practice is a matter of concern; in this research we will assess the effectiveness of safe surgery checklist through education among Nurses in public hospital of Lahore through direct observation.

In order to reduce error and increase safety for the patients undergone surgery World Health Organization (WHO) introduced Surgical Safety Checklist (SSCL) during the year of 2009. They have implemented this checklist in more than 360 international hospitals of 58 countries and found very effective, only within a month mortality rate has been lower to 38% in comparison with those hospitals that didn't adapt SSCL (Urbach et al., 2016).

In Pakistan, initial checklist compliance was 20.4%, which increased to 89.9% after 4 years. Bashford *et al* in 2016 showed a decline

in the compliance rate – from 83% one month after implementation to 18% eight months after implementation (Bashford *et al* in 2016).

Barriers to the effective implementation of the SSCL, as identified and 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 (Walker et al., 2017).

The SSCL for all intents and purposes identifies 3 separate phases of a surgical procedure, each phase is related to a definite era of the operation: sign in (pre induction of an aesthesia), time out (pre incision), and sign out (before the closure of skin). Checklist coordinates with each phase of surgical operation in operating room (Bergs et al., 2017).

It has been anticipated that about 2 billion surgical operations are performed every year universally. Generally 10% adverse events happened in hospital settings, from which 1/3 are purely related to surgeries (Conley et al., 2018). In order to improve safety during surgery WHO implemented a surgical safety program. It was recommended that the use of SSCL help surgical team to stay away from creating simple complications, for example wrong site, wrong patient or wrong surgery.

## Literature Review

Aveling et al in 2017 suggested that surgical procedures provide instant cure for a number of critical health situations, generally in one go, and is an important restorative approach worldwide. But it is sometimes unfortunately become a chief cause of undesirable morbidity as well as mortality all over the world. The use

of SSCL is progressively more reliable and effective to save lives and to reduce morbidity/mortality in patients undergo surgical intervention (Aveling et al., 2017).

In 2016 Ragusa et al also studied the compliance in public hospital during 1 year following application of the WHO SSCL. They found that compliance of SSCL increased to 70 % of cases fulfillment (Ragusa et al., 2016).

In the same way Gołębiowska et al in 2018 assessed the compliance of SSCL implemented by WHO, according to them pre-operative compliance was 61% and post-operative was 67% which improves after one year to 80% & 85% respectively (Gołębiowska et al., 2018). Even though above mentioned studies measures the compliance of 1 year, none of them was reported 100% compliance rate. Consequently, there should be particular factors that manipulate.

A systematic review suggested that in the hospital, the majority of the adverse events take place in the operating theater and 43% of these mishaps were preventable using the current standards of care. According to one survey, 234 million people are operated on each year, out of which one million die because of complication and among all at least half of these complications are avoidable (De Vries et al., 2018). Data from the developed nations revealed the complication rate of 3%–16% in inpatient surgical procedures, and the death rate was 0.4%–0.8%. (Borchard et al., 2017). Despite this data, the need for surgical safety is not recognized as a significant health problem, especially in middle- and low-income group countries where the resources are limited. Furthermore, the reliability and timely issuance of basic routine steps to decrease infection-related complications such as administration of antibiotic remains doubtful (Bosk et al., 2019).

Haynes et al (2019) 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. In the UK, unfamiliarity, embarrassment during timeout or the introduction process, hierarchical issues, timing of the checklist and duplication of checks were recognized as challenges (Haynes et al., 2019).

SSCL is designed for a large-scale populace and is as similarly valid for high income countries as for low and the results are considerably sky-scraping. Surgical team is responsible to improve the safety of patient's outcomes. Pugel et al 2018 implemented a study on SSCL to check the effectiveness, they observed 1440 surgeries. They measures the efficiency of the application of the SSCL and its effect on mortality as well as on post surgery complications. There were multiple barriers in the way of success to implement this checklist. Influential personnel's approval capacities imitate their objective to use it at the same time as their attentiveness and understanding of the SSCL evaluate the efficacy of the education progression. They also distributed a structured questionnaire among health care providers, 147 responses were collected using this questionnaire, 88% respondents knows about the SSCL, its objectives and effectiveness in safe surgery. Overall result was good and checklist has already been implemented in selected hospital setting (Pugel et al., 2018).

Cabral et al in 2016, proposed an intercontinental study to observe the usefulness of SSCL in the course of minimizing complication of surgery. They conclude implementation of SSCL only is not effective to reduce mortality rate, it cannot work properly if there is no change in culture and behavior of health care providers. This study suggested that

SSCL has considerable effect over post-operative outcomes (Cabral et al., 2016).

Surgical procedures are an essential part of modern medicine. It is estimated that there are 187.2 - 281.2 million major surgical cases per year, equating to about one procedure per 25 people. Surgery, however, is not without risk. An Australian study that investigated negative events associated with surgery found that 21.9% of surgical admissions were associated with an adverse event, and that 47.6% of these were preventable complications if the use of SSCL will become more effective (Lingard et al., 2018).

In more recent studies, the International Surgical Outcomes Study (ISOS) showed that 16.8% of patients developed complications due to non adherence with SSCL in operating room, with a mortality rate of 2.8%, the European Surgical Outcomes Study (EuSOS) showed a mortality rate (MR) of 4%, and in the South African Surgical Outcomes Study (SASOS) the MR was 3.1%, with the highest hospital mortality being 9.5% Efforts to decrease adverse events and improve patient safety led to the Safe Surgery Saves Lives program and subsequently to the World Health Organization Surgical Safety Checklist (WHO SSCL) (Haynes et al., 2019).

A pilot study conducted by Biccard et al in 2017 suggested that after introduction of the WHO SSCL to assess the effect of implementation showed a reduction in surgical complication rate, surgical site infection, unexpected re-operation and death rate in hospital (Biccard et al., 2017)

Another study done by Takala et al in 2019, showing improvement of patient identification and surgical site confirmation, emphasized that better understanding of each team member's role aided in better communication and teamwork. They investigated the effect of surgical safety checklists at 101 hospitals. They compared

mortality data, surgical complications and readmissions before and after implementation of an SSCL, which did not show any significant differences. It's also showed no effect on 30-day mortality, unplanned critical care admissions and unplanned repeat surgery.

Takala et al observed the completion of the SSCL, completion of all parts of the checklist occurred in only 27% of cases, who investigated completion of the first part of the SSCL, found that only two parts of WHO SSCL were completed >90% of the time, whereas the rest of the checkpoints were completed in <60% of cases (Takala et al, 2019).

### **Research Variables:**

#### **Dependent Variable:**

Effectiveness of surgical safety checklist

#### **Independent Variable:**

Nurses are independent variable of this research

### **Operational definitions**

#### **Assessment:**

Observational assessment of nursing staff to assess the effectiveness of surgical safety education through a valid checklist.

#### **Effectiveness of surgical safety checklist (education):**

Effectiveness of surgery safety will be checked through an observation checklist adopted from David Rakoff et al, prepared by WHO in 2009 among Nurses.

#### **Nurses:**

Nurses will be participants of this research, in the following research Nurses will observe directly through a valid checklist.

### **Definition of key concepts**

#### **Assessment**

The act of making opinions regarding someone or something on the basis of observations. This term refers to a number of methods used by educators to estimate, determine, and/or document the educational inclination, knowledge advancement, ability to achieve certain goals, and learning requirements of pupils.

### **Effectiveness of Surgical safety checklist (education):**

A Checklist helps ensure that teams consistently follow a few critical safety steps, and thereby minimize the avoidable risks endangering the lives of surgical patients. The WHO Surgical Checklist is intended to give surgical teams a simple and efficient set of priority checks to ensure patient safety, effective teamwork, and communication in every operation performed (Walker et al., 2017).

### **Nurses:**

Nurses are health care professional who care for ill patient. They work with communities, families and at clinical area, help them to recover from diseased condition. Nurses worked in many specialties for the betterment of critically ill clients. They also worked in operating room as an important member of surgical team to make sure surgery will be safe and secure.

### **Objectives:**

Objectives of the proposed research are

#### **Specific objective**

Is to assess the effectiveness of surgery safety checklist through education among nurses at individual level through observation.

#### **General objective:**

Is to assess the effectiveness of educational session provided by researcher, provide necessary information which is

deficient, promote use of SSCL in operating rooms, prevent patients from harm, make the use of SSCL more effective through instruction and increase awareness of other health care providers in accordance with patient's safety.

### **Hypothesis:**

#### **1. Null Hypothesis**

Education has no impact over the use, adherence and effectiveness of SSCL

#### **2. Alternative Hypothesis**

Education has good impact over the use, adherence and effectiveness of SSCL

#### **Assessment criteria for interpretation of results**

All dependent variables defined as no, moderate, good and excellent.

- Score of 25% or less after educational session indicates no effect of education on the effectiveness of SSCL
- Score of 26-50% indicates moderate effect
- Score of 51-75% indicates good effect
- Score of above 75% indicates excellent effect

### **Methodology**

In order to assess effectiveness of surgical safety checklist through education related to SSCL among nurses, we conducted a quasi-experimental study. Nurses from operating room were target population. A convenient sample of 160 surgical procedures and 50 nurses was taken from selected population.

#### **Method of data collection:**

WHO surgical safety checklist adopted from David Rakoff et al., 2018 was used to collect data through direct observation. The above mentioned checklist consists of 3 main sections (1.sign in, 2.Time out, 3.Sign out) which are further subdivided into many sections. Checklist was filled by researchers themselves.

160 SSCL was filled in operating room through direct observation to ensure safe surgery.

### **Study Design:**

Study design for this research was Quasi-experimental

### **Population and sampling**

Convenient sample of 50 nurses from operating room of public hospital of Lahore was the population of this research study.

### **Study site:**

Proposed research was held in operating room of public hospital in the city of Lahore, Punjab, Pakistan.

### **Sampling Method:**

Convenient sampling technique was used to conduct this research.

### **Sample Size:**

Checklist was filled through observation of 160 surgeries in operating room of public hospital of Lahore, Punjab, Pakistan.

### **Inclusion criteria:**

Nursing staff belong to operating room and/or surgical unit

Nurses who are working in OR from more than 02 years but unaware of SSCL was also in research for educational session.

### **Exclusion criteria:**

Nursing staff from other units

Newly appoint Nurses who have working experience less than 1 month

Other health care workers

### **Ethical considerations**

Authorization to conduct this research was requested from the venerated Principal LSN (Lahore School of Nursing), The University of Lahore and Medical superintendent of selected public hospital. Observant were informed about the intention of the research, their participation will purely depend on their agreement and they were allowed to withdraw at any time during the research. The confidentiality and privacy of observant names and hospital setting was ensured.

### **Time Line for Study:**

04 months from January 2020 to April 2020.

### **Research Tools:**

An approved checklist introduced by WHO in 2008 and adopted from David Rakoff et al 2018. [[Checklist](#)]

### **Reliability:**

Analysis was performed with an overall Cronbach-alpha 0.8

### **Research Question:**

What is the effectiveness of surgery safety checklist education among Nurses in public hospitals of Lahore, Pakistan?

### **Problem statement:**

In low income countries of the world including Pakistan mortality rate increasing with the passage of time due to wrong surgeries, new incidence are happen at daily basis due to negligence of health care providers (HCP). This research was conducted to identify the barrier to effective care and safe surgery, measures that HCP generally use to decrease the risk of physical or psychological injury to patient during surgery. Implementation of SSCL, adherence of HCP to the process of SSCL during surgical intervention and measures its effect on patient's safety.

### **Data Analysis:**

Collected facts were analyzed on SPSS version 25 and presented in the structure of frequencies and bar graphs, paired sample T.test was applied to check the significance of the education on effectiveness of SSCL.

### Purpose of the research

Purpose of the planned research was to recognize the effectiveness of surgical safety checklist education among Nurses in the public hospital of Lahore.

### Significance of research:

Following research will prove advantageous for patients in order to recover their selves as early as possible from diseased condition through an effective process while undergo surgery, equally beneficial for health care workers, As well as for hospitals to avoid any legal or other inconvenient situation which can disrepute institute or any individual. Substantial important for the country to implement strategies to prevent people from harm within available resources.

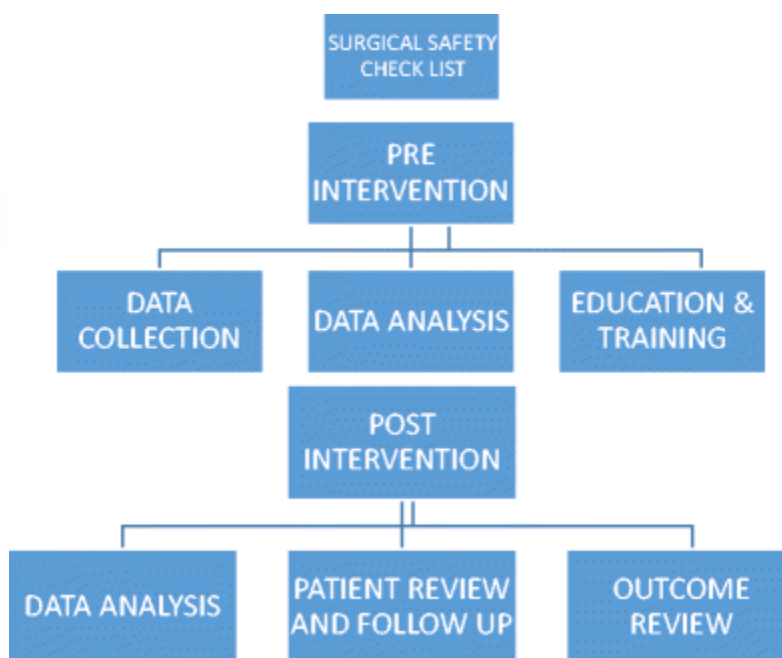


Figure 1.1 Flow chart of research regarding the use of SSCL pre and post-educational session

### Results

Results are calculated using SPSS version 25. Descriptive statistical analysis was used to check the adherence of medical professionals with SSCL, all contents of the

checklist was analyzed separately with percentage as shown in tables and figures below. Self filled checklist was used, which contains 26 total points to check during surgery, aligned in three sections. Total 160 surgeries was observed

for this purpose, of which 80 was observed before providing education related to checklist and 80 after education. Paired sample t test was also used to check the hypothesis that the education can affect the compliance and adherence of SSCL or not? So the results prove

that the education has a significant affect over the compliance and adherence with the P value of 0.000 which means the affect is highly significant. Results are shown below.

**Description given in table in percentage of met criteria before and after educational session during sign in – before induction of anesthesia**

Sr. #	Description	Pre-session	Post-session
1	Anesthesia equipment safety checks completed?	0%	96.3%
2	Patient information confirmed?	0%	91.5%
3	Review final test results?	22%	100%
4	Confirm essential imaging displayed?	4.9 %	97.6%
5	ASA classification followed?	0%	89%
6	Allergies documented?	3.7%	96.3%
7	Pre-procedure medication?	8.5%	97.6%
8	VTE prophylaxis?	0%	20.7%
9	Difficult airway?	0%	23.2%
10	Vitals monitoring?	98.8%	100%
11	Estimated blood loss?	100%	100%
12	Surgeon’s review?	13.4%	92.7%
13	Anesthesiologists review?	14.6%	97.6%
14	Nurses review?	12.2%	98.8%
15	Patient’s positioning and use of support devices?	93.9%	100%
16	Special precautions?	2.4%	96.3%
17	Expected procedure time and post-operative destination?	2.4%	97.46%

Table 1.1 descriptive analysis of section I of surgical safety checklist

**Description given in table in percentage of met criteria before and after educational session during time out – before skin incision**

Sr. #	Description	Pre-session	Post-session
1	All team members introduced themselves by name and role?	0%	98.8%
2	Team members confirmed patient’s name, site, and procedure before	24.4%	96.3%

	proceeding?		
3	Does anyone have any other questions or concerns before proceeding?	3.7%	19.5%

Table 1.2 sections II SSCL

**Description given in table in percentage of met criteria before and after educational session during sign out – before patients leaves OR**

Sr. #	Description	Pre-session	Post-session
1	Surgeon reviews	7.3%	97.6%



	with entire team after surgery?		
2	Anesthesiologist review with entire team after surgery?	4.9%	96.3%
3	Nurses review with entire team after surgery?	13.4%	96.3%
4	Specimen label and sponge count?	100%	100%

Table 1.3 sections III SSCL

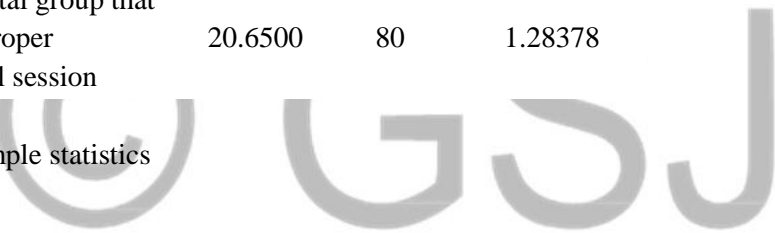
### Paired sample T test

Paired T test was applied to prove the hypothesis that education has significant impact on the effectiveness of surgical safety checklist. Two groups was defined as group 1 = control group (observant that not received any educational session) and group 2 = experimental group (observant that received proper educational session to increase the effectiveness of SSCL). Each group contains 80 members that selected using convenient sampling technique, mean of control and experimental group was 6.8 and 20.65 respectively.

### Paired Samples Statistics

	Mean	N	Std. Deviation	
Pair 1	Control group that not received any educational session	6.8000	80	2.08915
	Experimental group that received proper educational session	20.6500	80	1.28378

Table 1.4 paired sample statistics



### Paired Samples Correlations

	N	Correlation	Sig.
Pair 1	80	.106	.351

Table 1.5 paired samples correlation

### Paired sample test significance and frequencies

Paired differences can clearly seen in table 4.3, mean of paired sample was -13.8, standard deviation was calculated 2.33,

confidence interval was 95% with lower difference of -14.36 and upper 13.33, tabulated value was -53.085, degree of freedom was 79 with 2 tailed significance of 0.000 which considered as highly significance. Which proves that education has significance role in the implementation and outcomes of SSCL?

**Paired Samples Test**

	Paired Differences				t	df	Sig. (2-tailed)
	Mean	Std. Deviation	95% Confidence Interval of the Difference				
			Lower	Upper			
Pair 1 Control group that not received any educational session - Experimental group that received proper educational session	13.85000	2.33357	14.36931	13.33069	-53.085	79	.000

Table 1.6 Paired Samples Test

**Discussion:**

It is estimated that there are about 313 million operations worldwide every year and surgery is an important cure for variation. Every surgical procedure is felt by risk and death. Numerous complex characteristics persuade surgical intervention including both practical and technical. As a result procedural effects are inclined by the several team members, organizations and countries, due to less number of care givers and systematic deficiencies. Consequently multiple events to develop performance of entire surgery team and therefore militate beside procedure impediments or unpleasant measures have been activist.

In 2016 Ragusa et al explains that in spite of many through chief health association to develop surgical protection but more work is needed to minimize wrong site procedure and other mistakes during surgery. Executions of such sets of rules have enhanced client's

wellbeing and, in collective, are viewed constructively by health care providers. Educational program and implementation of guidelines by WHO may assist to decrease communication fault, which will minimize the sentinel events resulting from wrong site surgery. All health provider organizations have to maintain to move forward to implement SSCL in order to minimize surgical errors worldwide (Ragusa et al., 2016). In the following study results shows that educational session prove very effective to minimize wrong site surgeries with compliance rate of 91.5% following instructions.

In 2018 a pilot study was conducted by an international author Cadman, he inspects the efficacy of SSCL by WHO to prevent procedural complications during surgeries. He concluded that implementation of SSCL in accordance with change in culture will be more significant to minimize death rate. The study showed that introduction of WHO SSCL into OR procedures significantly influence surgical outcomes (Cadman., 2018). In the same way our study proves that the implementation and educational

session is highly effective to minimize the sentinel events as well as to diminish the death rate.

In 2018 Dinesh et al, illustrate outcomes of surgical intervention enhanced with implementation of SSCL. This checklist is practicable and should be considered in emergency as well as elective surgical operations. Learning activities has an important role to make the checklist more effective and its accomplishment is less costly and highly effective (Dinesh et al., 2018). In our research result proves that the learning activities has good impact over the enhancement and effectiveness of the SSCL which are significant with p value of 0.000.

In 2016 Komasa and berg explains that installation of a pre-operative managing panel together with surgeons, anesthesiologists, nurses and other health care personnel are obligatory for surgical supervision enforcement. OR team training and education will endow with an exclusive and efficient move toward the expansion of capability and appliance of significant technological and non-technological proficient skills, vigilance, communal managerial and management (Komasawa & Berg., 2016). In the same way our study showed that education and training of entire operating room team will enhance their skills, safe surgery, patient's protection, organization repute and prove to decrease in sentinel events.

Wali et al., 2019 concluded in their study that training has significant impact over the effectiveness of SSCL and participants can enhance their educational requirements. Useful guidance is indispensable to continue secure quantifiable practices contained by HCP, and teaching techniques with a number of learning styles can also improve the enhance ability and adherence to checklist (Wali et al., 2019). Our research outcomes also demonstrate that the

training and education regarding the effective use of SSCL through different methods and teaching styles will prove beneficial and increase the ability of surgical team to do work more efficiently in OR.

De Jager et all in 2016 explains that SSCL been implemented all over the world to diminish complication caused by surgical procedure due to wrong practices in operating rooms. On the other hand they suggested that to make the checklist more effectiveness it's necessary to have premeditated methods of implementation, ongoing observation and learning sessions with entire team. In addition, when the SSCL become a daily practice of entire team, they will experience a sense of safety to all group affiliate of surgical team (De Jager et al., 2016). In the proposed research it has been found that only education is not necessary to implement SSCL but it's equally vital to have check and balance through audits and other methods which are feasible and financially possible for organizations to make the use of SSCL more effective.

Rakoff et al in 2018 observed 244 surgical procedures to test the success of SSCL and impact of teaching on its adherence as well as effectiveness. They proves that the compliance and effectiveness of SSCL was higher in experimental group (74%) in comparison with control group (34%) with the p value of 0.001. they also explains that the modified teaching agenda increase compliance rate among HCP and has ability to minimize death rate (Rakoff et al in 2018). Same as this study our research demonstrate that the compliance rate was high in experimental group (90%) in comparison with control group (40%) with p value of 0.000 which is highly significant.

## Conclusion:

The aim of the study was to assess the effectiveness of surgical safety checklist through education, for this purpose an observational quasi experimental study was done, 160 surgeries were observed by researcher from which 80 were pre-education and 80 were post-education. A non participant checklist was used

to collect the data and then this collected data analyzed on SPSS version 25. Through analysis found that the education has extremely good effect over the compliance and effectiveness of the SSCL. Although result was positive but more work should be done to adhere the surgical team in regard of SSCL to minimize medical, practical and technical errors in OR.

## References

- Aveling, E. L., McCulloch, P., & Dixon-Woods, M. (2017). A qualitative study comparing experiences of the surgical safety checklist in hospitals in high-income and low-income countries. *BMJ open*, 3(8), e003039.
- Bergs, J., Hellings, J., Cleemput, I., Simons, P., Zurel, Ö., Vertriest, S., & Vandijck, D. (2017). Surgical safety checklists: an update. *Acta chirurgica Belgica*, 114(4), 219-224.
- Borchard A, Schwappach DL, Barbir A, Bezzola P. A systematic review of the effectiveness, compliance, and critical factors for implementation of safety checklists in surgery. *Ann Surg*. 2017;256:925–33. [PubMed] [Google Scholar]
- Bosk CL, Dixon-Woods M, Goeschel CA, Pronovost PJ. Reality check for checklists. *Lancet*. 2019;374:444–5. [PubMed] [Google Scholar]
- Biccard BM, Madiba TE; on behalf of the South African Surgical Outcomes Study Investigators. The South African Surgical Outcomes Study: A 7-day prospective observational cohort study. *S Afr Med J* 2018;105(6):465-475. <https://doi.org/10.7196/samj.9435>
- Cabral, R. A., Eggenberger, T., Keller, K., Gallison, B. S., & Newman, D. (2016). Use of a surgical safety checklist to improve team communication. *AORN journal*, 104(3), 206-216
- Conley, D. M., Singer, S. J., Edmondson, L., Berry, W. R., & Gawande, A. A. (2018). Effective surgical safety checklist implementation. *Journal of the American College of Surgeons*, 212(5), 873-879.
- De Vries EN, Ramrattan MA, Smorenburg SM, Gouma DJ, Boermeester MA. The incidence and nature of in-hospital adverse events: A systematic review. *Qual Saf Health Care*. 2018;17:216–23. [PMC free article] [PubMed] [Google Scholar]
- Dinesh, H. N., Ravva, R. S., & Kumar, S. (2018). Surgical safety checklist implementation and its impact on patient safety. *International Surgery Journal*, 5(11), 3640-3643.
- De Jager, E., McKenna, C., Bartlett, L., Gunnarsson, R., & Ho, Y. H. (2016). Postoperative adverse events inconsistently improved by the World Health Organization surgical safety

- checklist: a systematic literature review of 25 studies. *World journal of surgery*, 40(8), 1842-1858.
- Gołębiowska, M., Gołębiowska, B., Chudzik, R., Jasiński, M., & Dubelt, J. (2018). Utilization and Effectiveness of Surgical Safety Checklist in European Region. *World Scientific News*, 99, 169-180.
- Haynes AB, Weiser TG, Berry WR, et al. A surgical safety checklist to reduce morbidity and mortality in a global population. *N Engl J Med* 2019;360(5):491-499.  
<https://doi.org/10.1016/j.spinee.2010.04.021>
- Komasawa, N., & Berg, B. W. (2016). Interprofessional simulation training for perioperative management team development and patient safety. *Journal of perioperative practice*, 26(11), 250-253.
- Lingard L, Regehr G, Orser B, Reznick R, Baker GR, Doran D, et al. Evaluation of a preoperative checklist and team briefing among surgeons, nurses, and anesthesiologists to reduce failures in communication. *Arch Surg*. 2018;143:12–7. [PubMed] [Google Scholar]
- Pugel, A. E., Simianu, V. V., Flum, D. R., & Dellinger, E. P. (2018). Use of the surgical safety checklist to improve communication and reduce complications. *Journal of infection and public health*, 8(3), 219-225.
- Ragusa, P. S., Bitterman, A., Auerbach, B., & Healy III, W. A. (2016). Effectiveness of surgical safety checklists in improving patient safety. *Orthopedics*, 39(2), e307-e310.
- Rakoff, D., Akella, K., Guruvegowda, C., Chhajwani, S., Seshadri, S., & Sola, S. (2018). Improved compliance and comprehension of a Surgical Safety Checklist with customized versus standard training: a randomized trial. *Journal of patient safety*, 14(3), 138-142.
- Takala RSK, Pauniah S-L, Kotkansalo A, et al. A pilot study of the implementation of WHO surgical checklist in Finland: Improvements in activities and communication. *Acta Anaesthesiol Scand* 2018; 55(10):1206-1214.
- Urbach, D. R., Govindarajan, A., Saskin, R., Wilton, A. S., & Baxter, N. N. (2016). Introduction of surgical safety checklists in Ontario, Canada. *N Engl J Med*, 370, 1029-1038.
- World Health Organization. Safe Surgery Saves Lives. 2008. [Last accessed on 2016 Oct 16]. Available from: <http://www.who.int/patientsafety/safesurgery/ss-checklist/en/index.htm> .
- Walker IA, Reshamwalla S, Wilson IH. Surgical safety checklists: Do they improve outcomes? *Br J Anaesth*. 2017;109:47–54. [PubMed] [Google Scholar]
- World Health Organization. WHO guidelines for safe surgery 2009. Safe surgery saves lives. [http://whqlibdoc.who.int/publications/2009/9789241598552\\_eng.pdf](http://whqlibdoc.who.int/publications/2009/9789241598552_eng.pdf) (accessed 26 February 2018).
- Wali, R., Halai, T., & Koshal, S. (2019). WHO surgical safety checklist training: An alternative approach to training in local safety standards for invasive procedures. *European Journal of Dental Education*.