

Effect of An Educational Guidelines on Compliance level Regarding Standard Precautions Measures among the Operating Room Nurses

Enas Ebrahem Elsayed Aboelfetoh¹ and Taghreed Talaat Shakweer²

- (1) Lecturer in Adult Health Nursing Department Faculty of Nursing, Helwan University, Egypt.
(2) Assistant professor in Adult Health Nursing Department Faculty of Nursing, Helwan University, Egypt.

Abstract

Background: The Operating Room (OR) is considered one of the high-risk areas in hospital that encounter high rate of infection and mortality. Standard precautions considered as barriers and work practice controls established to prevent sharp injuries and blood exposure. Aim: This study aims to assess the effect of an educational guideline on compliance level regarding standard precautions measures among the operating room nurses. **Research design:** A quasi-experimental design was used in this study. **Setting:** The present study was conducted at the operating room unit at El-Hussein University Hospital. **Subjects:** A convenience sample of all available nurses (40) who are working in operating room unit at El-Hussein University Hospital and accept to be in the study was selected as a study sample. **Data collection tools:** Nurses' structured self-administered questionnaire, nurses' compliance self-reported scale and nurses' practices observational checklist. **Results:** Regarding the total level of knowledge and practices regarding to infection control among operating room nurses the present study reported that all of the study nurses had unsatisfactory level of total knowledge and practices at pre educational guidelines implementation phase, while this level was improved at post and follow up phases. Regarding the total compliance level with standard precautions, the present study revealed that all of the study nurses had low level of total compliance pre educational guidelines implementation phase, while compliance level was improved at post and follow up phases. Regarding correlation between total level of knowledge, practice and compliance with standard precautions measures post educational guidelines implementation, the present study showed that there was highly positive correlation between total level of knowledge, practices and compliance with standard precautions measures among the operating room nurses post educational guidelines implementation. **Conclusion:** This study concluded that the educational guidelines for nurses' in the operating room was effective in improving their compliance level (knowledge, practices and self-reported compliance) regarding standard precaution measures, so the study results supporting the hypothesis of the present study. **Recommendation:** The importance of periodic in-service training program for nurses in OR regarding compliance standard precautions of infection control for continues updating their knowledge and focusing on areas of non-compliance and close supervision is needed to ensure that quality of care is provided by nurses while compliance standard precautions of infection control.

Keywords: educational guidelines, standard precautions, operating room nurses.

Introduction:

The operating room (OR) is considered one of the high-risk areas in hospitals with high infection and mortality rates. Therefore, the compliance

of health care workers (HCW) and the level of knowledge of the mechanism to reduce this risk, namely standard precautions (SPs), are very important and directly affect the safety of patients and HCW (Ganczak & Szych, 2017).

The Centers for Disease Control recommends standard precautions to reduce the risk of blood borne and other pathogens being spread by hospitals. Standard precautions combine the main features of universal precautions measures, which are designed to reduce the risk of spreading blood-borne pathogens and body fluids, and apply them to all patients receiving treatment in hospitals, regardless of their diagnosis or presumed infection status (**Damani, 2019**).

Standard precautions are an effective means of providing protection to medical staff and patients; but only if implemented systematically and comprehensively. Although SPs are easy to understand and implement, there is obvious reluctance among HCWs to fully comply with SPs. (**Donati et al., 2020**).

Standard precautions have been considered barriers and work practice controls have been established to prevent serious injuries and blood contact. Despite these precautions, the success in reducing the incidence of sharp injuries has been limited due to the reduction in selective compliance with SPs. The results of this study provide information on the degree of compliance of OR nurses to SPs and help to determine the areas of training and education. Also it can be useful to assess the compliance progress of OR nurses over time (**Rashmi & Kundapur, 2018**).

The occupational specificity of nursing staff includes direct and permanent care, continuous and frequent dealing with needles and other sharp objects, and daily contact with objects that may be contaminated, so nurses are most affected by occupational accidents and are exposed to potentially contaminated biological materials in the process of cleaning, disinfecting, sterilizing, and processing fecal

specimens and materials for laboratory testing (**Donati et al., 2019**).

Regarding standard precautions, the main reporting factor that has a negative impact on the level of compliance is the lack of understanding of standard precautions, knowledge and appropriate training among health workers (**Haile, Engeda& Abdo, 2017**).

Compliance is the level of precision and constancy in following prescribed standard protocols to achieve the desired outcomes. In addition, Compliance is the extent to which certain behavior is in accordance with the set instructions or health care advice. In this study compliance is the extent to which nurses practices are in accordance with CDC guidelines on infection prevention and control (**Esmail, Taha, & Hafez, 2019**).

Many factors can positively contribute to the application of standard precautions. This causes or forces nurses to follow standard precautions: nurses may be obliged to do so (as directed by supervisor), or may be concerned about the risk of infection for themselves or their family members because nurses have not taken the necessary precautions. Continuous reminders and continuous education on precautions measures are also regarded as important factors to improve compliance (**Powers, Armellion & Dolansky 2016**).

Significance of study

Healthcare-associated infections (HAIs) can be considered the most common adverse events in the provision of healthcare on a global scale. It is estimated that HAI occurs in more than 4 million patients in Europe and 1.7 million patients in the United States each year, and the prevalence is higher in developing countries. HAI is associated

with elongated hospital stays, higher mortality rates, higher health care costs, and the psychosocial and economic burdens of the individuals and their families and communities involved (Moralejo et al., 2018).

Also Ahmed (2014) found that the prevalence of needle stick and sharp injuries among nurses at Zagazig University Hospitals was 74.57%. The injuries resulting from percutaneous exposure to blood are estimated to result in 16,000 hepatitis C, 66,000 hepatitis B, and 200 to 5000 HIV infections. More than 90% of these infections are occurring in least developed countries and most are preventable.

Evidence shows that compliance with specific aspects of SPs are different, and practitioners are selective in the choice of recommended practices., so that it is important to evaluate the effect of an educational guidelines on compliance level regarding standard precautions measures among the operating room nurse (Damani, 2019).

Aim of the Study

This study aims to assess the effect of an educational guidelines on compliance level regarding standard precautions measures among the operating room nurses **through the following:**

1- Assessing the operating room nurses level of knowledge, practices and self-reported compliance regarding standard precautions.

2- Developing and implementing an educational guideline for operating room nurses regarding standard precautions.

3- Evaluating the effect of an educational guideline on compliance level

regarding standard precautions measures among the operating room nurses.

Research Hypothesis:

The current study hypothesized that, the educational guidelines will improve compliance level regarding standard precautions measures among the operating room nurses.

Subject and method

Research design:

A quasi experimental design was used in this study.

Study Setting:

The present study was conducted at the operating room unit at El-Hussein University Hospital. The operating room unit is located in the third and fourth floor of the hospital and containing six theaters for different types of surgery that done daily in a planned time among the week as (general surgery, cardiothoracic surgery, orthopedic surgery, neuro surgery, endoscopic surgery and urology surgery). There are two sinks with water tap at the unit one of them for hand washing and the second for washing the surgical instruments. Also the operating room unit containing recovery room with six beds that arranged and prepared for receiving the patients immediately post-operative. Also there are special places in the unit for nurses (for clothes and eating).

Sample:

A convenience sample of all available nurses (40) who are working in operating room unit at El-Hussein University Hospital and accept to be in the study was selected as a study sample.

Data collection tools:

Two tools were used to collect the data according to the following:

Tool I: Nurses' structured self-administered questionnaire:

This tool was designed and written in simple Arabic language by the investigators after reviewing relevant literature, **Hinkle, & Cheever (2018)** and **Ignatavicius, Workman& Rebar (2018)** agreed upon by a panel of medical surgical experts to assess nurses knowledge. It was divided into three major parts:

Part (1): To assess demographic characteristics of the operating room nurses included age, gender, educational qualifications, years of experience in the OR, training courses regarding standard precautions of infection control and numbers of this courses.

Part (2): To assess nurses' level of knowledge regarding infection (meaning, types, nosocomial infection, chain of infection, modes of transmission) that consist of 16 questions divided into:- 6 items true and false questions, 8 items multiple choice questions (MCQ) and 2 items completing questions.

Part (3): To assess nurses' level of knowledge regarding standard precautions of infection control in operating room it includes:- 21 questions: (7 items true and false questions and 14 main items each item have sub items of structured questions about standard precautions for infection control in the operating theater answered by checking yes or no for each sentence).

The scoring system for nurses' self-administered structured questionnaire:

Regarding nurses level of knowledge about infection control and standard infection control precautions in operating room. The correct response scored 1 (1=correct) and the incorrect response scored zero (0= incorrect) for each area of information. The total score of response was 104 point. According to statistical analysis, the level of knowledge considered satisfactory if the total score equal or more than 80% (equal 83 degree) and unsatisfactory if the total score less than 80% (less than 83 degree).

Tool II: Nurses' compliance self-reported scale:

This tool was adapted by the investigators from **Lam (2014)** to assess nurses' compliance regarding standard precautions. Compliance with Standard Precautions Scale (CSPS) is a 20-item scale that assesses the self-reported compliance with SPs. The scale is a meticulous review of the existing guidelines on universal precautions, SPs and existing instruments. (**Cruz et al., 2016**).

The scoring system for compliance self-reported scale:

The scale's items evaluate nurses' compliance with the use of PPE, disposal of sharps and wastes, decontamination of spills and used articles, and prevention of cross infection. The response set is a 3-point adjectival scale that consists of responses such as "never", "sometimes" and "always" with higher scores signifying high compliance with SPs. Items 2, 4, 6 and 15 are negatively stated; thus, scores are reversed before computations. According to statistical analysis, total score equal or more than 80% (equal or more than 16 degree) was high compliance and considered low compliance if the score of less than 80% (less than 16 degree).

Tool III: Nurses' practices observation checklist:

This checklist adopted by the investigators from **Damani (2019)** to assess nurses' practices regarding standard precautions (SP). It included a list of eight (SP) practices, to determine whether the practice was performed correctly or not correctly. Practices were observed and recorded by the investigator. It includes the following items:

(1) OR boots: Wearing OR boots and taking off OR boots (3steps).

(2) Surgical hand washing (15 steps)

(3) Headgear: putting headgear and removing headgear (2 steps).

(4) Surgical mask: Putting on surgical mask and removing surgical mask (5items).

(5) Goggles: Putting on goggles and removing goggles (2 steps).

(6) Surgical gown: Wearing and removing gown(7 steps).

(7) Surgical gloves: Donning and removing the gloves (10 steps).

(8) Handling sharp instruments: (6 steps)

The scoring system for observation checklist:

To assess the nurses' level of practice regarding standard precautions. The correct response scored 1 (Done =1) and incorrect response scored zero (Not done =0) the total score of response was 50 point. According to statistical analysis, total score equal or more than 80% (equal 40 degree) was high compliance and

considered low compliance if the score of less than 80% (less than 40 degree.)

The three tools were filled three times; the first time before the program implementation; the second time was immediately after the program implementation and the third time after 3 months later (follow up).

Validity and Reliability:

Testing validity of the tools was reviewed by a panel of five experts in the Medical Surgical Nursing faculty staff to ascertain their clarity, relevance, comprehensiveness, simplicity and applicability; minor modification was done. Testing reliability of proposed tools was done statistically by alpha Cronbach test. The reliability for these tools were 0.612 for Knowledge, compliance self-reported scale 0.73 for and 0.812 for practice that indicate high reliability of the used tool.

Research implementation

Administrative design

The necessary official approvals were obtained from the director of El-Hussien University Hospital for conducting the study.

Ethical Considerations and human rights

1.Explained the aim of the study to the hospital director to apply this study for nurses included in the study.

2.The researchers clarified the objective and aim of the study to the nurses included in the study.

3.The investigator assured maintaining anonymity and confidentiality of the subjects data.

4. The nurses were informed that they are allowed to choose to participate or withdraw from the study at any time.

5. The nurses were assured that the results of the study were not used for any performance evaluation.

Pilot study:

A pilot study was carried out on 10% of the total number of the study sample to test the applicability, clarity, and efficacy of the study tools. There was no modifications on tools were done, so that, the nurses who included in the pilot study were included in the main study group.

Field Work

The tools were developed by the researchers based on reviewing the recent and related literature. Data collections took about 6 months started from July until December 2019. The methods of teaching used were lecturing followed by focus group discussion in addition to audiovisual materials.

Three tools were used to assess compliance level regarding standard precautions measures among the operating room nurses. The educational guideline; a booklet in Arabic language, based on recent medical and surgical nursing knowledge derived from **Hinkle & Cheever (2018); Damani (2019) & Ignatavicius, Workman & Rebar (2018)**; it gives insight for nurses' work in operating room about standard precautions measures

Once the approval was taken to carry out the study, the researchers started to collect data and implement the educational guideline in the following way. Before the beginning of educational guidelines, the needs of the studied nurses should be assessed by the researchers

regarding their knowledge, compliance and practice regarding standard precautions measures in the operating room.

The observational checklist was used prior to administration of the questionnaire and compliance scale to ensure the maximal realistic observations of the nurses' performance and minimize the possibility of bias. The researchers observe nurses' practice of eight standard precautions practices, the observation took sometimes the whole shift or more than one shift to assess the nurses' practices regarding the standard precautions measures of infection control in operating room, without interrupting the sterility of the surgical field.

Nurses' structured self-administered questionnaire and self-reported compliance scale was filled by the nurses themselves during their free time before an educational guideline implementation to assess their demographic characteristics and their level of knowledge regarding infection, infection control in the operating room. Self-reported compliance scale used to evaluate nurses' compliance with the use of PPE, disposal of sharps and wastes, decontamination of spills and used articles, and prevention of cross infection. It took around 15-20 minutes for each nurse.

Then, the studied nurses receive an educational guidelines booklet regarding standard precautions measures in the operating room, which is illustrated and applicable by two researchers using (handout & power point).

The total number of the studied nurses' were 40 nurses; it was difficult to gather all the nurses at one time, so nurses were divided into six groups, each group about 6-7 nurses and the educational guidelines was implemented on 2-3 days

for each group separately in the suitable time for each one of them.

Educational guideline sessions were conducted by the researchers which are included 4 sessions (2 sessions for theoretical part and 2 sessions for the practical part). The sessions conducted in the morning and afternoon shift, at the end of surgical procedures. The study tools were filled 3 times pre the educational guidelines implementation; immediately post of the educational guideline implementation and post 3 months later (follow up).

Guidelines sessions:

❖ The first and second sessions of an educational guidelines were directed toward theoretical knowledge as the following:

• **The first session:** included an overview about the meaning of infection, nosocomial infection, chain of infection, factors enhancing transmission of infection, blood born disease, organism type that caused AIDS and hepatitis, the most susceptible person to blood-borne diseases in the operating room and sources of infection in the operating unit. It took about 45 min

• **The second session:** focused on knowledge about the standard precautions of infection control in operating room involving the following: sterilization in operating room, infection control in operating room including; When perform hand washing, Wearing gown, Using face mask and eye goggles, precautions with sharp disposal, Precautions with blood splash on mucous membrane, Precautions with needle puncture accidents, Handling of soiled linens, Precautions with blood sampling, Disposal of soiled non sharp wastes, Disposal of patients excretions, Disposal of single use instruments, Disinfection of non-disposable

instruments, Disinfection of soiled surfaces and Care of the unit environment. It took about 45 min.

❖ The third and fourth sessions of an educational guidelines were directed toward nurses' practice as the following:

• **The third session:** focused on nurses' practice regarding Standard Precaution measures in operating room including the following: OR Boots, Surgical Hand Washing, Headgear, Surgical mask, It took about 45 min.

• **The fourth session:** focused on nurses' practice regarding Standard Precaution measures in operating room including the following: Goggles, Surgical Gown, Surgical Gloves and Handling Sharp Instruments. It took about 45 min

The researchers were available in the morning and afternoon shift three days per week for four weeks in parallel. Nurses were handled the educational guideline booklet, with some explanations from the researchers regarding its importance. At the end of the educational guideline, its effectiveness was evaluated through assessing of nurses' knowledge, compliance and practice regarding standard precautions measures among the operating room.

Methods of teaching used were presentation; this method has greater possibility of tasks completed on time as well as a greater potential lesson to be executed as planned, Group discussion; this method of teaching has the greatest potential to build learner self-esteem and therefore enhance their performance and demonstration and re demonstration for practice. Media of teaching used were illustrated booklet and computer and board.

Statistical Analysis

Recorded data were analyzed using the Statistical Package for Social Sciences (SPSS), version 24 Quantitative data were expressed as mean and standard deviation (SD). Qualitative data were expressed as frequency and percentage. Friedman's test is a non-parametric test for finding differences in treatments across multiple attempts. Pearson's correlation coefficient (r) is a measure of the strength of the association between the two variables. P -value <0.05 was considered significant, and $P\leq0.001$ was considered as highly significant.

Results

Table (1) revealed that mean age of studied nurses was 31.5 ± 4.66 years, 80% of them were female and related educational level showed that 57.5% of studied nurses had nursing technical institute. Also, detected that only 20% of studied nurses attended training courses about standard precautions of infection control. Regarding years of experience, mean of experience at operation room was 6.42 ± 2.4 years, while mean of experience in nursing was 9.07 ± 3.7 years

Table (2) reported that there was highly statistically significant difference between nurses' level of knowledge about infection and infection control in the operating room at p value <0.01 . Regarding the total level of knowledge, only 32.5% of the studied nurses had satisfactory level of knowledge pre educational guidelines implementation, while 85% and 80% of them had satisfactory level of knowledge at post and follow up phases of the educational guidelines implementation

respectively with highly statistically significant difference at p value <0.01 .

Table (3) reported that there was highly statistically significant difference between satisfactory level of practice at pre, post and follow up phases of the educational guidelines implementation related to all procedures of standard precaution in the operating room at p value <0.01

Figure (1) reported that only 30% of the studied nurses had satisfactory level of practice at pre the educational guidelines implementation. While 92.5% and 87.5% of them had satisfactory level of practice at post and follow up phases of the educational guidelines implementation respectively

Table (4) reported that there was highly statistically significant difference between high level of compliance at pre, post and follow up phases of the educational guidelines implementation related to all items of compliance standard precaution scale at p value <0.01 . Figure (2) reported that only 35% of the studied nurses had high level of compliance at pre the educational guidelines implementation. While 87.50% and 82.50% of them had high level of compliance at post and follow up phases of the educational guidelines implementation respectively.

Table (5) showed that there was highly positive correlation between total level of knowledge, practice and compliance with standard precautions measures among the operating room nurses post educational guidelines implementation at p value <0.01 .

Table (1): Distribution of studied nurses related their demographic characteristics (n=40).

| Items | No | % |
|---|----|------|
| Age (years) | | |
| <30 | 14 | 35 |
| 30- <40 | 26 | 65 |
| Mean± SD 31.5±4.66 | | |
| Gender | | |
| Male | 8 | 20 |
| Female | 32 | 80 |
| Educational level | | |
| Bachelor of Nursing | 9 | 22.5 |
| Nursing Technical Institute | 23 | 57.5 |
| Nursing Diploma | 8 | 20 |
| Training courses about standard precautions of infection control | | |
| Yes | 8 | 20 |
| No | 32 | 80 |
| Years of experience in operating room | | |
| <5 | 22 | 55 |
| 5- <10 | 11 | 27.5 |
| 10 or more | 7 | 17.5 |
| Mean ± SD 6.42±2.4 | | |
| Years of experience in nursing | | |
| <5 | 7 | 17.5 |
| 5- <10 | 5 | 12.5 |
| 10 or more | 28 | 70 |
| Mean ± SD 9.07±3.7 | | |

Table (2): Comparison between total level of knowledge regarding to infection control among operating room nurses at pre, post and follow up phases of the educational guidelines implementation (n=40).

| Items | Pre | | Post | | Follow up | | Fri dma n test | P- va lu e |
|---|----------------------|------------------------|------------------|--------------------|------------------|--------------------|-------------------------|---------------------|
| | Satis facto ry | Unsat isfacto ry | Satisfac tory | Unsatisfac tory | Satisfac tory | Unsatisfac tory | | |
| | N (%) | N (%) | N (%) | N (%) | N (%) | N (%) | | |
| Knowledge about infection | 16 (40) | 24 (60) | 33 (82.5) | 7 (17.5) | 31 (77.5) | 9 (22.5) | 8.685 | .003* |
| knowledge about infection control in the operating room | 14 (35) | 26 (65) | 35 (87.5) | 5 (12.5) | 33 (82.5) | 7 (17.5) | 7.996 | .005* |
| Total knowledge | 13 (32.5) | 27 (67.5) | 34 (85) | 6 (15) | 32 (80) | 8 (20) | 8.410 | .004* |

*P ≤ 0.05 Significant, **P≤ 0.01 High Significant.

Table (3): Differences between level of practice regarding standard precautions measures among the operating room nurses at pre, post and follow up phases (n=40).

| Items | Pre | | Post | | Follow up | | Friedma n test | P value |
|-----------------------|--------------|----------------|--------------|----------------|--------------|----------------|-------------------|------------|
| | Satisfactory | Unsatisfactory | Satisfactory | Unsatisfactory | Satisfactory | Unsatisfactory | | |
| | N (%) | N (%) | N (%) | N (%) | N (%) | N (%) | | |
| Surgical Hand Washing | 4 (10) | 36 (90) | 30 (75) | 10 (25) | 28 (70) | 12 (30) | 8.991 | .005** |
| | 23 (57.5) | 17 (42.5) | 40 (100) | 0 (0) | 39 (97.5) | 1 (2.5) | 6.225 | .009** |
| | 18 (45) | 22 (55) | 38 (95) | 2 (5) | 37 (92.5) | 3 (7.5) | 6.481 | .009** |
| | 19 (47.5) | 21 (52.5) | 40 (100) | 0 (0) | 39 (97.5) | 1 (2.5) | 9.007 | .003** |
| | 0 (0) | 40 (100) | 25 (62.5) | 15 (37.5) | 24 (60) | 16 (40) | 10.136 | .000** |
| | 32 (80) | 8 (20) | 40 (100) | 0 (0) | 40 (100) | 0 (0) | 7.601 | .008** |
| | 33 (82.5) | 7 (17.5) | 39 (97.5) | 1 (2.5) | 40 (100) | 0 (0) | 6.900 | .008** |
| Handling Instruments | 17 (42.5) | 23 (57.5) | 38 (95) | 2 (5) | 36 (90) | 4 (10) | 10.741 | .000** |

*P ≤ 0.05 Significant, **P≤ 0.01 High Significant.



Figure (1) Percentage distribution of total level of practice regarding standard precautions measures among the operating room nurses at pre, post and follow up phases (n=40).

Table (4): Differences between level of compliance regarding standard precaution scale among the operating room nurses at pre, post and follow up phases (n=40).

| Items | Pre | | Post | | Follow up | | Fri dema n Test | p. valu e |
|--|------------------------|-----------------------|------------------------|-----------------------|------------------------|-----------------------|--------------------------|-----------------|
| | High compli ance | Low compli ance | High compli ance | Low compli ance | High compli ance | Low compli ance | | |
| I wash my hands between patient contacts | 6 (15) | 34 (85) | 33 (82.5) | 7 (17.5) | 29 (72.5) | 11 (27.5) | 14.256 | <0.01** |
| I only use water for hand washing | 21 (52.5) | 19 (47.5) | 39 (97.5) | 1 (2.5) | 38 (95) | 2 (5) | 10.150 | <0.01** |
| I use alcohol hand rubs as an alternative if my hands are not visibly soiled | 23 (57.5) | 17 (42.5) | 39 (97.5) | 1 (2.5) | 39 (97.5) | 1 (2.5) | 12.714 | <0.01** |
| I recap used needles after giving an injection | 19 (47.5) | 21 (52.5) | 40 (100) | 0 (0) | 39 (97.5) | 1 (2.5) | 10.899 | <0.01** |
| I put used sharp articles into sharps boxes | 26 (65) | 14 (35) | 40 (100) | 0 (0) | 36 (90) | 4 (10) | 11.007 | <0.01** |
| The sharps box is only disposed when it is full | 5 (12.5) | 35 (87.5) | 30 (75) | 10 (25) | 28 (70) | 12 (30) | 13.614 | <0.01** |
| I remove PPE in a designated area | 10 (25) | 30 (75) | 32 (80) | 8 (20) | 31 (77.5) | 9 (22.5) | 12.045 | <0.01** |
| I take a shower in case of extensive splashing even after I have put on PPE | 18 (45) | 22 (55) | 35 (87.5) | 5 (12.5) | 32 (80) | 8 (20) | 14.375 | <0.01** |
| I cover my wound(s) or lesion(s) with waterproof dressing before patient contacts | 7 (17.5) | 33 (82.5) | 34 (85) | 6 (15) | 33 (82.5) | 7 (17.5) | 13.056 | <0.01** |
| I wear gloves when I am exposed to body fluids, blood products, and any excretion of patients | 30 (75) | 10 (25) | 39 (97.5) | 1 (2.5) | 37 (92.5) | 3 (7.5) | 10.900 | <0.01** |
| I change gloves between each patient contact | 6 (15) | 34 (85) | 27 (67.5) | 13 (32.5) | 25 (62.5) | 15 (37.5) | 11.376 | <0.01** |
| I decontaminate my hands immediately after removal of gloves | 13 (32.5) | 27 (67.5) | 33 (82.5) | 7 (17.5) | 33 (82.5) | 7 (17.5) | 15.044 | <0.01** |
| I wear a surgical mask alone or in combination with goggles, face shield, and apron whenever there is a possibility of a splash or splatter | 20 (50) | 20 (50) | 35 (87.5) | 5 (12.5) | 34 (85) | 6 (15) | 12.634 | <0.01** |
| My mouth and nose are covered when I wear a mask | 28 (70) | 12 (30) | 37 (92.5) | 3 (7.5) | 37 (92.5) | 3 (7.5) | 13.177 | <0.01** |
| I reuse mask or disposable PPE | 35 (87.5) | 5 (12.5) | 39 (97.5) | 1 (2.5) | 39 (97.5) | 1 (2.5) | 15.006 | <0.01** |
| I wear a gown or apron when exposed to blood, body fluids, or any patient excretions | 20 (50) | 20 (50) | 35 (87.5) | 5 (12.5) | 34 (85) | 6 (15) | 12.476 | <0.01** |
| Waste contaminated with blood, body fluids, secretion, and excretion are placed in red plastic bags irrespective of patient's infective status | 20 (50) | 20 (50) | 37 (92.5) | 3 (7.5) | 35 (87.5) | 5 (12.5) | 13.038 | <0.01** |
| I decontaminate surfaces and equipment after use | 25 (62.5) | 15 (37.5) | 35 (87.5) | 5 (12.5) | 34 (85) | 6 (15) | 10.953 | <0.01** |
| I wear gloves to decontaminate used equipment with visible soils | 30 (75) | 10 (25) | 40 (100) | 0 (00) | 40 (100) | 0 (00) | 9.801 | <0.01** |
| I clean up spillage of blood or other body fluid immediately with disinfectants | 15 (37.5) | 25 (62.5) | 38 (95) | 2 (5) | 35 (87.5) | 5 (12.5) | 12.341 | <0.01** |

*P ≤ 0.05 Significant, **P ≤ 0.01 High Significant.

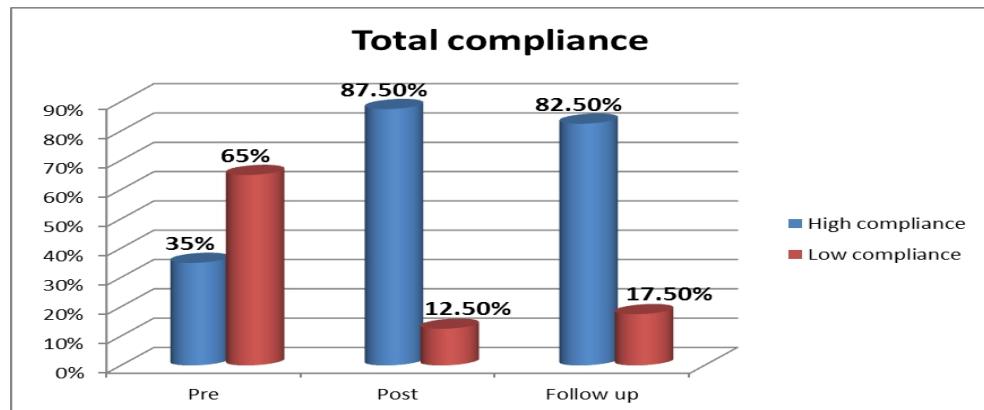


Figure (2) Percentage distribution of total level of compliance regarding standard precautions measures among the operating room nurses at pre, post and follow up phases (n=40).

Table (5) Correlation between total level of knowledge, practice and compliance with standard precautions measures among the operating room nurses post educational guidelines implementation

| | Total compliance | Total knowledge | Total practice |
|------------------|------------------|-----------------|-----------------|
| Total compliance | r. p | 0.741 .004** | 0.698 .005** |
| Total knowledge | r. p | 0.741 .004** | 0.802 .001** |
| Total practice | r. p | 0.698 .005** | 0.802 .001** |

*P ≤ 0.05 Significant, **P≤ 0.01 High Significant.

Discussion

Regarding the study nurses' characteristics, the results of the present study revealed that near two third of the study nurses' age were more than 30 years old, which might explain that nurses are aware enough to the nature of OR work. This finding is consistent with what was reported by **Batran, et al. (2018)** whose study entitled "Are standard precautions for hospital-acquired infection among nurses in public sector satisfactory?" who revealed that more than half of the studied nurses' age were more than 30-40 years old.

The finding of the current study revealed that, more than three quarter of nurses under the study were females. This may be due to the nursing profession in Egypt is predominantly made up of females. This finding also is in agreement with **Shaban, Ali & Mostafa (2019)** whose study entitled "Factors Affecting Compliance level Regarding Standard Precautions Measures among the Operating Room Nurses" who revealed that the majority of the study sample were female

Related educational level, the study finding showed that more than half of studied nurses had nursing technical institute. This might elaborate the current

condition of nursing qualification that, the nurses have a need to improve their educational level. This results are supported by **Awadalla, Garas & Hanafy (2019)** whose study entitled "Compliance with Standard Precautions Among Operating Room Nurses at a University Hospital, Egypt" who reported that the majority of the studied sample were diploma nurses.

Also, the study results revealed that, one fifth of studied nurses attended training courses about standard precautions of infection control. This may be related to work load, it is important for all nurses attend a training courses about standard precautions of infection control. This finding isn't in agreement with **Shaban, Ali & Mostafa (2019)** whose study results revealed that half of the studied nurses were received an infection control training courses.

Regarding years of nurses' experience in operating room, the present study revealed that more than half of the studied nurses had less than 5 years of experience. This finding is consistent with **Batran, et al.,(2018)** whose study reported that half of the studied nurses had less than 5 years of experience

As regards the level of knowledge regarding to infection control among operating room nurses at pre, post and follow up phases of the educational guidelines implementation, the results of the present study revealed that, there was highly statistically significant difference between nurses' level of knowledge about infection and infection control measures in the operating room. This could be attributed to the effectiveness of conducting the educational guideline. In a study conducted by **Koohsari et al. (2016)** whose study entitled "Assessing the Effect of Educational Intervention Based on Health Belief Model in Improving Standard Precautions Adherence to

Prevent Needle stick among Clinical Staff of Hospitals" who reported that similar results were obtained, showing that after standard precautions (SPs) education based on health beliefs model regarding infection control measures health care worker perceived susceptibility and severity increased.

Also the study result in the same line with **Donati et al. (2020)** whose study entitled " Effectiveness of implementing link nurses and audit and feedback to improve nurses' Compliance with Standard Precautions: A cluster randomised controlled trial" who reported that OR staff's understanding regarding the importance of controlling infectious diseases, severity of facing infectious hazards, and consequences of neglecting SPs improved.

Also, the results of the present study reported that all of the study nurses had unsatisfactory level of total knowledge at pre educational guidelines implementation phase which may be due to unavailability of posters and booklets and training courses, while the satisfactory level was improved post educational guidelines implementation, while this improvement lowered slightly in the follow up phase. This might be due to retention of knowledge with the time factor. This finding was in the same line with **Abd Elhamied et al. (2016)** whose study entitled "Impact of training education program on improving of nurses performance regarding infection control in endoscopy unit" who revealed that, nurses had a good level of knowledge regarding to infection control in endoscopy unit after educational program implementation.

Also, the result of the study is confirmed by **Mohseni et al. (2015)** whose study entitled "The Effect of an Educational Intervention Based on Health Belief Model on the Standard Precautions

among Medical Students of Rafsanjan University of Medical Sciences" who reported addressing infection prevention and control in the OR is a significant issue for maintaining and improving the health of patients and HCWs

Regarding level of practices with standard precautions measures among the operating room nurses at pre, post and follow up phases, the results of the present study reported that there was highly statistically significant difference between satisfactory level of practices at pre, post and follow up phases of the educational guidelines implementation related to all procedures of standard precaution in the operating room.

This result is in agreement with **Park & Byun (2020)** whose study entitled "Effects of self-efficacy, standard precaution knowledge, awareness on performance of nursing students" who revealed that, Awareness of standard precautions improves infection control performance of studied nurses related to all procedures of standard precaution, So they can provide leadership in reviewing and enhancing their organization's current disease containment and chemical incident response strategies.

Regarding total level of practice regarding standard precautions measures among the operating room nurses at pre, post and follow up phases, the results of the present study reported that all of the study nurses had low level of total practice pre educational guidelines implementation phase. While total level of practice was improved at post and follow up phases of educational guidelines implementation. This was due to the effectiveness of the educational guideline implementation.

This result is in the same line with **Lin, Wang, Luo, & Qin (2020)** whose study entitled " A management program

for preventing occupational blood-borne infectious exposure among operating" who revealed that, the level of nurses' practice regarding standard precaution was more significant in the group with greater knowledge that has implications for the control of hospital infections and exposure to accidents and diseases, so investment in training and practices related to SP are recommended.

Regarding the compliance level with standard precaution scale among the operating room nurses at pre, post and follow up phases, the present study revealed that there was highly statistically significant difference between high level of compliance at pre, post and follow up phases of the educational guidelines implementation related to all items of compliance standard precaution scale.

This result is in the same line with **Donati et al. (2020)** who reported that, at the post-test, nurses in the intervention group reported significantly increased Compliance with Standard Precaution Scale Italian version scores, whereas no significant improvement was found in the control group.

This result is consistent with **Abd Elhamied et al. (2016)** who reported that the compliance level of the studied nurses with the eight SPs was low at pre educational program implementation and this level improved after educational program implementation.

While, the previous result is contradicted with **Gholami et al. (2014)** whose study entitled "Hand-Washing Compliance Rate and the Influencing Factors" reported that the nurses' compliance rate with SPs was low, which has implications for their safety, patient protection and the care environment. Furthermore, OR nurses were selective in their compliance to certain measures of the precautions

Regarding the total compliance level with standard precautions scale among the operating room nurses at pre, post and follow up phases, the present study revealed that all of the study nurses had low level of total compliance pre educational guidelines implementation phase. This could be attributed to the lack of orientation program prior to work in operating room, unavailability guideline books and lack of in-service training courses. While compliance level was improved at post and follow up phases of educational guidelines implementation.

These finding were in agreement with **Porto (2016)** whose study entitled "Integrative Review Reasons and consequences of low adherence to standard precautions by the nursing team" who reported that intervention strategies carried out have shown high compliance by only focusing on the health care worker in the operating room. Also, **Osta et al. (2018)** whose study entitled "The Effect of Education Based on The Health Belief Model on Adherence to Standardized Precautions among Operating Room Staff" who reported that educational program can alter staff behavior regarding adherence to SPs.

These finding, in agreement with **Hassan (2018)** whose study entitled "Improving knowledge and compliance with infection control Standard Precautions among undergraduate nursing students in Jordan" who reported that the majority of nurses had low levels of compliance with standard precaution practices preprogram implementation with statistically significant improvement post program implementation.

While, the previous finding was inconsistent with **Porto (2016)** whose study results reported that the majority of nurses had good levels of compliance

with Standard Precaution practices during assessment phase of the research study.

Regarding correlation between total level of knowledge, practice and compliance with standard precautions measures among the operating room nurses post educational guidelines implementation, the present study showed that there was highly positive correlation between total level of knowledge, practice and compliance with standard precautions measures among the operating room nurses post educational guidelines implementation at p value <0.01. This might be due to that the educational guideline improved level of nurses' knowledge which affecting positively on their practice and compliance regarding standard precautions measures in operating room

This result was in the same line with **Osta et al. (2018)** who revealed that with educational intervention, OR staff's understanding regarding the significance of controlling infectious diseases, severity of facing infectious hazards, and consequences of neglecting SPs improved

The study result is supported by **Zhang et al. (2020)** whose study entitled " Hospital response to the COVID-19 outbreak: The experience in Shanghai, China" whose study results revealed that Education on infection control improves health professionals' adherence to standard precautions. For instance, teaching infection control in nursing education is valuable for preventing nosocomial infection and reducing the infection rate. As healthcare professionals, nurses worldwide are on the front lines in caring for infected patients.

This result is in the same line with **Lin, Wang, Luo, & Qin (2020)** who revealed that, low-scoring items for level of knowledge, practice and behaviour were identified in the baseline assessment,

while six months post-intervention, there were significant improvements in knowledge about safety precautions, preventive practice, and behaviour compliance with standard precautions.

This result isn't in the same line with **Kim & Kim (2017)**: whose study entitled "The effect of compliance knowledge and compliance support systems on information security compliance behavior" who revealed that adherence to SP differs according to the patient's disease. Knowledge on SP has little impact on adherence to these measures.

Conclusion

This study concluded that the educational guideline for nurses' in the operating room was effective in improving their compliance level (knowledge, practices and self-reported compliance) regarding standard precaution measures, so the study results supporting the hypothesis of the present study.

Recommendation:

1- The importance of periodic in-service training program for nurses in OR regarding compliance standard precautions of infection control for continues updating their knowledge and focusing on areas of non-compliance.

2- Close supervision is needed to ensure that quality of care is provided by nurses while compliance standard precautions of infection control.

3- Reminders for standard precautions practices should be placed in OR as wall charts.

Conflict of interest

There were no conflicts of interest.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article

References

Abd-Elhamid, A., El-khashab, M., Taha, N., & Saleh, M. (2016): Impact of training education program on improving of nurses performance regarding infection control in endoscopy unit. Afro-Egyptian journal of Infectious and Endemic Diseases, 6(1):p16-28.

Ahmed, A.S.,(2014): Needle stick injuries among nurses at zagazig university hospitals, Sharkia governorate Egypt: Middle east journal of applied Sciences; 2014, 4(4):1205-1211

Awadalla B., Garas A. & Hanafy N. (2019): Compliance with Standard Precautions Among Operating Room Nurses at a University Hospital, Egypt, American Journal of Biomedical science& Research, Volume 3 - Issue 3 DOI: 10.34297/AJBSR.2019.03.000676

Batran, A., Ayed, A., Salameh, B., Ayoub, M., & Fasfous, A. (2018): Are standard precautions for hospital-acquired infection among nurses in public sector satisfactory?. Archives of Medicine and Health Sciences, 6(2):p 223.

- Cruz, J. P., Colet, P. C., Al-otaibi, J. H., Soriano, S. S., Cacho, G. M., & Cruz, C. P. (2016):** Validity and reliability assessment of the Compliance with Standard Precautions Scale Arabic version in Saudi nursing students. *Journal of Infection and Public Health*, 9(5), 645-653.
- Damani, N. (2019):** Manual of Infection Prevention and Control 4th edition. Oxford University Press, Oxford, p128-138.
- Donati D., Biagioli V., Cianfrocca C., De Marinis M. & Tartaglini D. (2019):** Compliance with Standard Precautions among Clinical Nurses. *Int J Environ Res Public Health*. 2019 Jan 4;16(1):121. doi: 10.3390/ijerph16010121. PMID: 30621210 Available at: <https://pubmed.ncbi.nlm.nih.gov/30621210/> Accessed date January 2020
- Donati D., Miccoli G., Cianfrocca C., Di Stasio E., De Marinis M. & Tartaglini D. (2020):** Effectiveness of implementing link nurses and audit and feedback to improve nurses' Compliance with Standard Precautions: A cluster randomised controlled trial. *Am J Infect Control*;48(10):1204-1210.
- Esmail R., Taha N., & Hafez G (2019):** Factors Influencing Nurses' Compliance with Standard Precautions Regarding Occupational Exposures to Blood and Body Fluids, *Zagazig Nursing Journa*, July; Vol.15, No.2, P.119 Available at: <https://znj.journals.ekb.eg/article/Accessed date: 1-2021>
- Ganczak Z. & Szych (2017):** "Surgical nurses and compliance with personal protective equipment" *Journal of Hospital Infection*, vol. 66, no. 4, pp 346-35
- Gholami F.M., Rahmati N. F., Aghamiri Z & Mohamadian M. (2014):** Hand-Washing Compliance Rate and the Influencing Factors. *Arch Clin Infect Dis.*;9(4)]. doi: 10.5812/archcid.17316.
- Haile, T. G., Engeda, E. H., & Abdo, A. A. (2017):** Compliance with standard precautions and associated factors among healthcare workers in Gondar University Comprehensive Specialized Hospital, Northwest Ethiopia. *Journal of Environmental and Public Health*, 2050635. <https://doi.org/10.1155/2017/2050635>.
- Hassan, Z. M. (2018):** Improving knowledge and compliance with infection control Standard Precautions among undergraduate nursing students in Jordan. *American journal of infection control*, 46(3), p297-302.
- Hinkle, J. L., & Cheever, K. H. (2020):** Brunner and Suddarth's Textbook of Medical Surgical Nursing, infection control strategies in the operating room (14thed.). PP. 443-447; 2122-2125
- Hinkle, J.L., & Cheever, K.H., (2018),:** Brunner & Suddarth's Textbook of Medical-Surgical Nursing, Infection Control Strategies 14th ed., Philadelphia, Wolters Kluwer,, p. 1373
- <http://dx.doi.org/10.1590/1983-1447.2016.02.57395>
- <https://pubmed.ncbi.nlm.nih.gov/32178856/>
- <https://www.ijcmph.com/index.php/ijcmp/h/issue/view/34>

Ignatavicius DD, Workman ML & Rebar CF,(2018): Medical-Surgical Nursing: Concepts for Interprofessional Collaborative Care. Patient safety and infection control measures 9th ed. St. Louis, MO: Elsevier; p. 1053

Kim SS.& Kim YJ. (2017): The effect of compliance knowledge and compliance support systems on information security compliance behavior. *Journal of Knowledge Management* 21(4):986-1010

DOI: 10.1108/JKM-08-2016-0353

Koohsari M., Mohebbi B., Sadeghi R., Tol A. & Rahimi FA. (2016): Assessing the Effect of Educational Intervention Based on Health Belief Model in Improving Standard Precautions Adherence to Prevent Needlestick among Clinical Staff of Hospitals. *J Hospital.*;15(4):49-57

Lam, S. C. (2014): Validation and cross-cultural pilot testing of compliance with standard precautions scale: Self-administered instrument for clinical nurses. *Infection Control & Hospital Epidemiology*, 35, 547-555. Available at: <https://doi.org/10.1086/675835>

Lin H, Wang X., Luo X. & Qin Z. (2020): A management program for preventing occupational blood-borne infectious exposure among operating room nurses, *The journal of international medical research*, Jan;48(1) doi: 10.1177/0300060519895670.

Mohseni M., Mahbobi M., Sayadi AR., Shabani Z. & Asadpour M. (2015): The Effect of an Educational Intervention Based on Health Belief Model on the Standard Precautions among Medical Students of Rafsanjan University of Medical Sciences. *Res Med Educ.*;7(1):63-72. doi: 10.18869/acadpub.rme.7.1.63

Moralejo D., El Dib R., Prata R.A., Barretti P. & Corrêa I (2018):

Improving adherence to Standard Precautions for the control of health care-associated infections. *Cochrane Database Syst.Rev.*;2:CD010768. doi: 10.1002/14651858.CD010768.pub2.

Osta A., Vasli P., Hosseini M., Nasiri M.& Rohani C. (2018): The Effect of Education Based on The Health Belief Model on Adherence to Standardized Precautions among Operating Room Staff, Iran Red Crescent Med J. 20(S1):e60112. doi:10.5812/ircmj.60112.

Park S.H.& Byun E.K. (2020): Effects of self-efficacy, standard precaution knowledge, awareness on performance of nursing students. *J. Korea Acad. Ind. Coop. Soc.*;21:127-135. doi:10.5762/KAIS.2020.21.7.127.

Porto A. (2016): Integrative Review Reasons and consequences of low adherence to standard precautions by the nursing team. *Epub, Revista Gaúcha de Enfermagem journal* vol.37 no.2

Powers D., Armellion D. & Dolansky M. (2016): Factors influencing nurse compliance with Standard Precautions 2016 *American Journal of Infection Control* 44(1):4-7 <https://www.researchgate.net/publication/289490407>

Rashmi A. & Kundapur R. (2018): Factors influencing observation of standard precautions among nursing staff in tertiary care setting in Mangalore, *International Journal of Community Medicine and Public Health*, Vol 5, No 1 (2018)

Shaban M, Ali Z. & Mostafa H. (2019): Factors Affecting Compliance level Regarding Standard Precautions Measures among the Operating Room Nurses, published Master thesis, Helwan University.

Zhang Y., Sun Z., Latour J.M., Hu B. & Qian J. (2020): Hospital response to the COVID-19 outbreak: The experience in Shanghai, China. *J. Adv. Nurs.*;76: 1483-1485. doi: 10.1111/jan.14364.