The Effect of Educational Program on Nurses' Performance and Compliance regarding Infection Control Measures in Isolated Departments

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Abstract

Background: Hospital-acquired infections are the major concern of the health care system and agencies particularly in the isolation department. Nurses have the key and most important role in applying infection control measures in isolated departments. **Aim of study:** This study aimed to evaluate the effect of educational program on nurses' performance and compliance regarding infection control measures in isolated departments. **Design**: Quasi-experimental research design was utilized to conduct the aim of this study. **Setting:** The study was conducted in the isolation departments at Benha University Hospital. **Sample:** A convenient sample of all available nurses (60) from both sexes who are working at the previous mentioned setting. **Tools:** Three tools are used Tool I: A Self – administered questionnaire Tool II: Observational checklist Tool III: ـــ The Isolation Precautions Compliance Scale. **Results:** 18 % of the studied nurses had satisfactory level of the total knowledge at preprogram implementation which improved to 85% immediately post and slightly decreased to 78.3% after 3 months post program implementation. It showed statistically highly significant improvement between total practice and compliance immediately post and after 3 months of program implementation as compared with pre program p (0.001**). **Conclusion:** Educational program effectively improved the studied nurses' knowledge and practice regarding infection control measures with a highly statistical significance correlation between nurses performance and their compliance in the isolation department. **Recommendation:** Providing continuous educational or training program for nurses regarding occupational hazards and especially on protective measures.

Keywords: Compliance, educational program, infection control measures, performance.

Introduction

Infectious diseases are caused by pathogenic microorganisms, such as bacteria, viruses, parasites, or fungi. The diseases can be symptomatic or asymptomatic **(Agrebi & Larbi, 2020).**

Transmission of microbes between patients and HCP during routine care is common, regardless of whether the patient is actively infected or asymptomatically colonized. HCP can be contaminated during direct contact with patient skin or bodily fluids (direct contact transmission) or by contact with the patient's environment (indirect contact transmission) **(Reddy et al., 2019).**

Health acquired infections (HAIs) are a worldwide problem that increases morbidity and mortality among the hospitalized patients and surges an additional cost. Nurses' knowledge and practices about precautions and infection prevention strategies are the cornerstones to minimize the burden of hospital acquired infections. The infection control is a key part of training for all health services personnel, for their health as

well as to minimize nosocomial infection and along these lines improve nurses and patients safety **(Hattab et al., 2021).**

Standard precaution requires healthcare professionals to consider all patient secretions to prevent the spread of pathogens, including blood and body fluids, as potential infection sources, and avoid being exposed to them. In addition, the WHO recommends applying the practice of standard precaution among all patients, including practicing hand and respiratory hygiene, using appropriate Personal Protective Equipment (PPE) according to risk assessment as well as proper linens, promoting injection safety practices and safe waste management, environmental cleaning, and sterilizing patient-care equipment **(Kim et al., 2021).**

Isolation Precautions (IP) have been used as an integral part of infection control practices to prevent transmission of pathogens. One of the key components of IP includes isolation or cohorting of hospitalized patients with known or suspected colonization or infection with pathogens that may be transmitted within hospitals **(Nair et al., 2020).** As isolation is an important component of IPC for patients, it requires contact, droplet or airborne precautions **(O'Reilly et al.,** 2020).

The nurse plays an important role in the translation of knowledge about infection prevention and control into attitudes and practice. Continuing education is very important for all health care professions. Attendance in in-service education provides nurses with theoretical and practical evidence needed to attain certain types of skills and continuous improvement practice **(Belal et al., 2020).**

Significance of the study

Healthcare-associated infections are a major problem for patients' and healthcare workers' safety and their prevention must be a top priority for healthcare systems and organizations. HAIs can result in low quality of life, or even reduce life expectancy of the infected person, as well as increased considerable costs in the long run. About 55–70% of HAIs may be preventable through certain measures such as standard precautions and isolation precautions (contact, droplet, and airborne precautions) **(Alhumaid et al., 2021)**.

Aim of the study:

The aim of the study is to evaluate the effect of educational program on nurses' performance and compliance regarding infection control measures in isolated departments.

Research hypothesis:

H1: Nurses knowledge regarding infection control measures in isolated department will be significantly improved after implementing educational program than before.

H2: Nurses practice regarding infection control measures in isolated department will be significantly improved after implementing educational program than before.

H3: there will be significantly positive correlation between nurses' performance and their compliance regarding infection control measures.

Subject and Methods

Research design:

Quasi-experimental research design was utilized to conduct the current study. This design is aimed to evaluate interventions but that do not use randomization. Similar to randomized trials, quasi-experiments aim to demonstrate causality between an

intervention and an outcome. Quasi-experimental studies can use both pre intervention and post intervention measurements as well as non-randomly selected control groups **(Maciejewski, 2020).**

Setting:

This study was conducted at the isolation medical and surgical departments in Benha University Hospital. The sixth floor of medical department has isolation room for five beds while inter mediate care unite also has four beds, medical unite two in the fifth floor has one room for four beds, catheter care in the first floor contain room for four beds and surgical department consist of five room in each floor has one room for four beds.

Subjects

Convenience sample of all available nurses (60) from both sexes who are working at the previous mentioned setting during the time of the data collection and agreed to participate in this study.

Tools of data collection:

Three tools were used to conduct the study

Tool: (1): Self-administered questionnaire

It was questionnaire administered to the nurses, -used to assess nurses knowledge about infection control measures. It developed by researchers, based on reviewing of past and present local and international related literature It translated into Arabic language. It composed of two parts:

Part I: Demographic data of nurses:

It aimed to assess nurses demographic data it included (7) questions about (age, gender, level of education, years of experience in nursing, years of experience in isolation department, previous training, guideline and sources of information regarding infection control measures)

Part II: Nurses' knowledge about infection control measures:

It was designed to assess nurses' level of knowledge it was guided by **(Marey et al., 2020) and Alhassan, (2023)** and was modified by researchers based on reviewing of past and present local and international related scientific literatures and theoretical knowledge of various studies. This tool consists of (48) inform of multiple –choice question (MCQ)and true &false (6). Such as: - Knowledge about definition of infection control ,mode of transmission , incubation period and sources of infection (9) questions - Knowledge about infection control measures in isolation department (5) questions - Knowledge about hand washing (7) questions - Knowledge about personal protective equipment (12) questions - Knowledge about medical disposal items (5) questions - Knowledge about environmental disinfection (3) questions - Knowledge about cough etiquette (1) questions - Knowledge about characteristics of isolation department (6) questions.

Scoring system for knowledge assessment:

The score distributed as: each correct answer was given (1) and each incorrect answer was given (0). With total scores of questionnaire (48 degree) = 100%. The knowledge score converted into percentage and categorized into: • ≥ 80% (3848- score) graded as satisfactory level of knowledge. • < 80% (038- score) graded as unsatisfactory level of knowledge.

Tool II: Observational checklist:

It developed by the researchers based on related literature review **(Abalkhail et al., 2021)** .It divided into two parts:

Part I: Nurses' practice observational checklist. It was used to assess nurses' practice

regarding infection control measures. This tool adapted from **(AL Hassan et al., 2023)** and modified by the researchers, it included nurses' practices preprogram, immediate post and after 3 month of programed implementation as the following: - Routine hand washing (15) steps - Donning &removing mask (10) steps - Surgical hand washing (19) steps - Gowning (12) steps - Glaving (13) steps - Cleaning the instrument (5) steps - IV drip system (15) steps - Urinary catheter care (20) steps - Mlti-dose vial (9) steps - wound care (26) steps .

Scoring system: it classified as follow: nurses practice was classified into (1) Score was given for correctly done and (0) score was given for not done. The total score of practice was 144 score was classified into two levels: • The total practice were consider competent if the score of the total practice >85%.(122 degree= 100%) • The total practices were considered incompetent if the score of the total practice < 85%. (122 degree= 100%) .

Part (II): Environmental safety measures checklist. It was designed by the researchers based on literature review to assess safety measures in isolated departments (design of the rooms, ventilation, lightening, specific regulation, policies and consumers).

Scoring system: Scoring system was graded according to the items of the questionnaire, Rate availability of each item as follow: (0) Unavailable (NOT available for everyone who needs it) ; (1) Limited (available to half, but not to everyone who needs it); or (2) available (present, available to almost everyone in need, and used when needed). The total score for all questions related to hospital safety measures in isolation departments was 62 points which represented (100%) and evaluated based on the following classification: Unavailable (0 point) Limited (50%) (31 points) Available (>50%- 100%) (>31-62 points).

Tool (III): The Isolation Precautions Compliance Scale (TIPCS):

The scale was adapted by Tayran &Ulupinar, (2011); the 27 items scale is 5 point likert type (1= strongly disagree ,2=disagree ,3= no idea ,4= agree and 5= absolutely). Scores to be obtained from the scale range between 27 and 135. High scores obtained from the scale indicate good compliance with isolation precautions. The scale is composed of hand hygiene, use of gloves, environmental infection control, worker and patient safety.

Nurses' educational program

It consisted of two parts:

Theoretical part: booklet was given to each nurses that included a brief summary about definition of infection, causes, hospital acquired infection, risk factor for hospital acquired infection, methods of prevention and information about safety precautions.

Practical part: demonstration will be done for each patient as needed. It was included five moments of hand hygiene, routine hand hygiene, surgical hand hygiene, wearing and removing personal protective equipment (gloves – gown – mask), cleaning the instrument, intravenous drip, urinary catheter care, multi dose vials, and wound care.

Administrative design and ethical consideration:

- The researchers approval was obtained from scientific research ethical committee in the Faculty of Nursing Benha University before starting the study - An official approval was obtained from medical directors of isolated department of Benha University Hospital and head nurses of medical departments - A clear explanation of the nature, aim

and expected outcome of the study were clarified to nurses and they were assured that all information will be confidential and it will be used only for the research purpose only written consent of participation in the study obtained from studied nurses. Nurses were informed that they are allowed to choose to participate or not in the study and they have the right to withdraw from the study at any time without giving any reasons.

Preparatory phase (Developing Tools)

This phase includes reviewing the recent related literature of various books, articles, and internet, periodicals of journal for data collection. The tools will check for the validity, and reliability as well as the pilot study will be done as follow:

Content validity:

Content validity of suggested tools was done a jury of five experts in Medical Surgical Nursing in Faculty of Nursing Benha University; three assistant professor and two lecturer to determine whether the included items are clear and suitable to achieve the aim of the current study.

Reliability of tools:

Testing the reliability of the tools through Alpha Cronbach reliability analysis. Knowledge questionnaire coefficient which was 0.795 . For the second tool practice, reliability was 0.810. This only proves that this tool is an instrument with good reliability.

Pilot study:

A pilot study was conducted on 6 nurses (10%) from the total number of the studied nurses and they were included in the study. The pilot study aimed to test the feasibility, clarity and applicability of the tools also to determine the time needed for filling the structured questionnaire.

Field work:

Once the researcher will be interviewed the nurses to obtain consent and explain the purpose of the study, the data will be collected and conducted through four phases:

1-Assessment Phase:

Assessment phase: - After assessing nurses' practice the researchers started to assess the nurses' knowledge through self-administrated questionnaire (Tool I) was given to each nurse to fill it and time required for completion of the questionnaire was 15 minutes. Assessment of the nurses' practical skills through observational checklists (tool II) was done and assessment the environmental safety through observational checklists by the researcher. The researchers started to assess the isolation precautions compliance (Tool III) was given to each nurse and time required for completion it was 10 minutes.

2-Planning phase:

- Based on initial assessment of nurses knowledge and their practice. After gathering the initial information and determining the deficits of nursing in isolation department from pre-program assessment, informs nurses about educational programs. The educational booklet was discussed to nurses by the researcher individually. The total number of nurses examined was 60, divided into small groups (6 groups), each group had 10 nurses. Each group of nurses selected the most convenient hour, which was the most appropriate time throughout the day for the nurses. The researchers participated three days/week from 3 p.m to 5 p.m.

3-Implementation phase:

- Educational program designed by researchers in Arabic language based on review include six sessions, the researchers

met each group. Two theoretical sessions and four practical sessions. Each session lasted from 30 to 45 minutes, including the discussion time. Each session began with a short review of what was delivered during the previous session, then the goals of the new topics, taking into consideration the use of simple language to suite the level of all nurses' education. - Teaching techniques included group discussion, instructions and example during sessions.

For theoretical part:

- 1st session (introductory session) :it included information about infection , chain of infection , mode of transmission , types of hospital acquired infection , sources of infection ,sign and symptoms and definition standard precaution of infection control.

- 2nd session: include information about: - standard precaution (hand hygiene – personal protective equipment –cough etiquette – safe injection – waste management – environmental cleaning – handle of Laundry –handle of instruments) - Types of isolation precaution (contact – droplet – airborne) .

For practical part :

- 3rd session include re- demonstration hand wash explanation using discussion and giving handout followed by demonstration the procedure (definition hand hygiene – types of hand hygiene- five moment – practical hand washing) each session take (30 -45) .

- 4th session include re- demonstration wearing personal protective equipment explanation using discussion and giving handout followed by demonstration the procedure :(Types personal protective equipment-Steps to Gloves wearing, removing -mask and eye protection precaution)). Before starting of each session , the researchers asks question related to the topics to reinforce the feedback and plan for next session

- 5th session include re- demonstration cleaning the instrument, and intravenous drip

- 6th session include re- demonstration urinary catheter, multi dose vial and wound care using discussion and giving handout followed by demonstration the procedure.

4-Evaluation phase:

After educational program the researchers interviewed with studied nurses and evaluated them using the same pre-test tools It was used 3 times (pre programme, immediate and post three month) to evaluate:

- Nurses' knowledge (Tool I).
- Nurses' practice (Tool II).
- Their copmliane (Tool III).

Then comparison between all nurses pre-program, immediately and after 3 months post program implementation.

Statistical Analysis:

Data Analysis The collected data were tabulated and statistically analyzed using an IBM computer and the statistical package for social science (SPSS) advanced statistics, version 25 (SPSS Inc., Chicago, IL). Numerical data were expressed as mean and standard deviation. Qualitative data were expressed as frequency and percentage. Chi-square test was used to examine the difference between qualitative variables. Pearson method was used to test correlation between numerical variables. A p-value < 0.05 was considered significant.

Results:

Table (1) shows that 46.7% of the studied nurses aged from 21 to less than 30 years old with a mean 33.30 ± 7.54 years old . Meanwhile, 66.7% of the studied nurses were females and 50% of the studied nurses were technical institute. Whereas 36.6% of the studied nurses had 2-≤ 5 years' experience in nursing occupation.

Figure (1) shows that, only 18.3% of the studied nurses have satisfactory level of total knowledge about infection control measures in isolation departments, pre- program implementation. Which improved to 85% immediately post and slightly decrease to78.3% after 3 months of program implementation.

Figure (2) shows that only 26.7% of the studied nurses have competent level of total practice about infection control measures in isolation departments, preprogram implementation. which improved to 78.3% immediately post and slightly decrease to73.3% after 3 months post program implementation.

Figure (3) illustrates that frequency distribution of hospital safety measures in isolation departments shows that 100% availability of lighting and ventilation while 53.3% the design of the room is available and 30 % specific regulation and policies and consumers is available.

Table (2) displays that there was a highly statistically significant difference in total mean score of nurses' compliance with isolation precautions for infection control measures pre and immediate post and after 3 months of program at p value (0.001**).

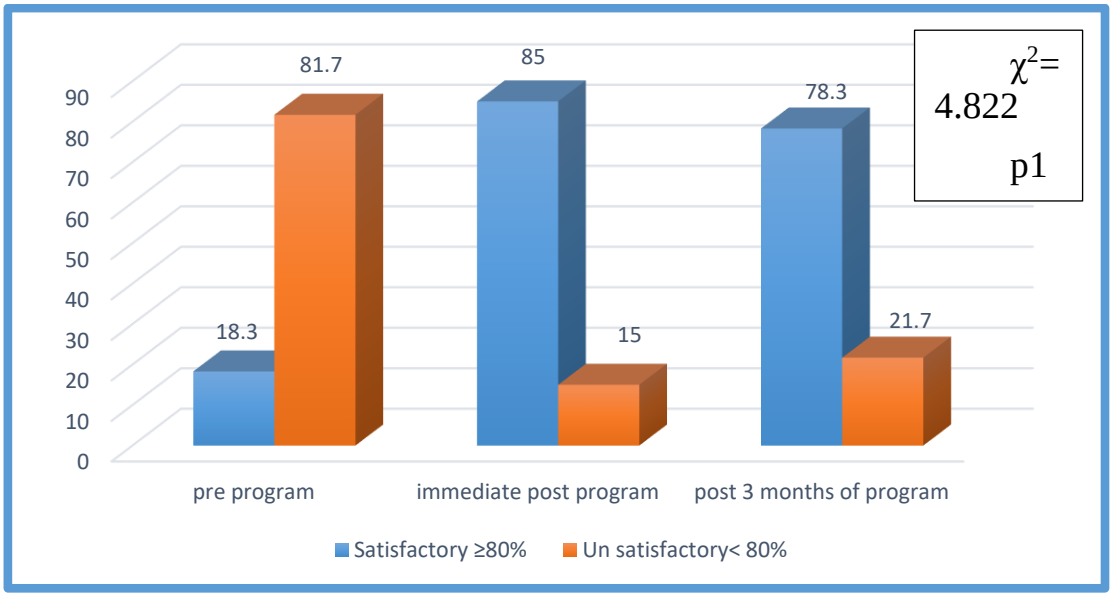
Table (3) shows that, there was statistically significant relation between total level of studied nurses' knowledge and age and qualification preprogram implementation at p value (0.021* and 0.035* respectively). While there was no statistically significant relation between total level of knowledge and all items of demographic data of the studied nurses immediately post program. There was highly a statistically significant relation between total studied nurses' knowledge and age, years of experience in nursing occupation at post 3 months of program implementation at p value (<0.001**).

Table (4) shows that there is no statistically significant relation between the total level of practice and all items of demographic data at pre and immediately post program implantation. While there was a statistically significant relation between total level of practice and age after 3 months of program implementation.

Table (3) shows that, there was statistically significant correlation between the total level of knowledge & practice and compliance of studied nurses preprogram , immediately post program and after 3 months at p value (0.042*&0.021*respectively). while there was highly statically significant correlation value(0.001total level of knowledge and practice at at p value(0.001*) after 3 months of program implementation .

Table (1): Frequency distribution of the studied nurses according to their demographic data (n = 60)

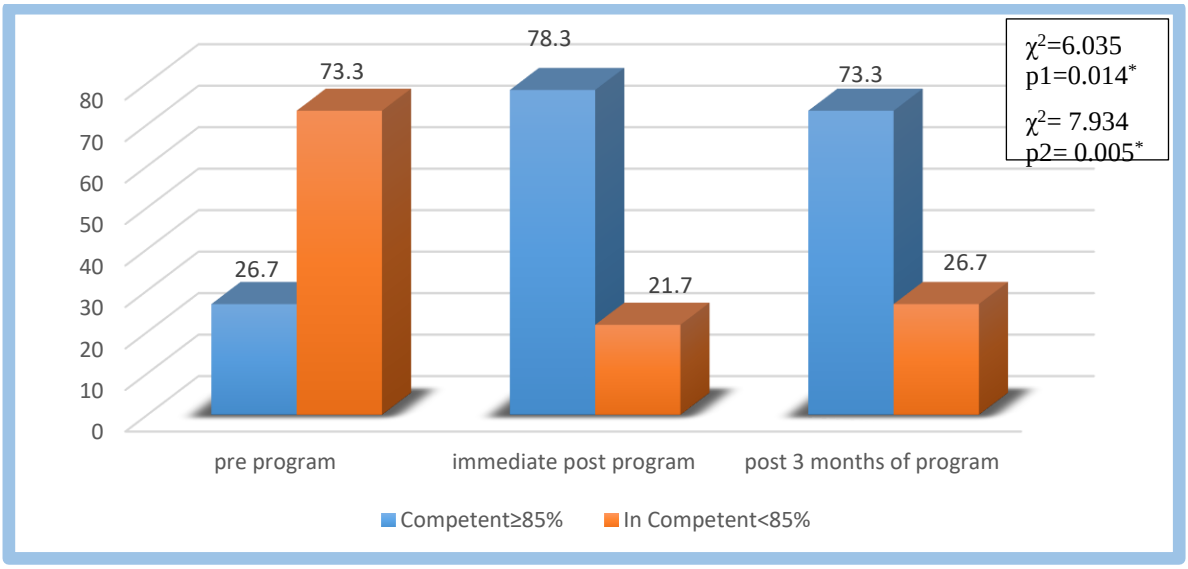
Nurses' demographic data		No.	%
Age years	21-<30	28	46.7
	30- < 40	18	30.0
	40-<50	12	20.0
	≥ 50	2	3.3
	Mean ± SD	**33.30 ± 7.54**	
	Rang	**25 – 53 year**	
Sex			
Male		20	33.3
Female		40	66.7
Qualification			
Nursing Diplom		11	18.3
(Health- nursing) technical institute		30	50.0
Bachelor of Nursing		14	23.3
Post graduate qualification nursing		5	8.4
Years of Experience in nursing occupation			
< 2 years		10	16.7
2-< 5 years		22	36.6
5-< 10 years		13	21.7
≥ 10 years		15	25.0
Years of Experience in isolation departments			
< 2 years		41	68.3
2-< 5 years		19	31.7
Mean ± SD		5.31 ± 1.04	
Attending previous training course for infection control measures			
Yes		39	65.0
No		21	35.0
If yes, since when		**(n=39)**	
< 6 months		15	38.5
>6 months		13	33.3
≥1 year		11	28.2
Presence of written instructions on infection control policies in isolation departments			
Yes		21	35.0
No		39	65.0
Sources of information regarding infection control measures			
instructional signs in the workplace		37	61.7
Websites of international health organizations		23	38.3



(*) Statistically Significant at ≤0.05

(1) Difference of total knowledge between pre and immediate post program
(2) Difference of total knowledge between pre and post 3 months of program

Fig (1): Distribution of nurses' total knowledge level about infection control measures in isolation departments pre, immediately and post 3 months of program implementation (n=60)



(*) Statistically Significant at ≤0.05

(1) Difference of total practice between pre and immediate post program
(2) Difference of total practices between pre and post 3 months of program

Fig (2): Percentage distribution of total level nurses' practice regarding infection control measures in isolation departments pre, immediately and post 3 months of program implementation. (n=60)

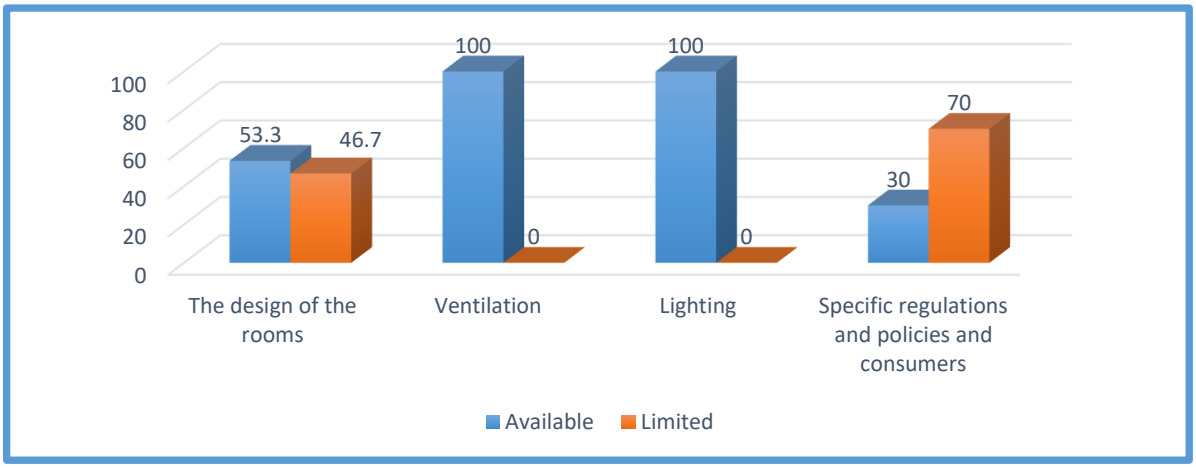


Figure (3): Percentage distribution of hospital safety measures in isolation departments according to their availability. (n=60)

Table (2): Frequency difference between the total mean score of nurses' compliance with isolation precautions for infection control measures pre, immediately and post 3 months of program implementation (n=60)

Total of nurses' compliance	Max. score	Pre- program (n=77)	immediately Postprogram (n=77)	3 months Post program (n=77)	% of mean (at3 months Post program)	t-test P value(1)	t- test P value (2)
		$\bar{x} \pm SD$	$\bar{x} \pm SD$	$\bar{x} \pm SD$			
Hand hygiene	25	15.68 ± 2.28	20.30 ± 1.85	19.58± 2.39	78.3%	-46.981 <0.001**	-8.982 <0.001**
Protective precautions for contact isolation	20	12.68 ± 1.95	16.36 ± 1.57	15.96 ± 2.01	79.8%	-43.845 <0.001**	-24.773 <0.001**
Protective precautions for droplet isolation	25	15.15± 3.02	19.85 ± 2.50	19.26 ± 2.76	77.0%	-40.964 <0.001**	-13.604 <0.001**
Protective precautions for respiratory isolation	20	12.61 ± 2.92	16.26 ± 2.44	15.71 ± 2.65	78.5%	-31.460 <0.001**	-13.473 <0.001**
Environmental control	25	15.58 ± 3.61	20.20 ± 3.06	19.40 ± 3.55	77.6%	-33.764 <0.001**	-10.765 <0.001**
Worker and safety patient	20	12.21 ± 1.63	16.26 ± 1.90	15.65 ± 2.42	78.3%	-17.723 <0.001**	-13.112 <0.001**
Total	135	83.93 ± 13.88	109.25 ± 11.32	105.58 ±11.77	-	-42.759 <0.001**	-17.943 <0.001**

****Highly significant at p ≤0.001.**

(1) Difference of total compliance between pre and immediate post program

(2) Difference of total compliance between pre and post 3 months of program

Table (3): Relation between nurses' demographic data and their total knowledge pre, immediately post and post 3 months of program implementation (n=60)

Demographic data	Total knowledge level									
	variables	Pre program		X^2 Test P value	Immediately post program		X^2 Test P value	Post 3 months of program		X^2 Test P Value
		Satisfactory (n=11)	Un Satisfactory (n=49)		Satisfactory (n=51)	Un Satisfactory (n=9)		Satisfactory (n=47)	Un Satisfactory (n=13)	
		No.(%	No. (%)		No. (%)	No. (%)		No. (%)	No. (%)	
Age	21-<30	5(45.5)	23(46.9)	9.748 0.021*	21(41.2)	7(77.8)	7.495 0.058 n.s	15(31.9)	13(100.0)	18.967 <0.001**
	30- < 40	3(27.3)	15(30.6)		17(33.3)	1(11.1)		18(38.3)	0(0.0)	
	40-<50	1(9.1)	11(22.4)		12(23.5)	0(0.0)		12(25.5)	0(0.0)	
	≥ 50	2(18.2)	0(0.0)		1(2.0)	1(11.1)		2(4.3)	0(0.0)	
Sex	Male	4(36.4)	16(32.7)	0.056 0.813 n.s	17(33.3)	3(33.3)	0.000 1.000 n.s	16(34.0)	4(30.8)	0.049 0.825 n.s
	Female	7(63.6)	33(67.3)		34(66.7)	6(66.7)		31(66.0)	9(69.2)	
Qualification	Nursing diplom	0(0.0)	11(22.4)	8.603 0.035*	9(17.6)	2(22.2)	0.256 0.968 n.s	7(14.9)	4(30.8)	3.029 0.387 n.s
	Technical institute	4(36.4)	26(53.1)		26(51.0)	4(44.4)		26(55.3)	4(30.8)	
	Bachelor of Nursing	6(54.5)	8(16.3)		12(23.5)	2(22.0)		10(21.3)	4(30.8)	
	Post graduate qualification	1(9.1)	4(8.2)		4(7.8)	1(11.1)		4(8.5)	1(7.6)	
Years of experience in nursing occupation	< 2 years	3(27.3)	7(14.3)	1.679 0.642 n.s	7(13.7)	3(33.3)	5.987 0.112 n.s	3(6.4)	7(53.8)	21.916 <0.001**
	2-< 5 years	3(27.3)	19(38.8)		17(33.3)	5(55.6)		16(34.0)	6(46.2)	
	5-< 10 years	3(27.3)	10(20.4)		12(23.5)	1(11.1)		13(27.7)	0(0.0)	
	≥ 10 years	2(18.1)	13(26.5)		15(29.4)	0(0.0)		15(31.9)	0(0.0)	
Years of experience in isolation departments	< 2 years	6(54.5)	35(71.4)	1.183 0.277 n.s	35(68.6)	6(66.7)	0.014 0.907 n.s	32(68.1)	9(69.2)	0.006 0.937 n.s
	2-< 5 years	5(45.5)	14(28.6)		16(31.4)	3(33.3)		15(31.9)	4(30.8)	
Attending training course for infection control measures	Yes	7(63.6)	32(65.3)	0.011 0.916 n.s	33(64.7)	6(66.7)	0.013 0.909 n.s	31(66.0)	8(61.5)	0.087 0.767 n.s
	No	4(36.4)	17(34.7)		18(35.3)	3(33.3)		16(34.0)	5(38.5)	
Source of information regarding infection control measures	instructional signs in the workplace	5(45.5)	32(65.3)	1.498 0.221 n.s	31(60.8)	6(66.7)	0.112 0.738 n.s	32(68.1)	5(38.5)	3.780 0.052 n.s
	Websites of international health organizations	6(54.6)	17(34.7)		20(39.2)	3(33.3)		15(31.9)	8(61.5)	

Table (4) Relation between nurses' demographic data and their total practice pre, immediately post and post 3 months of program implementation (n=60)

Demographic data	Variable	Total practice level								
		Pre program		X^2 Test P value	Immediately post program		X^2 Test P value	Post 3 months of program		X^2 Test P value
		Competent (n=16)	Incompetent (n=44)		Competent (n=47)	Incompetent (n=13)		Competent (n=44)	Incompetent (n=16)	
		No. (%)	No. (%)		No. (%)	No. (%)		No. (%)	No. (%)	
Age	21-<30	5(31.3)	23(52.4)	5.191 0.158 n.s	23(48.9)	5(38.5)	1.758 0.624 n.s	16(36.4)	12(75.0)	7.976 0.047*
	30- < 40	5(31.3)	13(29.5)		13(27.7)	5(38.5)		16(36.4)	2(12.5)	
	40-<50	6(37.4)	6(13.6)		10(21.3)	2(15.4)		10(22.7)	2(12.5)	
	≥ 50	0(0.0)	2(4.5)		1(2.1)	1(7.6)		2(4.50	0(0.0)	
Sex	Male	3(18.8)	17(38.6)	2.088 0.148n.s	15(31.9)	5(38.5)	0.196 0.658 n.s	17(38.6)	3(18.8)	2.088 0.148 n.s
	Female	13(81.2)	27(61.4)		32(68.1)	8(61.5)		27(61.4)	13(81.2)	
Qualification	Nursing diplom	4(25.0)	7(15.9)	2.714 0.438 n.s	6(12.8)	5(38.5)	4.567 0.206 n.s	8(18.2)	3(18.8)	3.210 0.360 n.s
	Technical institute	9(56.2)	21(47.7)		25(53.2)	5(38.5)		23(52.3)	7(43.6)	
	Bachelor of Nursing	3(18.8)	11(25.0)		12(25.5)	2(15.4)		11(25.0)	3(18.8)	
	Post graduate qualification	0(0.0)	5(11.4)		4(8.5)	1(7.6)		2(4.5)	3(18.8)	
Years of experience in nursing occupation	< 2 years	2(12.5)	8(18.2)	1.851 0.604 n.s	10(21.3)	0(0.0)	4.679 0.197 n.s	6(13.6)	4(25.0)	4.701 0.195 n.s
	2-< 5 years	5(31.3)	17(38.6)		16(34.0)	6(46.2)		14(31.8)	8(50.0)	
	5-< 10 years	3(18.8)	10(22.7)		11(23.4)	2(15.4)		12(27.3)	1(6.2)	
	≥ 10 years	6(37.5)	9(20.5)		10(21.3)	5(38.4)		12(27.3)	3(18.8)	
Years of experience in isolation departments	< 2 years	9(56.3)	32(72.7)	1.472 0.225n.s	31(66.0)	10(76.9)	0.566 0.452 n.s	28(63.6)	13(81.2)	1.682 0.195 n.s
	2-< 5 years	7(43.8)	12(27.3)		16(34.0)	3(23.1)		16(36.4)	3(18.8)	
Attending training course for infection control measures	Yes	11(68.8)	28(63.6)	0.13 0.713n.s	16(34.0)	5(38.5)	0.087 0.767 n.s	29(65.9)	10(62.5)	0.060 0.807 n.s
	No	5(31.3)	16(36.4)		31(66.0)	8(61.5)		15(34.1)	6(37.5)	
Source of information regarding infection control measures	instructional signs in the workplace	10(62.5)	27(61.4)	0.006 0.936 n.s	30(63.8)	7(53.8)	0.429 0.512 n.s	28(63.6)	9(56.2)	0.271 0.603 n.s
	Websites of international health organizations	6(37.5)	17(38.6)		17(36.2)	6(46.2)		16(36.4)	7(43.8)	

Table (5) Correlation between total knowledge, practice and compliance among nurses during pre, immediately post, and post 3 months of program implementation(n=60)

r-\ p values / variable	Study Periods	Total knowledge		Total compliance	
		r	P - value	r	P - value
Total practice	Pre	0.263	0.042*	0.298	0.021*
	Immediately post	0.873	<0.001**	0.747	<0.001**
	Post 3 months of program	0.439	<0.001**	0.824	<0.001**
Total knowledge	Pre	-	-	0.429	0.001**
	Immediately post	-	-	0.724	0.001**
	Post 3 months of program	-	-	0.405	0.001**

(*) Statistically Significant at ≤0.05 (**) Highly statistically significant at ≤0.001

Discussion

The infection control is a key part of training for all health services personnel, for their health as well as to minimize nosocomial infection and along these lines improve nurses and patients safety. Regarding to age the results of the present study revealed that nearly half of the studied nurses were aged between 21-<30 years old with mean age of 33.30 ± 7.54 SD. From the researchers' point of view, this result might be because the fact that most of the studied nurses being aged between 21 to 30 years old and which considered the age of working and distribution in hospitals.

This finding was in agreement with **Belal et al., (2020)** whose study entitled " In-services Education Program for Improving Nurses' Performance Regarding Infection Control Measures in a Rural Hospital" which conducted in a Fayoum Governmental hospital, Egypt and reported that more than half of their age group ranged from 23 to 32 years and attributed due to the stability of job, family, and life in these ages.

Regarding to the gender, two third of the studied nurses were females. From the researchers' point of view, the nursing workforce used to be occupied with females for several years. This was in accordance with **Haque et al., (2018),** conducted a study which entitled " Personal Protective Equipment Knowledge and Practices among Nurses Working at Al-Baha King Fahad Hospital, Saudi Arabia". His study findings showed a higher perception of female nurses in a hospital than their male counterparts and this difference was statistically significant.

Regarding to nurses' qualification and years of experience of the studied nurse, the present study illustrated that half of them had technical institute of nursing and more than

one third of them had less than two years of experience in isolation department. From the researchers' point of view, recently most of nursing school closed as an educational regulatory affair and the remaining school their student must complete their education until having technical institute of nursing certificate. Most of the studied nurses have 2 ≤ 5years experience in the isolation department may be due to most of the studied nurses being aged between 21 to 30 years.

This result was in consistent with **El Sebaey et al., (2022)** in their study that titled " Knowledge, Attitudes and Practices related to Standard Precautions among Nurses, a comparative study" and found that most of their studied nurses had less than two years' experience and attributed to higher education. Where this result was contradicted with **Narouz & Hanafy, (2019)** study which entitled as " Effect of an instructional program about selected patient safety guidelines on nurses' knowledge and self-reported practice at a government hospital-Egypt" showed that less than half of their nurses had experience less than 10 years and more than 5 years.

The present study showed that about two third of studied nurses attended training courses about infection control measures in the isolation department. These findings were disagreed with **Nour-Eldien and Mohamed, (2020)** in a study entitled " Effect of Education Intervention on Prevention of Blood Borne Infections for Health care Worker" and reported that more than two-thirds of their participants did not attend any training courses about infection control and policies.

Regarding to nurse's total knowledge level about infection control measures in isolation department the study revealed that only one fifth of the studied nurses have satisfactory level of total knowledge pre- program implementation. Which improved to the majority of nurses immediately post and slightly decline to three fourth after 3 months of program implementation. From the researchers point of view, the total knowledge increased due to implementing a suitable and convenient educational program contain most of the required knowledge for nurses about infection control measures in the isolation department. However, this percentage slightly decreased post three months of program implementation, may be due to long time after training.

These findings were agreed with the study done by **El Sebaey et al., (2022)** revealed a statistically significant increase in total knowledge score after implementation of educational program. In addition, these findings also agreed with **Alhumaid et al., (2021)** whose study entitled " Knowledge of infection prevention and control among healthcare workers and factors influencing compliance and reported that overall the level of health care workers knowledge increased after implementing adequate educational training program.

Regarding to total level nurses' practice regarding infection control measures in isolation departments. The results shows that only one quarter of the studied nurses have competent level of total practice about infection control measures in isolation departments, pre program implementation . which improved to more than three quarter immediately post program then slightly decrease after 3 months post program implementation . This finding was in line with **El-Shafei et al., (2019)** that entitled "World Health Organization Surgical Safety Checklist with Addition of Infection Control Items: Intervention Study in Egypt" and showed an improvement in both knowledge and practices of all the studied participants regarding patient

safety and infection control measures after the educational program.

Regarding the nurses' compliance with the isolation precautions in isolation departments, the present study findings revealed that there was a highly statistically significant difference in total mean score of nurses' compliance with isolation precautions for infection control measures pre , immediate and post and after 3 months of program at p value (0.001**). From the researchers' point of view, the total compliance with isolation precautions increased due to implementing an active educational program which illustrated the importance of applying infection control measures in decreasing the hospital acquired infection among healthcare workers and patients and providing a safe work environment for them.

In the same line with the study findings, **Karagülle and Yildiz, (2021)** study that entitled " The Effect of Education on the Compliance of Nurses Working at Surgical Units to Isolation Measures " and reported a significant difference in compliance about isolation precaution among pre- training,

The present study revealed that there was statically significant difference between the total level of knowledge, age and qualification of the studied nurses at pre-program while there is no relation between nurses' level of knowledge and their demographic data at immediately post program. On the other hand, there is a statistically significant difference between the total the level of knowledge, age and years of experience in nursing occupation at post 3 months of program implementation. From the research point of view, these findings could be attributed as the age and qualification of the studied nurses increased the experience and the knowledge of nurse's increase.

This findings was in consistent with the previous study by **Elgazzar & Qalawa, (2020)** study which entitled as" Nurse's awareness of infection control measures in operating room" which conducted in port said general hospital, Egypt, revealed that there were a highly significant relation between nurse's sociodemographic characteristics and their knowledge regarding basis of sterilization and principles ,infection control basics mainly in items related to marital status , educational level, years of experience worked in nursing hospital.

The results also revealed that there is no statically significant difference between the total level of practice and all items of demographic data at pre- program and immediately post program. On the other hand, there is a statistically significant difference between the total the level of practice and age at post 3 months of program implementation.

In agreement with the current study results, **El-Aziz et al., (2018)** in their study that entitled " Developing, Implementing and Evaluating Patients Safety Guidelines for Nurses " found highly statistically significant correlation between age and three phases of total performance.

The current study demonstrated that there is statistically significant difference between the total level of knowledge and practice at pre-program, immediately program and post 3 months of program implementation. From the researchers point of view, the continuous and periodical training and follow up have a vital role in improving the practice, awareness and compliance of nurses to the infection control measures which will lead to decline the rate of hospital acquired infection in the isolation department.

This results agreed with **Rayan & Adam, (2021)** demonstrates there was a positive significance correlation among total knowledge score and total practice score related occupational health hazards among nurse interns throughout program phases and documented that, there was a highly

significance correlation among total compliance and total knowledge score regarding occupational health hazards among nurses through post and follow up program phases.

Conclusion

An improvement was found among nurses concerning knowledge and practice with high significance difference immediately post and post three month implementing of educational program. Also, there was positive statistically significant correlation between knowledge with practice and their compliance to program instruction immediately post and after three-month post implementing educational program as compared with pre implementation.

Recommendations

• Providing continuous educational or training program for nurses regarding occupational hazards and especially on protective measures.

• Dissemination and development of policies and rules of safety practices among nurse interns

• Provide regular vaccination for all nurse interns to minimize liability for acquiring work related infection to prevent biological hazards.

• Monitoring nurse safety practices and it's need to be ameliorated through training as well as close supervision of their application, to ensure their compliance with safety measures.

• Replication of the study using a larger probability sample from different geographical regions generalization of results.

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تأثير البرنامج التعليمي على أداء الممرضين والالتزام بمعايير مكافحة العدوى في أقسام العزل

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تشير معايير مكافحة العدوى إلى القواعد والإجراءات اللازمة للسيطرة على العدوى وتقليلها في أقسام العزل. لذلك هدفت هذه الدراسة إلي تقييم تأثير البرنامج التعليمي على أداء الممرضين والالتزام بمعايير مكافحة العدوى في أقسام العزل. تم استخدام تصميم البحث شبه التجريبي (قبل وبعد) لتحقيق هدف هذه الدراسة. أجريت هذه الدراسة في أقسام العزل بمستشفيات بنها الجامعي. حيث يوجد بقسم الباطنة بالطابق السادس غرفة عزل بها 5 أسرة بينما تحتوي وحدة الرعاية المتوسطة أيضًا على أربعة أسرة والوحدة الثانية باطنه بالدور الخامس غرفة واحدة بها (4) أسرة وعناية القسطرة في الطابق الأول بها غرفة واحدة تحتوي على (4) أسرة وقسم الجراحة يتكون من خمس غرف (غرفة بكل دور) تحتوي على (4) أسرة, تم اختيار عينة ملائمة تمثلت في جميع الممرضين المتاحين (60) الذين يعملون في الاماكن السابقة والذين كانوا يقدمون إجراءات مكافحة العدوى في أقسام العزل بمستشفيات بنها الجامعي. واظهرت النتائج الي تحسن بين الممرضين فيما يتعلق بالمعلومات والممارسات مع اختلاف كبير مباشرة بعد تنفيذ البرنامج وبعد ثلاثة أشهر من تنفيذ البرنامج التعليمي. كما أن هناك علاقة إيجابية ذات دلالة إحصائية بين المعلومات والممارسات والالتزام مباشرة بعد وبعد ثلاثة أشهر من تنفيذ البرنامج التعليمي مقارنة مع ما قبل التنفيذ. واوصت الدراسة بتوفير برنامج تعليمي أو تدريبي مستمر للممرضين فيما يتعلق بالمخاطر المهنية وخاصة فيما يتعلق بمعايير مكافحة العدوى في اقسام العزل.