# Effect of a Training Program on Nurses' Knowledge and Performance Regarding Infection Control Standard Precautions at M.C.H. Center in Rural Area

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**Abstract:** Standard precautions formerly known as universal precautions underpin routine safe practice protecting both staff and clients from infection by applying standard precautions at all times and to all patients. This study aimed to evaluate the effect of a training program on nurses' knowledge and performance regarding standard precautions in M.C.H center. A quasi-experimental research was used to conduct this study. The study was conducted at the mother and child health center(M.C.H) affiliated to the ministry of health and population at El-Fayoum village (Sanoras). A purposeful sample was included 35 nurses who were working in M.C. Hcenter after receiving their consents for participation in the research. Two tools were used to achieve the objective of the study: ***Tool I:*** An interview questionnaire was developed and used by the researchers as a tool for data collection. The questionnaire consisted of two parts: ***The first part:*** Is concerned with: The demographic characteristics of nurses. ***The second part*****:** A pre and post test questionnaire was used to collect the nurses' knowledge regarding standard precautions. ***Tool II*****:** An observational checklist sheet was used to record performance of the nurses regarding application of standard precautions. Majority of the studied nurses experienced deficit in their knowledge and performance regarding infection control standard precautions which is mainly related to not being used to do it and this deficit was corrected after implementation of the training program. It was concluded that training program regarding infection control standard precautions was effective in improving nurses' knowledge and performance in M.C.H center with highly statically significant differences in all tested items between pre/post program implementation( P< 0.001). It was recommended that establishment of a training program for nurses and health team members working in M.C.H centers with continuous supervision, assessment and evaluation of nurses performance related to infection control measures to improve the quality of care given in relation to prevention and control of infection in M.C.H centers.

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**Keywords:** Infection control, standard precautions, nurses' knowledge – performance, nurses training program.

## 1. Introduction

Infections acquired in the health care setting have emerged as an important public health problem worldwide and are a leading cause of morbidity and mortality in developing countries; they contribute significantly to increased costs of health care services due to prolonged hospital stay. During the past 10 years, health care delivery in Egypt has undergone enormous changes with rapid advances in technology and increasing numbers of staff performing complex invasive procedures **(Wong etal, 2015)**. These diagnostic and therapeutic technologic advances modernize health care, but also place patients at increasing risk for health care related problems. So a national plan for infection control was established with realistic goals of improving quality of health care by preventing disease transmission **(World Health Organization, 2014).**

Planning outcomes that prevent infection or interfere with the infection cycle is an exciting challenge and an opportunity to see positive results and prevent gaining infections, using standard precautions techniques which include hand washing, using personal protective equipment, cleaning, disinfect and sterilization of the medical equipment, environmental cleaning, respiratory hygiene and cough etiquette, linen and waste management with safe sharp disposal are nurses' responsibilities to control and prevent infection in health care setting**(Amoran & Onwube,2013).**

Also, **Marcus, (2015)**, mentioned that standard precautions are a set of precautions designed to prevent transmission of human immunodeficiency virus (HIV), hepatitis B virus (HBV), and other blood borne pathogens when providing first aid or health care. They are the basic levels of infection control precautions which are to be used as a minimum in the

care of all patients, and the quality of nursing care depends on a large degree on knowledge and performance of the practicing nursing staff.

According to **Kermode, et al (2014)**, standard precautions are clinical practice recommendations to help minimize the risk of exposure to infections materials, such as blood and other body fluids by both clients and staff, help break the disease transmission cycle at the mode of transmission step and prevent the transmission of bacteria and viruses from patient to patient. The primary aim of a standard precaution training program, whether in the community or hospitals is to prevent people from acquiring avoidable infection. Achieving this aim requires the willingness of all health care staff to maintain the highest possible standard of clinical practice and follow standard precaution principles. Unfortunately, there are even today, some methods used to control infection which are based on tradition but which have little effect on cross infection rates **(Griffiths &Ward, 2015).**

Effective nursing training program can control and prevent infection; the nurse reviews the assessment data, considers the cycle of events that result in the development of an infection, and incorporate principles of infection control while formulating patient outcomes **(Kotwal & Taneja, 2014).**

The severe physical, financial, emotional and psychological consequences of accidental exposure development of an effective program to minimize their incidence, so effective training is essential to ensure that these concepts are understood and put into practice wherever health care is provided. Nursing staff must be educated in the basic principles of infection control and acquire new knowledge and skills because the quality of nursing care depends to a large degree on the knowledge, skills, and activities of the practicing nursing staff. **(Sreedharan et al, 2015).**

**Significance of the study**

Health care professionals and particularly nurses are often exposed to microorganisms, many of which can cause serious or even lethal infections. In 2015, the Centers for Disease Control and Prevention (CDC)issued the standard precautions but unfortunately, despite the simplicity and clarity of these guidelines, compliance among nurses is reported low. Although high incidence of exposure to microorganisms is observed among all nurses who are more highly exposed. Also, the risk of healthcare-associated infections (HCAIs) in developing countries can exceed 25% compared to developed countries. Lack of awareness and institutional framework to deal with patient safety in general and HCAI in particular perpetuate the culture of acceptance of avoidable risks as inevitable. Most HCAIs are avoidable and can be prevented by relatively simple means. Health care workers are at a high risk of needle stick injury and blood borne pathogens. **(Simard etal, 2015)**.Therefore nurse's awareness of infection control, the factors that affect nurses' compliance with standard precautions and their motivation toward its application is highly needed.

**Aim of the study**

This study aim to evaluate the effect of a training program on nurses' knowledge and performance regarding infection control standard precautions at M.C.H centers in rural area through:

1) Assessing the nurses' knowledge regarding standard precautions at M.C.H centers.
2) Assessing the nurses' performance regarding standard precautions at M.C.H centers.
3) Assessing the nurses' response regarding factors affecting application of standard precautions.
4) Implementing the training program to evaluate nurses' knowledge and performance regarding standard precautions at M.C.H centers.

**Research hypothesis**

A training program regarding infection control standard precautions at M.C.H centers will improve nurses' knowledge and performance.

**2. Subjects and methods**

**Research design:**

A quasi- experimental design was used to explore the effect of a training program for improving the nurses' knowledge and performance towards infection control standard precautions at M.C.H centers in rural areas.

**Setting of the study**

The study was conducted at maternal and child health center (M.C.H) center affiliated to the ministry of health of the rural area in El-Fayoum village (Sanors).

**Sample**

A purposeful sample includes35 nurses working in mother and child health center (all nurses working in M.C.H),were included in the study at the time of the research conduction with no control group, aged from 20- 40 years, providing direct care to clients.

**Tools**

Two tools were used to achieve the aim of the study:

***Tool I:*** An interview questionnaire was developed and used by the researcher as a tool for data collection. A questionnaire consisted of two parts:

***The first part:*** Is concerned with, the demographic characteristics of the nurses' which includes (age, sex, marital status, education level, years of experience, previous attendance of infection control standard

precautions training, presence of standard precautions guideline in the unit and M.C.H center application of standard precautions.

***The second part*:**

A pre and posttest questionnaire was used to assess the nurses' knowledge regarding standard precautions. It includes the following: Definition of standard precautions, elements of standard precautions, hand washing (the indications of hand washing & the ideal duration of hand washing), gloving and face shield, and importance of standard precautions.

***Tool II*:**

An observational checklist sheet was used to evaluate the nurse's performance regarding proper application of standard precautions.

**Scoring system:**

Scoring system related to nurses knowledge and performance: The respondent was given one point for each correct answer and (0) for incorrect answer. The total knowledge score was 105 points and performance was calculated to be (150) points. It was divided as follows: poor <50%, Average 50-60 %, Good > 65% the total score. The collected data was organized, tabulated and statistically analyzed using SPSS software statistical computer package version 17.

**Procedure**

**Approval to conduct the study:**

An official letter was sent to the director of MCH center to facilitate the research implementation.

**Period of study:**

Data were collected over a period of six months from the beginning of October 2014 till the end of March 2015.

**Validity and reliability**

**Content validity of tools:**

The tool was modified by the researchers and test for its content was done by five experts from the community health nursing and medical surgical of faculty of nursing staff, Ain Shams and Cairo University and the required modifications were done.

**Content reliability of tools:**

The reliability of the tools was estimated using SPSS software statistical computer package version 17. The reliability of the tools was 0.89.

**Operational design**

**Pilot study**

A pilot study was carried out on 10% of the sample that were chosen randomly from the MCH enter of the pre mentioned setting in order to test the applicability and clarity of the tools, and the time required to complete all questions using an interviewing questionnaire as a pre- test sheet. those who shared in the pilot study were excluded from the main study sample.

**Field work**

Review of current and past available literature and theoretical knowledge was done, using books articles and magazines to develop the tools for data collection it takes about one month.

Both the questionnaire and the check list were drafted in a structured format and they were used in a pilot test before being applied to the nurses who were enrolled in this study.

The researcher was attending the maternal and child health of the pre mentioned setting, by using a time schedule, 3 days/week, Saturday, Monday & Wednesday) during day time, 9 am to 1 pm.

Data collection was carried out in a period of six month until the sample size was attained. The program was designed to evaluate the nurses' knowledge and performance through simplified sessions presented in Arabic language.

**Ethical consideration**

An official approval letter was taken from the Dean of the Faculty of Nursing to the general manager of the selected maternal and child health center in order to conduct this study. Also, a written consent was designed in order to take the acceptance for the nurse to be engaged in the training program, they were given the opportunity to refuse to participate.

**Nursing training program in M.C.H center**

**Time allocated:**

A program was applied in six sessions, (6) hours for total sessions, (2 hours for theory and 4 hours for practices). The sessions were implemented every week in a special classroom in the pre mentioned setting for an hour for each session over a period of three weeks and each session contained ( 35 nurses). Then data were collected twice after 2 weeks (post test) in order to identify differences, similarities and areas of improvements as well as defects.

The researchers shared on observed the nurses in all the procedure; the nurses were encouraged to participate actively in group discussion through listening to each other and providing feedback.

**Program description:**

**Preparatory phase:**

**Human rights consent:**

The researchers established with the nurses the purpose and benefits of the program. The agreement for participation of the subjects was taken as will aim of the study was explained to the nurses.

**Planning phase:**

- Determine of learning objectives of the program.
- Determine of learning contents of the program.
- Selection of the teaching methods as lecture, discussion, role play, demonstration, re-demonstration.

- Educational media as lap top, power point, video and written materials and pictures are provided as mechanism to gain knowledge and facilitate practice.
- Determine for assessment materials related to study tools.

**Implementation phase:**

Through group discussion, the researchers discuss with nurses the following items:

Content included:

- Infection and its seriousness
- Causes of spread infection in health care setting
- Infection modes of transmission
- The benefits of infection control
- Definition of standard precautions
- Importance of standard precautions
- Elements of standard precautions.
- Standard precautions application

**Performance included:**

Hand hygiene, gloves, facial protection, and gown, prevention of needle, respiratory hygiene, environmental cleaning, handles linens, waste disposal and patient care equipment.

**Evaluation phase:**

Assessment of the effectiveness of the pre/post phases of the program on improving nurse's knowledge and performance.

**Statistical analysis**

The collected data were organized, categorized, tabulated and analyzed. Data were presented in tables and charts using numbers and percentage, statistics and associations were done using mean, standard deviation SD, t-test and p-value, significant of result, no significant if $p< 0.05$ and highly significant if $p<0.001$.

## 3. Results

**Table (1):** Shows that the majority of the study samples (54.28 %) were more than 30 years and females, also (85.7%) were married. As regard to level of education, the majorities (91.4%) were graduates of technical secondary school of nursing and the rest of the studied nurses were either graduates of technical health institute (2.9%), Regarding the previous attendance of infection control standard precautions training, only (28.6%) of the nurses attended training courses, while most of them (71.4%) had attended conferences for infection control standard precautions.

**Table (2):** Shows that (97.1%) of the study sample had satisfactory knowledge regarding infection and its seriousness in health care setting post training program in relation to (31.4%) pre program. The percentage of the studied nurses (94.3%) had satisfactory knowledge regarding infection modes of transmission and the benefits of infection control post training program than (57.1) pre program. As regard to elements of standard precaution (97.1%) of the nurses had satisfactory knowledge, while the small percentages of nurses (2.95%) had unsatisfactory knowledge post training program.

**Table (3):** Shows that the majority (97.1%) of the nurses reported that deficiency of the MCH center financial resources, allowance and supplies. While (65.7%) of the study nurses agreed about the effect of low nurses' salary and reward. As regard to the work overload, most of the nurses reported the following factors: Shortage of nurses and increase the number of patients (82.9%), increase the work overload (80%), and increase the patient/ nurse ratio (77.1%).

**Table (1): Distribution of the studied sample of nurses at M.C.H centers according to their socio-demographic characteristics (n=35).**

| *Characteristics* | *N* | *%* |
|---|---|---|
| ***Age in years*** | | |
| 20+ | 3 | 8.6 |
| 30+ | 19 | 54.3 |
| 40+ | 13 | 37.1 |
| Mean= 36.286_+ 6.2 range=20-45 | | |
| ***Sex*** | 16 | 45.7 |
| Male | 19 | 54.3 |
| Female | | |
| ***Marital status*** | | |
| Married | 30 | 85.7 |
| Single | 4 | 11.5 |
| Widow | 1 | 2.8 |
| ***Educational level*** | | |
| Technical secondary schools | 32 | 91.4 |
| Technical health institute. | 1 | 2.8 |
| Bachelor | 2 | 5.8 |
| ***Years of experience*** | | |
| <5 | 5 | 14.3 |
| 5+ | 4 | 11.4 |
| 10+ | 26 | 74.3 |
| Mean= 15.257+_ 7.38 range= 3-25. | | |
| **Previous attendance of infection control standard precautions training:** | | |
| Training courses | 10 | 28.6 |
| Conferences | 25 | 71.4 |
| **Presence of infection control standard precautions guideline in the unit:** | 2 | 5.7 |
| Presence of notes | 30 | 85.7 |
| Presence of administrative rules | 3 | 8.6 |
| Not present | | |
| **M.C.H application to infection control standard precautions** | 4 | 11.4 |
| No | 31 | 88.6 |
| Yes | | |

**Table (2): Distribution of the nurses according to their Knowledge regarding infection control standard precautions pre/post training program.(n=35).**

| *Items* | *Pre program* | | *Post program* | | χ2 | P-value |
|---|---|---|---|---|---|---|
| | *Satisfactory knowledge N/%* | *Unsatisfactory Knowledge N/%* | *Satisfactory knowledge N/%* | *Unsatisfactory Knowledge N/%* | | |
| Infection and its seriousness | 24<br>68.6% | 11<br>31.4% | 34<br>97.1% | 1<br>2.95 | 10.058 | 0.0015*<br>(S) |
| Causes of spread infection in health care setting. | 12<br>34.3% | 23<br>65.7% | 31<br>88.6% | 4<br>11.4% | 21.766 | < 0.0001**<br>(HS) |
| Infection modes of transmission. | 15<br>42.9% | 20<br>57.1% | 33<br>94.3% | 2<br>5.7% | 21.477 | < 0.0001**<br>(HS) |
| The benefits of infection control. | 15<br>42.9% | 20<br>57.1% | 29<br>82.9% | 6<br>17.1% | 11.993 | 0.0005*<br>(S) |
| Means of infection control application | 10<br>28.6% | 25<br>71.4% | 30<br>85.7% | 5<br>14.3% | 23.333 | < 0.0001**<br>(HS) |
| Standard precautions definition. | 31<br>88.6% | 4<br>11.4% | 35<br>100.0% | 0<br>0.0% | 4.242 | 0.0394*<br>(S) |
| Importance of standard precautions. | 32<br>91.4% | 3<br>8.6% | 35<br>100.0% | 0<br>0.0% | 3.134 | 0.0767<br>(NS) |
| Standard precautions application. | 34<br>97.1% | 1<br>2.9% | 35<br>100.0% | 0<br>0.0% | 1.0145 | 0.3138<br>(NS) |
| List elements of standard precautions. | 28<br>80.0% | 7<br>20.0% | 34<br>97.1% | 1<br>2.95 | 5.0806 | 0.0242*<br>(S) |

*(NS )not significant* **(S) significant* ***(HS) highly significant*

**Table (3): Distribution as perceived by nurses regarding factors affecting application of standard precautions. (n=35)**

| Item | Agree<br>N % | |
|---|---|---|
| Financial and administrative factors | | |
| Decrease the MCH financial resources | 34 | 97.1 |
| Decrease in allowance and supplies | 34 | 97.1 |
| Low nurse's salary and reward. | 23 | 65.7 |
| Awareness and education of the nurses. | | |
| Lake of the nurse's knowledge and awareness. | 30 | 85.7 |
| Infection control is not important. | 30 | 85.7 |
| Lake of good supervision. | 29 | 82.9 |
| Believing that infection occurrence in God's welling. | 23 | 65.7 |
| Social and psychological. | | |
| Presence of patient's relatives and visitors. | 17 | 48.6 |
| Social problem affect the performance of nurses. | 17 | 48.6 |
| Bad relationship between nurses. | 25 | 71.4 |
| Lack of job satisfaction in MCH. | 25 | 71.4 |
| Work over load | | |
| Decrease the numbers of nurses in center | 29 | 82.9 |
| Increase the work over load. | 28 | 80.0 |
| Increase the patient / nurse ratio | 27 | 77.1 |
| Increase the number of patients. | 29 | 82.9 |

**Table (4)**: **Distribution of the nurses according to their total Knowledge score regarding the infection control standard precautions pre/post training program at MCH centers(n=35).**

| *Total nurses' Knowledge* | *Pre program* | | *Post program* | | χ2 | P-value |
|---|---|---|---|---|---|---|
| | *N* | *%* | *N* | *%* | 38.101 | < 0.0001**<br>***(HS)*** |
| ***poor*** | 24 | 68.6 | 2 | 5.7 | | |
| ***Average*** | 8 | 22.8 | 6 | 17.1 | | |
| ***Good*** | 3 | 8.6 | 27 | 77.2 | | |
| ***Total*** | 35 | 100.0 | 35 | 100.0 | | |

***(HS) highly significant*

**Figure (1): Distribution of the nurses according to their total Knowledge score regarding the infection control standard precaution pre/post training program in MCH centers(n=35).**

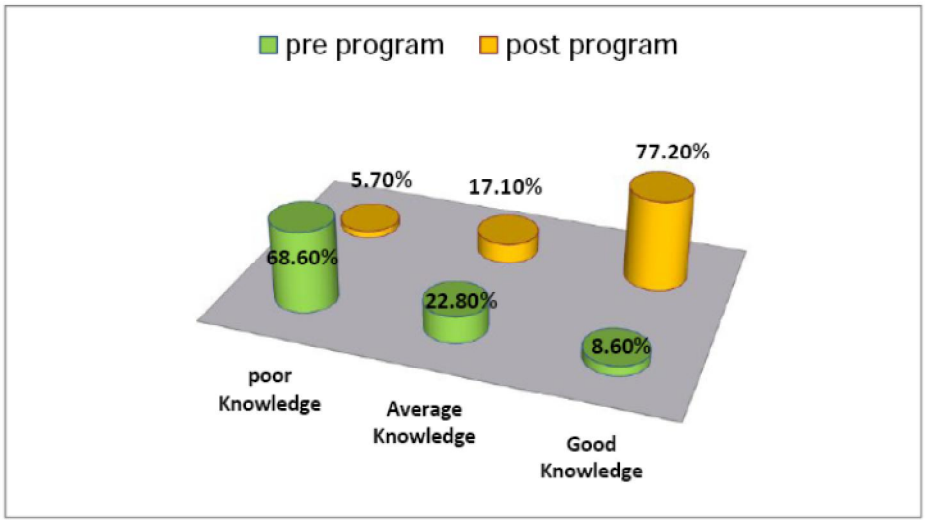



***Figure (1)***: Shows that the majority of the study nurses had poor knowledge (68.60 %) pre program while they had good knowledge (77.20%) post program.

**Table (5):** Shows that the majority of the study sample (94.3%) had satisfactory performance regarding hand hygiene, also (100%) of the nurses wash the equipment properly with water and change linen daily post training program**,** while the nurses had unsatisfactory performance regarding hand hygiene ( 25.7%), Respiratory hygiene and cough etiquette (11.4%)**,** handle Linens. (2.9%) pre program.

**Table (5): Distribution of the nurses according to their performance regarding the infection control standard precautions pre/post program (n=35).**

| *Items* | *Pre program* | | *Post program* | | $\chi 2$ | P-value |
|---|---|---|---|---|---|---|
| | *Satisfactory performance N/%* | *Unsatisfactory performance N/%* | *Satisfactory performance N/%* | *Unsatisfactory performance N/%* | | |
| Hand hygiene | 26<br>74.3% | 9<br>25.7% | 33<br>94.3% | 2<br>5.7% | 5.285 | **0.0215* (S)** |
| Gloves | 10<br>34.3% | 25<br>65.7% | 31<br>88.6% | 4<br>11.4% | 25.963 | **< 0.0001** (HS)** |
| Facial protection (eyes, nose, and mouth) | 16<br>45.7% | 19<br>54.3% | 30<br>85.7% | 5<br>14.3% | 12.428 | **0.0004* (S)** |
| Gown | 15<br>42.9% | 20<br>57.1% | 29<br>82.95 | 6<br>17.15 | 11.993 | **0.0005* (S)** |
| Prevention of needle stick injuries | 10<br>28.6% | 25<br>71.4% | 32<br>91.4% | 3<br>8.6% | 28.810 | **< 0.0001** (HS)** |
| Respiratory hygiene and cough etiquette | 25<br>88.6% | 10<br>11.4% | 35<br>100.0% | 0<br>0.0% | 11.667 | **0.0006* (S)** |
| Environmental cleaning | 27<br>91.4% | 8<br>8.6% | 35<br>100.0% | 0<br>0.0% | 9.032 | **0.0027* (S)** |
| Handle Linens | 29<br>97.1% | 6<br>2.9% | 33<br>94.3% | 2<br>5.7% | 2.258 | **0.1329 (NS)** |
| Waste disposal | 28<br>80.0% | 7<br>20.0% | 34<br>97.1% | 1<br>2.9% | 5.081 | **0.0242* (S)** |
| Patient care equipment | 19<br>54.3% | 16<br>45.7% | 31<br>88.6% | 4<br>11.4% | 10.08 | **0.0015* (S)** |

*(NS)notsignificant *(S) significant **(HS) highly significant*

**Table (6):** Shows that the majority of the nurses (94.3%) were being careful when handling sharps and dispose the used needle in safety box, also (100%) all nurses send the equipment for sterilization post training program**.**

**Table 7:** Shows that the majority of the study nurses had poor performance score regarding the infection control standard precautions pre program (68.60%) while the majority of them (77.20%) had good performance post program.

**Table (6): Distribution of the nurses according to their adequate performance regarding prevention of needle sticks injuries and patient care equipment pre/post program.(n=35).**

| *Items* | *Pre program* | | *Post program* | | *Test* | |
|---|---|---|---|---|---|---|
| | *N* | *%* | *N* | *%* | **χ2** | **P-value** |
| **Prevention of needle sticks injuries** | | | | | | |
| Careful when handling sharps | 25 | 71.4 | 33 | 94.3 | | |
| Dispose the used needle in safety box. | 23 | 65.7 | 33 | 94.3 | | |
| Cut the needles. | 23 | 65.7 | 35 | 100.0 | | |
| Full the safety box completely | 16 | 45.7 | 25 | 71.4 | | |
| Safe handling of safety box | 15 | 42.9 | 28 | 80.0 | | |
| **Patient care equipment** | | | | | | |
| Wash the equipment properly with water | 21 | 60.0 | 34 | 97.1 | **46.425** | **0.003* (S)** |
| Packing of equipment after drying | 19 | 54.3 | 30 | 85.7 | | |
| Send the equipment for sterilization | 27 | 77.1 | 35 | 100.0 | | |
| Proper storage of the sterilization equipment | 24 | 68.6 | 32 | 91.4 | | |

**Table (7): Distribution of the nurses according to their total performance score regarding the infection control standard precautions pre/post training program in M.C.H centers(n=35).**

| *Total nurses' performance* | *Pre program* | | *Post program* | | **χ2** | **P-value** |
|---|---|---|---|---|---|---|
| | *N* | *%* | *N* | *%* | | |
| ***poor*** | 29 | 68.6 | 3 | 5.7 | **46.374** | **< 0.0001** (HS)** |
| ***Average*** | 5 | 22.8 | 4 | 17.1 | | |
| ***Good*** | 1 | 8.6 | 28 | 77.2 | | |
| ***Total*** | 35 | 100.00 | 35 | 100.0 | | |

***(HS) highly significant.*

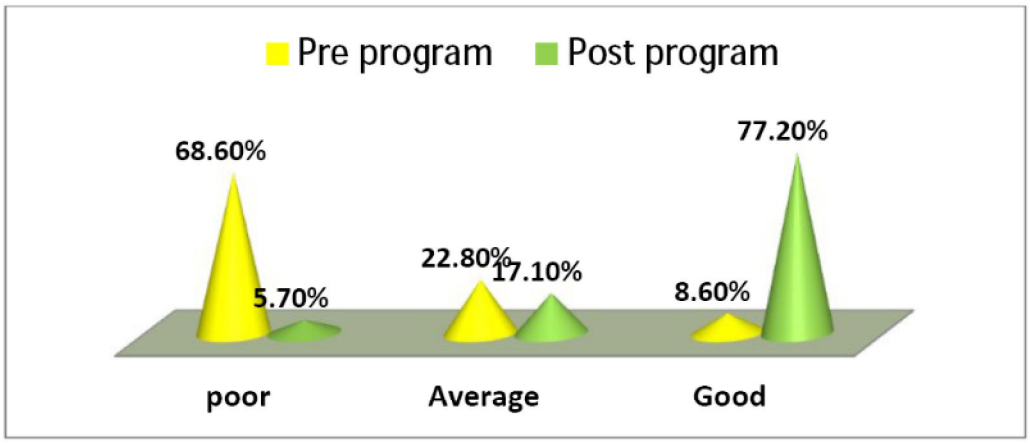


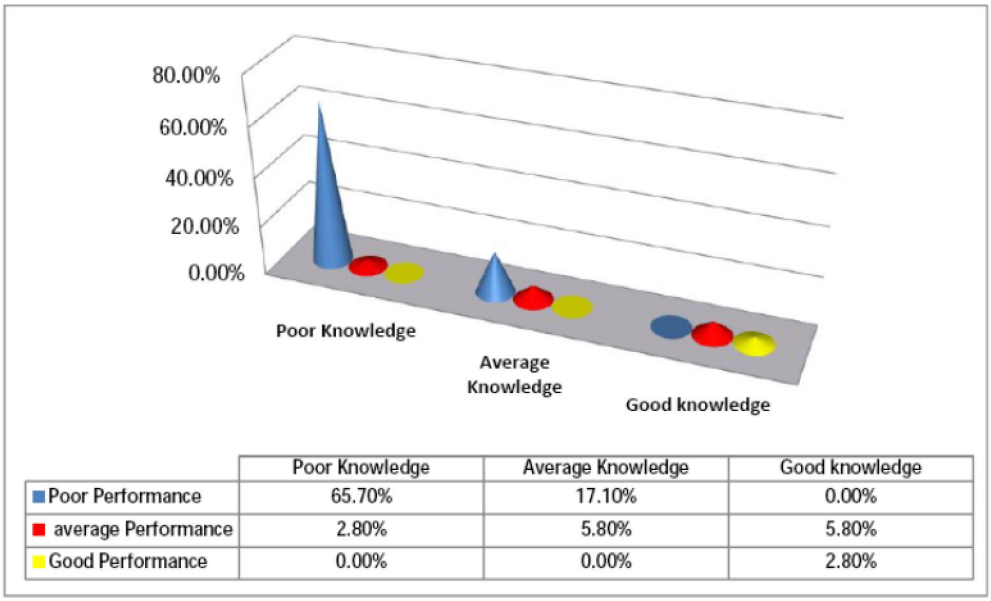

**Figure (2): Distribution of the nurses according to their total performance score regarding the infection control standard precautions pre/post training program in MCH center (n=35).**

**Table (8): Correlations between nurses performance and their knowledge about infection control standard precautions in MCH center(n=35).**

| *Total nurses' Knowledge* | *Total nurses' Performance* | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | *Poor* | | *Average* | | *Good* | | *Total* | |
| | *N* | *%* | *N* | *%* | *N* | *%* | *N* | *%* |
| *Poor* | *23* | *65.7* | *1* | *2.8* | *0* | *0.0* | *24* | *68.5* |
| *Average* | *6* | *17.1* | *2* | *5.8* | *0* | *0.0* | *8* | *22.9* |
| *Good* | *0* | *0.0* | *2* | *5.8* | *1* | *2.8* | *3* | *8.6* |
| *Total* | *29* | *82.8* | *5* | *14.4* | *1* | *2.8* | *35* | *100.0* |
| *Chi-square* | *X2* | | *21.8247* | | | | | |
| | *P-value* | | *0.0002* (S)* | | | | | |

**(S) significant*

**Figure (3): Correlations between nurse's knowledge and their performance about infection control standard precautions in MCH center (n=35).**




| | Poor Knowledge | Average Knowledge | Good knowledge |
|---|---|---|---|
| Poor Performance | 65.70% | 17.10% | 0.00% |
| average Performance | 2.80% | 5.80% | 5.80% |
| Good Performance | 0.00% | 0.00% | 2.80% |

**Figure (3):** Shows that the study nurses had poor performance (65.70%) regarding poor knowledge.

**Table (9):** Shows that the majority of the study nurses (82.8 %) had poor infection control standard precautions performance as regard to their educational level pre training program.

**Table (9): Correlations between total nurses' performance regarding infection control standard precautions and their educational level in MCH center (n=35).**

| **Nurses' Educational level** | **Total nurses' performance** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **Poor** | | **Average** | | **Good** | | **Total** | |
| | **N** | **%** | **N** | **%** | **N** | **%** | **N** | **%** |
| **Technical secondary schools** | **29** | **82.8** | **3** | **8.6** | **0** | **0.0** | **32** | **91.4** |
| **Technical health institute.** | **0** | **0.0** | **1** | **2.8** | **0** | **0.0** | **1** | **2.8** |
| **Bachelor** | **0** | **0.0** | **1** | **2.8** | **1** | **2.8** | **2** | **5.8** |
| **Total** | **29** | **82.8** | **5** | **14.3** | **1** | **2.8** | **35** | **100.0** |
| **Chi-square** | **X2** | | **26.6875** | | | | | |
| | **P-value** | | **< 0.0001 ** (HS)** | | | | | |

***(HS) highly significant*

**Table (10):** Shows that the majority of the study nurses (68.6%) had poor knowledge regarding infection control standard precautions as regard to their educational level pre training program.

**Table (11):** Shows that the majority of the study nurses (60.0 %) more than 10 years experience had poor performance regarding infection control standard precautions pre training program.

**Table (12):** Shows that the majority of the study nurses were not used to use barriers to performance of infection control standard precautions as hand washing, gloving (57.1%), masking (54.2%) and gowning/capping (51.4%).

**Table (10): Correlations between total nurses' knowledge regarding infection control standard precautions and their educational level in MCH center (n=35).**

| *Nurses' Educational level* | *Total nurses' knowledge* | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | *Poor* | | *Average* | | *Good* | | *Total* | |
| | *N* | *%* | *N* | *%* | *N* | *%* | *N* | *%* |
| **Technical secondary schools** | ***24*** | ***68.6*** | ***8*** | ***22.9*** | ***0*** | ***0.0*** | **32** | **91.4** |
| **Technical health institute.** | ***0*** | ***0.0*** | ***0*** | ***0.0*** | ***1*** | ***2.8*** | **1** | **2.8** |
| **Bachelor** | ***0*** | ***0.0*** | ***0*** | ***0.0*** | ***2*** | ***5.8*** | **2** | **5.8** |
| ***Total*** | ***24*** | ***68.6*** | ***8*** | ***22.8*** | ***3*** | ***8.6*** | **35** | **100.0** |
| **Chi-square** | ***X2*** | **35.000** | | | | | | |
| | ***P-value*** | **< 0.0001 ** (HS)** | | | | | | |

***(HS) highly significant*

**Table (11): Correlations between nurses total performance about infection control standard precautions and their years of experience in M.C.H center (n=35).**

| *Years of experience* | *Total nurses' performance* | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | *Poor* | | *Average* | | *Good* | | *Total* | |
| | *N* | *%* | *N* | *%* | *N* | *%* | *N* | *%* |
| <5 | ***5*** | ***14.3*** | ***0*** | ***0.0*** | ***0*** | ***0.0*** | ***5*** | ***14.3*** |
| 5+ | ***3*** | ***8.6*** | ***1*** | ***2.8*** | ***0*** | ***0.0*** | ***4*** | ***11.4*** |
| 10+ | ***21*** | ***60.0*** | ***4*** | ***11.4*** | ***1*** | ***2.8*** | ***26*** | ***74.3*** |
| **Total** | ***29*** | ***82.9*** | ***5*** | ***14.3*** | ***1*** | ***2.8*** | ***35*** | ***100.0*** |
| **Chi-square** | ***X2*** | 1.6247 | | | | | | |
| | ***P-value*** | 0.8044 ***(NS)*** | | | | | | |

**Table (12): Distribution of the nurses' according barriers to performance of infection control standard precautions as reported by nurses ((n=35).**

| Items | **No** | **%** |
|---|---|---|
| ***Hand washing:*** | | |
| •Lack of knowledge | 9 | 25.7 |
| •Not used to | 20 | 57.1 |
| •Lack of equipment/resources | 4 | 11.4 |
| •Lack of training | 2 | 5.7 |
| ***Masking:*** | | |
| •Lack of knowledge | 11 | 31.4 |
| •Not used to | 19 | 54.2 |
| •Lack of equipment/resources | 3 | 8.5 |
| •Lack of training | 2 | 5.7 |
| ***Gowning/capping*:** | | |
| •Lack of knowledge | 7 | 20 |
| •Not used to | 18 | 51.4 |
| •Lack of equipment/resources | 6 | 17.1 |
| •Lack of training | 4 | 11.4 |
| ***Gloving*:** | | |
| •Lack of knowledge | 6 | 17.1 |
| •Not used to | 20 | 57.1 |
| •Lack of equipment/resources | 3 | 8.5 |
| •Lack of training | 6 | 17.1 |
| ***Sharps disposal*:** | | |
| •Lack of knowledge | 8 | 22.8 |
| •Not used to | 8 | 22.8 |
| •Lack of equipment/resources | 10 | 28.5 |
| •Lack of training | 9 | 25.7 |

**4. Discussion**

Standard precautions are the system of infection control practices that apply to all patients regardless of their suspect or confirmed infection status in any setting where health care is delivered. They are based on the principle that all blood, body fluids, excretions, intact skin, and mucous membranes may contain transmissible infectious agent **(Nsubuga&Jaakkola,2015 ).**

As researchers opinion that the use of standard precautions is the primary strategy for the successful minimization of transmission of health care associated infection and are designed to protect both patients and health care workers. Standard precautions include: Hand hygiene, use of appropriate personal protective equipment, use of aseptic technique to reduce patients exposure to microorganisms and management of sharps, blood spills, linen, and waste to maintain safe environment.

The findings of the training program that was executed in this study revealed significant improvements in nurses' knowledge and performance regarding infection control standard precautions. These results are in line with **(Diekemaetal, 2015).** Who stressed that suggested training program is effective in improving nurses' knowledge and practice regarding infection control.

The finding of the present study revealed that a significant improvement was observed in respect to knowledge of infection control and standard precautions' definition, elements of standard precautions, potentially infected substances, these results reflected the weak knowledge of study nurses before the training program which in turn affects negatively on attaining adequate performance of standard precautions. In the same line, **Beghdadli, (2014),** who conducted a study in western Algeria observed that lack of adherence to standard precautions was primarily due to lack of knowledge. Furthermore, **Lopez, (2014),** portrayed a high degree of confusion and a lack of knowledge regarding standard precautions was observed among postgraduate nurses in Spain. However, the present study showed no significant improvements regarding nurses' knowledge about the elements that don't require application of standard precautions and the ideal duration of hand washing this result may reflect the weak respondents' knowledge before receiving the training program and even after receiving it regarding these elements. In the same line, **Chan et al., (2014),** reported in their study about the nurses' knowledge and compliance with standard precautions in an acute care that the nurses' knowledge standard precautions was inadequate. In addition, standard precautions was not only insufficiently and inappropriately applied, but also selectively practiced. This finding is supported by **Diekema et al., (2015)**, who found that standard precautions knowledge scores increased significantly after training program of nurses. Also, the present study was in line with **Terence et al., (2013),** who found improvement in knowledge following the educational intervention about universal precautions to be practiced for patients with HIV/AIDS. On the contrary, **Jamaica et al., (2013)** reported that, Almost two-thirds (64.0%) of the respondents were very knowledgeable of standard precautions. Most questions evaluated basic knowledge of standard precautions.

**Tadesse, (2014),** reported that hand hygiene as one of the standard precautions elements is widely acknowledged to be the single most important activity for reducing the spread of disease, yet, evidence suggests that many health care professionals do not decontaminate their hands as often as they need to or use the correct technique which means that areas of the hands can be missed. In the same line, the present study revealed that the minority of the nurses had appropriate technique of hand washing and they stated that slightly less than one third of them reported that the cause behind improper technique was related to lack of equipments& resources. However slightly more than one-half of them reported that they were not used to do it appropriately. After receiving the training program a significant improvements were apparent regarding the proper manner of hand washing ($p$-value <0.001).

Regarding prevention of needle sticks injuries and patient care, the present study revealed that nurses perform many risky activities while dealing with sharps; they still need training on safe handling and collection of needles and sharps. This result comes in agreement with **Ismail etal, (2013**), in the study of safe injection practice among health care workers in Tanta governorate. Also these findings were congruent with standard precautions involve the use of protective barriers such as gloves, gowns, aprons, masks, or protective eyewear, which can reduce the risk of exposure of the health care worker's skin or mucous membranes to potentially infective materials. In addition, under universal precautions, it is recommended that all health care workers take precautions to prevent injuries caused by needles, scalpels, and other sharp instruments or devices **(Muralidhar et al, 2014).**

Also, concerning sharps disposal as one of the standard precautions elements, **Canadian Center for Occupational Health and Safety (2012),** reported that the highest incidence of needle stick injuries occurred during venipuncture procedures or in the process of recapping needles after taking blood, procedures using hollow-bore needles. The present

study revealed that, a highly significant difference was observed regarding sharp disposal and use single-hand maneuver, only few percent of the total sample do recapping of the needle before training program however after receiving the training slightly less than three-quarters nurses' perform sharp disposal in proper manner especially concerning wear thick gloves when handling waste as observed from the investigator by following the checklist strictly.

Regarding the correlations between nurses performance and their knowledge about infection control standard precautions in MCH center, it was found that there was significant correlations between nurses' knowledge about standard precautions and their performance, this result come in agreement with, **Sari et al, (2014)**, who reported that increase in knowledge level leads to increase in the quality of performance and practice.

According to barriers for performing infection control standard precautions procedures. As reported by nurses, the only barrier to perform hand washing is the lack of equipment/resources. However as regards to other items of standard precaution, it was clear that the most frequent barrier to follow infection control procedures is that the nurses were not used to perform these procedures accurately. In this respect, **Tarek and Adel (2015)** reported that lack of resources and training opportunities, and excessive workload were the most frequent factors cited by health care workers for not implementing standard precautions during routine tasks. Furthermore, as regards barriers to perform preparation of client, room, and equipment as reported by nurses, it was clear that, the most frequent barrier related to preparation of client, room, and equipment is that nurses were not used to do these procedures.

The current study is figuring out that majority of the studied nurses reported the deficiency of MCH center financial resources and the deficiency of allowance and supplies for providing the required infection control standard precautions. The second reported obstacle was lack of the nurses' knowledge and absence of good supervision which was reported by most of the studied nurses. Work over load was reported by the majority of the studied nurses as they reported that the decrease in the number of nurses in MCH center, the increase in number of patients which affect negatively on the application of infection control standard precautions in MCH centers. This result comes in agreement with **Mokhtar, (2013)**, who stressed that nursing problems in Egypt was classified into three big problems, so effective nursing training is essential to ensure that these concepts are understood and put into practice wherever health care is provided. Nursing staff must be educated about the basic principles of infection control and acquire new knowledge and skills because the quality of nursing care depends to a large degree on the knowledge, skills, and activities of the practicing nursing staff.

**Conclusion**

The majority of nurses experienced deficit in their knowledge and performance regarding infection control standard precautions and this deficit was corrected after implementation of the training program, the most frequent causes behind these defects were that they were not used to do it. The education and training about standard precautions is indispensable; it is desirable to raise the nurses' knowledge and performance regarding infection control standard precaution especially in MCH center.

**Recommendation**

Based on the findings of the present study the following recommendations were suggested:

1- Establishment of in-service training program for nurses and health team members working in MCH centers.
2- Continuous supervision, assessment and evaluation of nurse's performance related to infection control measures to improve quality of care given in relation to prevention and control of infection in MCH centers.
3- Availability of all facilities and equipment those are required for applying standard precautions in MCH centers.
4- Improve the working conditions through increase salaries, rewards, proper distribution of nurses to maintain reasonable nurse patient ratio to permit a high quality of care.
5- Nurses are in need for continuous training program and motivation in order to follow the instructions.

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