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# ROLE OF CONTINUOUS TRAINING IN IMPROVING COMPLIANCE TO SAFE SURGICAL PRACTICES ON ESTABLISHED STANDARD OPERATING PROTOCOLS IN A TERTIARY CARE HOSPITAL AT NATIONAL CAPITAL REGION IN INDIA

Hospital Administration

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## ABSTRACT

**Background:** One of the most common interventions used in healthcare to improve safety and reliability is to formalize framework of activity based on Standard Operating Protocols (SOPs). The primary goal of SOPs is to structure and standardize work with predefined plans, minimizing errors which occur through failure of human memory and attention

**Methods:** A prospective observational study was conducted from January 2017 to June 2017 in a tertiary care hospital at National Capital Region in India. A sample size of 60 was taken based on a previous study. All Operation Theatre (O.T.) personnel with consent for the study were subjected to Pre-training evaluation based on WHO/NABH/Standard safe surgical practices & protocols for assessment of knowledge. Training of half an hour daily for 4 weeks was imparted to the O.T. personnel. Training was given with standard WHO/NABH material on safe surgical practices in the form of lectures, presentations, group discussions, audio-visuals etc. O.T. personnel who participated in training were re-evaluated immediately on completion of training and after 3 months with the same Pre- training evaluation process and material.

**Results:** Overall pre-training safe surgical practices compliance score for O.T. staff was 70.60%, which increased to 94.33% immediate post-training and persisted to 86.78% three months post-training. Difference in compliance after training was statistically significant.

**Conclusions:** It seems that training increases compliance of healthcare providers on safe surgical practices related to preoperative, operative, postoperative, anaesthesia related, surgical attire related and infection control related practices.

## KEYWORDS

Standard Operating Protocols, Training, Compliance, Safe Surgery

## INTRODUCTION

The Institute of Medicine (IOM) considers patient safety "indistinguishable from the delivery of quality health care". Patient safety was defined by the IOM as "the prevention of harm to patients" with emphasis placed on the system of care delivery that prevents errors, learn from the errors that do occur and built on a culture of safety that involves health care professionals, organizations, and patients.(Aspden P, Corrigan J, 2004)

WHO and various other agencies have formulated standard operating procedures (SOPs) for patient safety. Despite the guidelines and training the compliance rate for these SOPs is not satisfactory. The generally accepted metric for monitoring and recording adherence (compliance rate) is episodes performed divided by number of opportunities.(*WHO Guidelines on Hand Hygiene in Health Care First Global Patient Safety Challenge Clean Care is Safer Care*, 2009) An estimated 234 million major operations are performed around the world each year, corresponding to one operation for every 25 people alive. Surgical interventions account for an estimated 13% of the world's total disability-adjusted life years (DALYs). While the surgical procedures are intended to save lives, unsafe surgical care can cause substantial harm. Given the variability of surgery, the reported crude mortality rate after major surgery is 0.5-5%, complications after inpatient operations occur in up to 25% of patients and mortality from general anesthesia alone is reported to be as high as 1/150 in some parts of Sub-Saharan Africa.("WHO | Safe Surgery," 2014)

The need to develop specific strategies for maximizing the reliability of healthcare delivery, particularly surgery, and avoiding the risk of patient harm through unintentional deviation and error is now well recognized. One of the most common interventions used in industry to improve safety and reliability is to formalize framework of activity based on SOPs. The primary goal of SOPs is to structure and standardize work with predefined plans, minimizing errors which occur through failure of human memory and attention. (*To err is human: building a safer health system*, 2000)

Compliance to these SOPs is mandatory for clinical outcome. Various infection control practices & patient safety guidelines/ SOPs have been designed by World Health Organization (WHO). Despite training, sustained compliance rates remain low, sometimes below 50%.(Taylor, 2015) Compliance of using gloves in the operating room is still poor amongst anesthesia providers ranging from 10.93% to 50%.(Goudra, Singh, & Galvin, 2014) Noncompliance to safe surgical practices leads to health care associated infections (HAIs). The estimated annual cost of the 5 major HAIs in United States is $9.8 billion and 99,000 deaths.(Zimlichman et al., 2013) Factors cited for low compliance rates include lack of knowledge about its importance, lack of understanding about correct techniques, understaffing, poor access to facilities, and lack of commitment by facility leadership.(Pittet & Boyce, 2001)

Numerous authors highlight the importance of patient-surgeon communication and consider the inclusion of the patient in their treatment, the fundamental premise of healthcare. The informed consent form is a scientifically endorsed tool available to evaluate this relationship. (Tillman, Wehbe-Janek, Hodges, Smythe, & Papaconstantinou, 2013)(Butterworth, Gilheany, & Tinley, 2010) Yet, in clinical practice it is not always employed correctly and making a ground for patient claim. (Zgonis, Jolly, & Garbalosa, 2004)

## AIMS & OBJECTIVES

### AIM

Role of continuous training and assessment in improving compliance to safe surgical practices on established Standard Operating Protocols.

### OBJECTIVES

To study the effect of continuous education & training on compliance of O.T. personnel to established patient safety protocols.

## MATERIAL AND METHODS

**Study site and setting** - Main operation theatre complex at a tertiary care hospital at National Capital Region, India.

**Study population -** The study was conducted on 60 O.T. personnel, out of which 15 were O.T. technician and 45 were O.T. nurses

**Type of study** - Prospective observational study.

**Study period** - Study was conducted from January 2017 to June 2017.

**Sample size-** A previous study, **Friedland et al** [28] indicated a similar protocol which showed improvement in compliance of 23% of continuous training to safe surgical practices on established standard operating protocols. Expecting the same, sample size of 60 cases were required with power 90% and at an alpha 0.05.

**Inclusion criteria**

(A) O.T. personnel with consent

**Exclusion criteria**

(A) Any condition which affected the regularity of O.T. personnel like pregnancy, irregular staff.
(B) O.T. staff who did not gave consent for study

**Methodology -**

All O.T. personnel with consent for the study were subjected to Pre-training evaluation based on WHO/NABH/Standard safe surgical practices & protocols for assessment of knowledge. Training of half an hour daily for 4 weeks was imparted to the O.T. personnel. Training was given with standard WHO/NABH material on safe surgical practices in the form of lectures, presentations, group discussions, audio-visuals etc. O.T. personnel participated in training were re-evaluated immediately on completion of training and after 3 months with the same Pre- training evaluation process and material.

O.T. personnel with consent for the study
↓
Pre-training evaluation of O.T. personnel
↓
Training for half an hour daily for 4 weeks on safe surgical practices
↓
Evaluation immediately after training completion with same pre-training evaluation process and material
↓
Evaluation after 3 months of training completion

Statistical analysis was conducted with the statistical package for the social science system version SPSS 17.0.

**OBSERVATIONS AND RESULTS**

Sixty O.T. personnel (15 O.T. technicians and 45 O.T. nurses) with consent for study, in main operation theatre complex at a tertiary care hospital at National Capital Region, India were included in the study (Table 1).

Prospective observational study was done as:
Pre-training evaluation of study group: Phase 1

Followed by training
Immediate post-training evaluation: Phase 2
Evaluation 3 months after training: Phase 3

**Table 1. Composition Of Study Group**

| STUDY GROUP | 60 |
|---|---|
| O.T. TECHNICIAN | 15 (25%) |
| O.T. NURSES | 45 (75%) |

Study group included 15 (25%) O.T. technicians and 45 (75%) O.T. nurses.

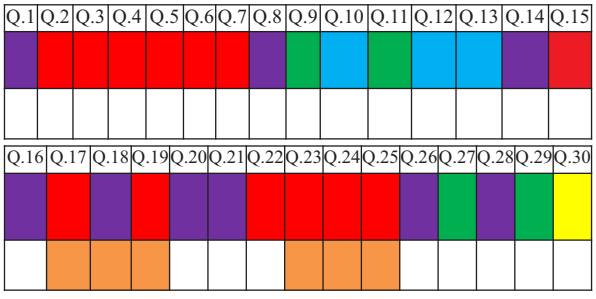
**Table 2. Composition Of Study Group On Gender Basis**

| STUDY GROUP | 60 |
|---|---|
| MALE HEALTHCARE PROVIDERS | 16(26.66%) |
| FEMALE HEALTHCARE PROVIDERS | 44(73.33%) |

Study group included 16 (26.66%) male healthcare providers and 44 (73.33%) female healthcare providers (Table 2).

Evaluation questionnaire included total 30 questions, which were related to preoperative, operative, postoperative, anaesthesia related, infection control and surgical attire related knowledge (Figure 1a & Figure 1b).

As shown in Figure 1a few questions were overlapping.




**Key**

| Pre-operative | Operative | Post-operative | Anaesthesia related | Infection control | Surgical attire |
|---|---|---|---|---|---|

**Figure 1b. Composition of evaluation questionnaire**

**Table 3. Comparison Of Compliance Related To Preoperative Safe Surgical Practices Among Three Phases Of Study**

| STUDY GROUP | PHASE 1 (PRE-TRAINING MEAN%AGE±SD) | PHASE 2 (IMMEDIATE POST-TRAINING MEAN%AGE±SD) | PHASE 3 (3 MONTHS POST-TRAINING MEAN%AGE±SD) | P VALUE PHASE 1-2 | P VALUE PHASE 1-3 | P VALUE PHASE 2-3 |
|---|---|---|---|---|---|---|
| O.T. TECHNICIANS | 53.33±22.44 | 88.00±9.30 | 83.33±10.91 | <0.001 | <0.001 | 0.003 |
| O.T. NURSES | 76.11±17.73 | 94.00±6.40 | 87.41±8.99 | <0.001 | <0.001 | <0.001 |
| TOTAL | 70.42±21.28 | 93.00±7.60 | 86.39±9.57 | <0.001 | <0.001 | <0.001 |

Pre-training compliance of O.T. personnel was 70.42%, which increased to 93% immediately post-training & persisted to 86.39% after 3 months of training, which was statistically significant (Table 3 & Figure 2).

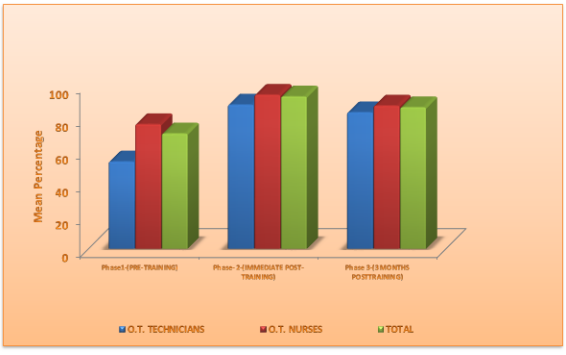



**Figure 2. Comparison Of Compliance Related To Preoperative Safe Surgical Practices**

**Table 4. Comparison Of Compliance Related To Operative Safe Surgical Practices Among Three Phases Of Study**

| Study Group | Phase 1 (pre-training Mean %age±sd) | Phase 2 (immediate Post-training Mean%age±sd) | Phase 3 (3 Months Post-training Mean%age±sd) | P Value Phase 1-2 | P Value Phase 1-3 | P Value Phase 2-3 |
|---|---|---|---|---|---|---|
| O.T. TECHNICIANS | 73.00±31.40 | 96.00±11.70 | 93.00±13.80 | 0.012 | 0.014 | 0.334 |
| O.T. NURSES | 78.00±18.80 | 96.00±11.50 | 91.00±16.50 | <0.001 | =0.001 | 0.032 |
| TOTAL | 77.00±22.40 | 96.00±11.40 | 92.00±15.80 | <0.001 | <0.001 | 0.018 |

Pre-training compliance of O.T. personnel was 77%, which increased to 96% immediately post-training & persisted to 92% after 3 months of training, which was statistically significant (Table 4 & Figure 3).

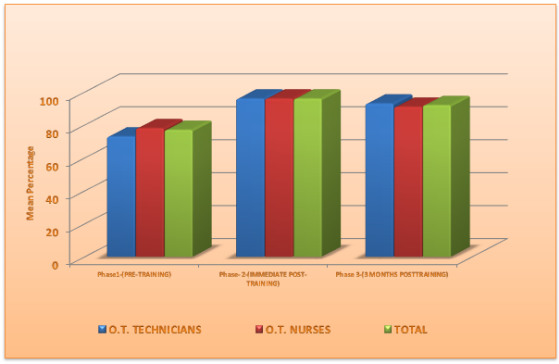



**Figure 3. Comparison Of Compliance Related To Operative Safe Surgical Practices**

**Table 5. Comparison Of Compliance Related To Postoperative Safe Surgical Practices Among Three Phases Of Study**

| Study Group | Phase 1 (pre-training Mean %age±sd) | Phase 2 (immediate Post-training Mean%age±sd) | Phase 3 (3 Months Post-training Mean%age±sd) | P Value Phase 1-2 | P Value Phase 1-3 | P Value Phase 2-3 |
|---|---|---|---|---|---|---|
| O.T. TECHNICIANS | 57.00%±41.70 | 90.00±20.70 | 87.00±22.90 | 0.003 | 0.003 | 0.334 |
| O.T. NURSES | 72.00±25.10 | 96.00±14.40 | 91.00±19.30 | <0.001 | <0.001 | 0.044 |
| TOTAL | 68.00±30.50 | 94.00±16.20 | 90.00±20.20 | <0.001 | <0.001 | 0.024 |

Pre-training compliance of O.T. personnel was 68%, which increased to 94% immediately post-training & persisted to 90% after 3 months of training, which was statistically significant (Table 5 & Figure 4).

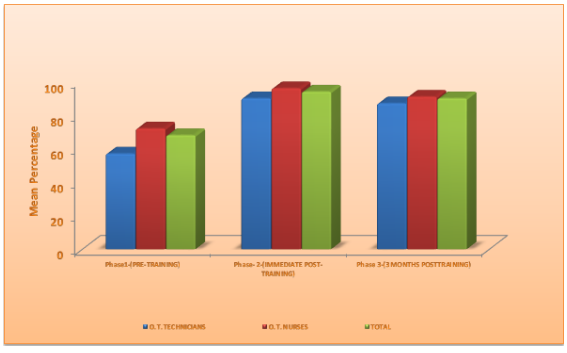



**Figure 4. Comparison Of Compliance Related To Postoperative Safe Surgical Practices**

**Table 6. Comparison Of Compliance Related To Anaesthesia Safe Surgical Practices Among Three Phases Of Study**

| Study Group | Phase 1 (pre-training Mean %age±sd) | Phase 2 (immediate Post-training Mean%age±sd) | Phase 3 (3 Months Post-training Mean%age±sd) | P Value Phase 1-2 | P Value Phase 1-3 | P Value Phase 2-3 |
|---|---|---|---|---|---|---|
| O.T. TECHNICIANS | 37.78±24.77 | 98.00±8.60 | 84.44±17.21 | <0.001 | <0.001 | 0.009 |
| O.T. NURSES | 39.26±17.82 | 94.00±12.90 | 79.26±21.66 | <0.001 | <0.001 | <0.001 |
| TOTAL | 38.89±19.56 | 95.00±12.00 | 80.56±20.62 | <0.001 | <0.001 | <0.001 |

Pre-training compliance of O.T. personnel was 38.89%, which increased to 95% immediately post-training & persisted to 80.56% after 3 months of training, which was statistically significant (Table 6 & Figure 5).

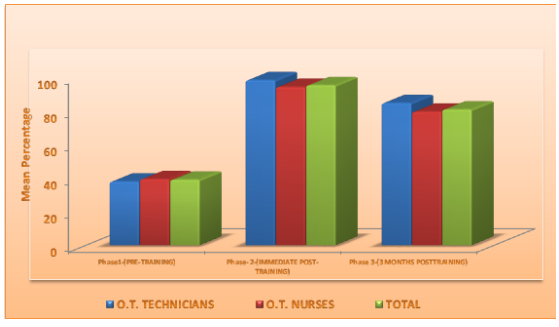



**Figure 5. Comparison Of Compliance Related To Anaesthesia Safe Surgical Practices**

**Table 7. Comparison Of Compliance Related To Infection Control Safe Surgical Practices Among Three Phases Of Study**

| Study Group | Phase 1 (pre-training Mean %age±sd) | Phase 2 (immediate Post-training Mean%age±sd) | Phase 3 (3 Months Post-training Mean%age±sd) | P Value Phase 1-2 | P Value Phase 1-3 | P Value Phase 2-3 |
|---|---|---|---|---|---|---|
| O.T. TECHNICIANS | 63.70±15.97 | 90.37±10.17 | 83.70±11.77 | <0.001 | =0.001 | 0.007 |

| | | | | | | |
|---|---|---|---|---|---|---|
| O.T. NURSES | 74.32±13.36 | 96.05±6.33 | 87.16±8.19 | <0.001 | <0.001 | <0.001 |
| TOTAL | 71.67±14.67 | 94.63±7.78 | 86.30±9.23 | <0.001 | <0.001 | <0.001 |

Pre-training compliance of O.T. personnel was 71.67%, which increased to 94.63% immediately post-training & persisted to 86.30% after 3 months of training, which was statistically significant (Table 7 & Figure 6).

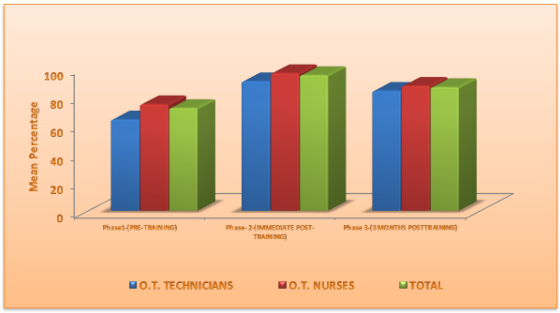



**Figure 6. Comparison Of Compliance Related To Infection Control Safe Surgical Practices**

**Table 8. Comparison Of Compliance Related To Surgical Attire Safe Surgical Practices Among Three Phases Of Study**

| Study Group | Phase 1 (pre-training Mean %age±sd) | Phase 2 (immediate Post-training Mean%age±sd) | Phase 3 (3 Months Post-training Mean%age±sd) | P Value Phase 1-2 | P Value Phase 1-3 | P Value Phase 2-3 |
|---|---|---|---|---|---|---|
| O.T. TECHNICIANS | 43.30±22.54 | 93.00±8.50 | 86.70±9.34 | <0.001 | <0.001 | 0.009 |
| O.T. NURSES | 60.70±16.34 | 95.00±7.60 | 82.60±15.06 | <0.001 | <0.001 | <0.001 |
| TOTAL | 56.40±19.43 | 95.00±7.80 | 83.60±13.89 | <0.001 | <0.001 | <0.001 |

Pre-training compliance of O.T. personnel was 56.40%, which increased to 95% immediately post-training & persisted to 83.60% after 3 months of training, which was statistically significant (Table 8 & Figure 7).

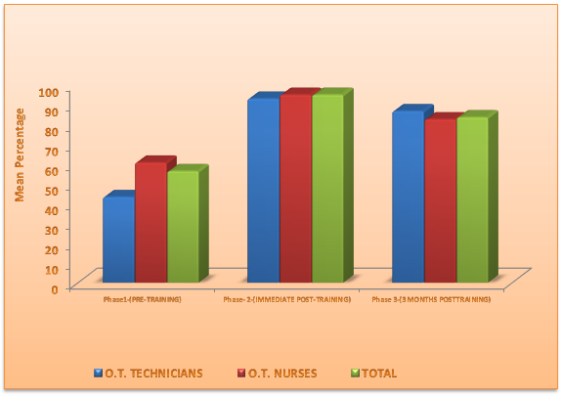



**Figure 7. Comparison Of Compliance Related To Surgical Attire Safe Surgical Practices**

**Table 9. Comparison Of Compliance Related To Overall Safesurgical Practices Among Three Phases Of Study**

| Study Group | Phase 1 (pre-training Mean %age±sd) | Phase 2 (immediate Post-training Mean%age±sd) | Phase 3 (3 Months Post-training Mean%age±sd) | P Value Phase 1-2 | P Value Phase 1-3 | P Value Phase 2-3 |
|---|---|---|---|---|---|---|
| O.T. TECHNICIANS | 59.60±16.56 | 90.89±4.62 | 84.67±6.99 | <0.001 | <0.001 | <0.001 |
| O.T. NURSES | 74.3±9.66 | 95.48±2.94 | 87.48±4.93 | <0.001 | <0.001 | <0.001 |
| TOTAL | 70.6±13.27 | 94.33±3.94 | 86.78±5.59 | <0.001 | <0.001 | <0.001 |

Pre-training compliance of O.T. personnel was 70.6%, which increased to 94.33% immediately post-training & persisted to 86.78% after 3 months of training, which was statistically significant (Table 9 & Figure 8).

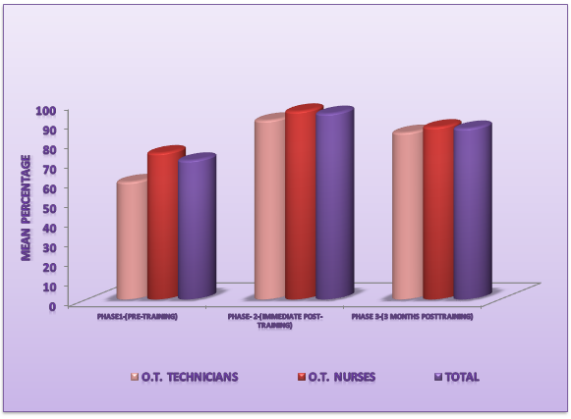



**Figure 8. Comparison of compliance related to overall safe surgical practices**

**Table 10. Comparison Of Compliance Related To Overall Safesurgical Practices Among Three Phases Of Study On Gender Basis (male Vs Female Healthcare Providers):**

| Study Group | Phase 1 (pre- Training Mean %age) | Phase 2 (immediate Post-training Mean%age) | Phase 3 (3 Months Post-training Mean%age) | P Value Phase 1-2 | P Value Phase 1-3 | P Value Phase 2-3 |
|---|---|---|---|---|---|---|
| MALE | 63.30 | 92.29 | 84.46 | <0.001 | =0.001 | =0.001 |
| FEMALE | 73.30 | 95.08 | 86.89 | <0.001 | <0.001 | <0.001 |
| TOTAL | 70.6 | 94.33 | 86.78 | <0.001 | <0.001 | <0.001 |

Pre-training compliance of male O.T. personnel was 63.30%, which increased to 92.29% immediately post-training & persisted to 84.46% after 3 months of training, which was statistically significant (Table 10 & Figure 9).

Pre-training compliance of female O.T. personnel was 73.30%, which increased to 95.08% immediately post-training & persisted to 86.89% after 3 months of training, which was statistically significant.

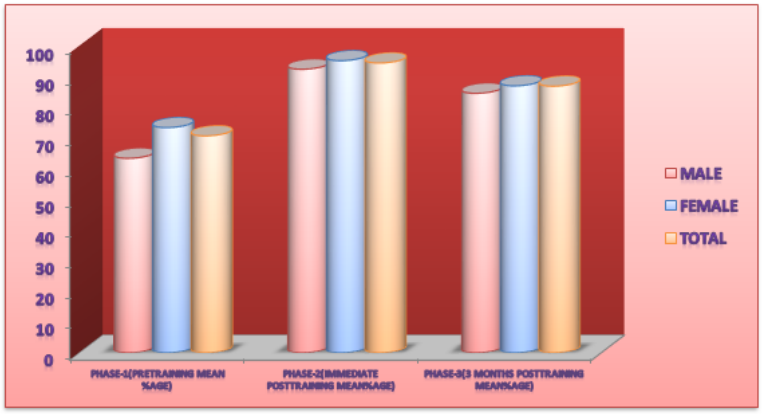



**Figure 9. Comparison of compliance related to overall safe surgical practices among three phases of study on gender basis**

## DISCUSSION

It was observed that the compliance percentage score for **preoperative safe practices** in post- training phase was more as compared to pre-training phase. It was 70.42% in pre-training, whereas in immediate post-training it increased to 93%. This difference was statistically highly significant (p<0.001). After 3 months of training, compliance rate dropped as compared to immediate post-training, it remained 86.39%, but still it was statistically significantly higher than pre-training level (p<0.001).

Among O.T. technicians and O.T. nurses training on safe surgical practices resulted in increase in compliance both immediate post-training as well as 3 months after training. Although compliance after 3 months of training decreased from immediate post-training level.

For O.T. technician compliance score in pre-training vs immediate post-training and 3 months post-training were 53.33% vs 88% vs 83.33% respectively. For O.T. nurses compliance score in pre-training vs immediate post-training vs 3 months post-training were 76.11% vs 94% vs 87.41% respectively. These differences were also statistically significant (p<0.001).

(Haynes et al., 2009) in their study also found clinically and statistically significant decrease in incidence of inpatient complications after the introduction of surgical safety checklist as compared to incidence prior to its introduction. These findings are like the present study.

(Mcculloch et al., 2016) studied the effect of team work training on technical skills among clinical staff. They found that teamwork training significantly improved non-technical skills and WHO's SSC compliance. These findings support the present study

(Morgan, New, et al., 2015) studied the effect of training SOPs on compliance with WHO's SSC and nontechnical skills. They found no significant difference in compliance or outcome measures before/ after intervention in active vs control group, which was contrary to this study.

It was found that, in pre-training phase compliance score for **operative safe practices** was 77%, whereas in immediate post-training and 3 month post-training compliance score increased, these were 96% and 92% respectively. Hence compliance for operative safe practices increased after-training. These differences were statistically significant (p values for phase 1 vs 2, 1 vs 3 & 2 vs 3 were < 0.001, <0.001 & 0.018 respectively).

For both O.T. technicians and O.T. nurses, compliance for safe operative practices increased immediately and 3 months after training. Although compliance after 3 months was lower as compared to immediate post-training level.

For O.T. technicians compliance score for prê-training, immediate post-training and 3 months post-training were 73%, 96% & 93% respectively. Differences among phase 1 vs 2 & phase 1 vs 3 were statistically significant (p=0.012 & 0.014 respectively). Difference for phase 2 vs 3 was not statistically significant (p=0.334).

For O.T. nurses, prêt-raining, immediate post-training and 3 month post-training compliance score were 78%, 96% and 91% respectively. The differences in compliance score were statistically significant (p value for phase 1 vs 2, 1 vs 3 & 2 vs 3 were <0.001, 0.001 & 0.032 respectively).

This observation was supported by **(Kim, Jeffe, Evanoff, Mutha, & Freeman, 2001)** who had studied the effect of educational intervention on compliance with safe operating surgical procedures in operating room. They found that the incidences of documented blood and body fluid exposures decreased following the interventions.

(Morgan, Pickering, et al., 2015) in their study observed effect of training of Standardized operating procedures. They found significantly improved rate of compliance for safe operating procedures after the intervention in the active vs control group.

68% in pre-training phase, 94% in immediate post-training and 90% in 3 months post-training phase, were compliance score for **postoperative safe practices.** Hence compliance rate increased after training, although 3 months after training it dropped as compared immediate post-training level. The difference in compliance seen with training was statistically significant (p value for phase 1 vs2, 1 vs 3 & 2 vs 3 were <0.001, <0.001 & 0.024 respectively).

Also, among O.T. technicians, compliance percentage score increased after training. These were 57%, 90% & 87% in phase 1, 2 &3 respectively. The difference among phase 1 vs 2 and phase 1 vs 3 were statistically significant (p value 0.003 & 0.003 respectively). Whereas difference between phase 2 vs 3 was not statistically significant (p= 0.334).

For O.T. nurses compliance score were 72%, 96% & 91% for phase 1, 2

& 3 respectively and impact of training was statistically significant ( p value for phase 1 vs 2, 1 vs 3 & 2 vs 3 were< 0.001, <0.001 & 0.044 respectively) . Compliance score increased after training, although it dropped after 3 months as compared to immediate post-training level.
(Bliss et al., 2012) compared the effect of team training on the use of surgical checklist and its completion post-operatively. They found that overall completion of checklist improved after training and also there was statistically significant decrease in 30 day postoperative morbidity. Thus, these observations support the present study.

Training caused marked improvement in **anaesthesia** related safe surgical practices. Immediate post-training compliance score was 95% as compared to pre-training which was 38.89% only. The impact of training was statistically highly significant (p value <0.001). 3 months post-training compliance score was slightly less than immediate post-training level, it was 80.56% (p value < 0.001), but it was still significantly higher than pre-training score (p value<0.001).

Immediately post-training O.T. technicians showed 98% compliance, which was 37.78% before training, making statistically highly significant difference (p value<0.001). 3 month post-training compliance score was 84.44% (p value < 0.001). Compliance score 3 months after training was lower as compared to immediate post-training (p=0.009)

The findings of study also showed 94% immediate post-training compliance among O.T. nurses which was at significantly highly acceptable level as compared to pre-training compliance, which was 39.26% (p value <0.001). The mean percentage of positive response 3 month post-training was 79.26% which was lower as compared to immediate post training level but still higher as compared to pre-training level, making difference statistically highly significant (p value <0.001).

It was observed that continuous training appeared as key component to support **infection control.** Encouraging results were found in immediate post-training as compliance mean percentage score was 94.63% whereas pre-training it was 71.67% (p value <0.001). After 3 months of training compliance score was 86.30% which was also statistically significantly high (p value <0.001).

Similarly among O.T. technicians and O.T. nurses infection control compliance was high both immediate post-training and 3 month post-training, 90.37% & 96.05% and 83.70 % & 87.15% respectively, which were significantly higher than pre-training level , 63.70% & 74.32% respectively. The training resulted in significantly higher compliance in infection control.

Similar to present study (Mukti et al., 2000) also reported statistically significant increased rate of compliance on universal precautions after the education intervention on healthcare workers in hospital. (Diekema, Schuldt, Albanese, & Doebbeling, 1995) in their study had also observed that after training compliance increased with infection control related safe surgical practices.

In **contrast** to present study, (Jeong, Cho, & Park, 2008) in their study on effect of training on compliance with standard precautions for infection control, like not recapping used needle, they found that operating room nurses rarely complied with standard precautions.

It was observed that there was a significant difference in compliance for **surgical attire** related safe surgical practices, among pre-training, immediate after training and three months after training in study group. Pre-training compliance was only 56.40% whereas immediate after training it improved to 95% and 3 months post-training it was 83.60%, making a highly significant difference (p<0.001).

In both O.T. technicians and O.T. nurses, improved compliance was noted after training. Among O.T. technicians immediate post-training compliance rate was 93%, in contrast to only 43.30% before training and among O.T. nurses immediate post-training compliance rate was 95% in contrast to 60.70% before training. 3 months post-training compliance rate persisted up to 86.70% among O.T. technicians and 82.60% among O.T. nurses which was significantly higher than pre-training level (p=0.001), and slightly lower than immediate pre-training level ( p=0.009 for O.T. technicians & p<0.001 for O.T. nurses).

(Talan & Baraff, 1990) similarly reported that there were significant increase between the frequency rate before and after education programme of gloves and protective eyewear use (p<0.025 & p<0.05 respectively)

(Kim et al., 2001) also reported significant increased use of protective eyewear and double gloving by surgical personnel in operating room following the educational intervention design to improve compliance with safe surgical practices.

After studying improved compliance rate for preoperative, operative, and postoperative safe surgical practices, anaesthesia related, infection control and surgical attire related safe surgical practices, and after combining results for all of them, as a whole, a significant improvement in compliance for safe surgical practices was found after training. It was observed that this compliance persisted after 3 months post-training also, but there was a little drop in compliance rate as compared to immediate post-training.

**Combined compliance rate** for all safe surgical practices before training was only 70.6%. After giving training on safe surgical practices for 4 weeks, compliance rate immediate post-training was 94.33% and 3 months post-training, it was 86.78%. Hence training caused significant difference in improving compliance to safe surgical practices (p<0.001).

There was marked impact of training on surgical safety compliance on O.T. technicians. Compliance was only 59.60% before training, it showed significant increase post-training to 90.89% (p<0.001). 3 months post-training compliance was 84.67%, it was significantly higher than pre-training level (p<0.001), but it slightly dropped as compared to immediate post-training level (p <0.001).

Also, among O.T. nurses higher compliance was seen immediate after training, it increased to 95.48% from pre-training level of 74.3% (p<0.001). 3 months post-training it persisted up to 87.48% and there is drop of 8% with respect to immediate post-training level. But, it was still higher than pre-training level.

It was also observed that the pre-training compliance among females was slightly higher as compared to males (73.30% vs 63.30%). Increase in compliance after training was statistically significant (p< 0.001) in both. Immediate post-training compliance in males and females were 92.29 & 95.08% respectively and after 3 months of training it persisted to 84.46% and 86.89% respectively.

**Similarly, (Friedland, Joffe, Wiley, Schapire, & Moore, 1992)** in their study found that after an educational programme compliance rate for less experienced staff nurses rose to 93% which was 70% before the programme. For more experienced staff nurses compliance rate rose to 93% which before programme was only 15%. But, after 5 months compliance rate declined to 50% which was at lower level as compared to immediate post education programme but still at a higher baseline level.

(Schwartz, Jacobs, & Juda, 1992) observed that after educational programme compliance rate for use of gloves was 61% as compared to 42% before the programme where as the use of goggles was 0% both before and after the programme, implementing that continuous education is necessary to increase the compliance

In **contrast** to present study, (Talan & Baraff, 1990) observed that there was no significant difference between mean overall correct response rate to questionnaire before and after education programme, which were 70% & 73% respectively (p=ns).

## CONCLUSIONS

It seems that training increases compliance of healthcare providers on safe surgical practices related to preoperative, operative, postoperative, anaesthesia related, surgical attire related and infection control related practices. It can also be concluded that with time, without continuous training compliance related to safe surgical practices decreases. So, sustainability of such educational interventional programmes should be ensured.

Larger multiple hospital based studies need to be done in this regard for better correlation of these findings. Better formulation of combating strategies, like continuous education/ regular training for uniform implementation of safe surgical practices.

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