Effect of Instructional Program on Nurses Compliance with Universal Precautions of Infection Control

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Abstract: The development of neonatal infection in intensive care unit is associated with an increase in morbidity, mortality and cost. Therefore, the aim of this study was to examine the effect of instructional program on Nurses Compliance with Universal Precautions of Infection Control in Neonatal Intensive Care Units. This study was conducted in the Neonatal Intensive Care Units (NICU) at El Menoufia University Hospital and El-Gamia sharaia in Shebien El kom city, Egypt. A quasi-experimental design was used. A convenient sample of all registered nurses who were working in the above mentioned settings were selected (60 nurses). Two tools were used for data collection; a structured interview questionnaire sheet and an observational checklist. The findings of this study revealed that nurses who attend an educational program their knowledge and practice regarding compliance with universal precautions of infection control were improved in posttest than in pretest. In conclusion, implementation of educational program for nurses improved their knowledge and practice toward compliance with universal precautions of infection control in neonatal intensive care unit. It is recommended that nurses needed continuous in-service education and training programs about infection control and should be conducted on a regular basis to improve their knowledge and practice. Also, written standard universal precautions guidelines for infection control should be available in NICU and should be updated periodically to suite the new trends.

Keywords: Instructional Program, Nurses compliance, Universal precautions, Infection control.

1. INTRODUCTION

Health care associated infections (HCAIs) persist as a major problem in most neonatal intensive care units (NICU). Neonates are susceptible to infection because their host defense mechanisms are not mature. They also occupy an environment in which frequently used antibiotics and invasive interventions often permit the invasion of common nosocomial pathogens, and the close proximity of neonates in many NICUs facilitates transfer of organisms from neonates to others (Allegranzi &Pittet, 2007).

Neonates are more liable to contract infections than any other age group. Many neonatal morbidities are due to infections and infectious diseases (Agarwal, Agarwal, Acharya, Christina, Sreenivas, Seetaraman ,2007). According to (World Health Organization, 2010) reports, infections and birth asphyxia are the two main causes of death among neonates. The incidences of neonatal infections vary from country to other and also vary with the hospital and ICU type. It is very difficult to measure hospitals acquired infections because infection is not often accurately recorded in medical or nursing records and very few hospitals have system in place to collect and analyze information about infection (ELshenawi, 2010).

Health care associated infections are a significant problem in Egyptian NICUs. In 2001 very high rates of sepsis (as high as 70%) were documented in a number of NICUs in Egypt (Ministry of health and population, 2005). Surveillance studies

have shown rates of infection in the NICU of 15% to 20%, which are as high as those in adult medical or surgical ICUs and higher than those in most pediatric ICUs (Ministry of health and population, 2005). In Egypt, (EL-Shamy, 2010) mentioned that the incidence of neonatal infections in ICU for open heart surgery was 30%.

The most important and most basic technique in preventing and controlling transmission of infection is hand washing (Perry and Potter, 2002). Protective barriers like gloves, gowns, masks and eye shields provide a physical impediment to transmission of infectious agents. The principles role of these barriers is to protect hospital staff from infectious agents that can be transmitted by blood and body fluid such as Human Immune deficiency Virus (HIV), hepatitis B and C viruses (Marino and Sutin, 2010).

Environmental cleaning services are generally provided a dedicated sanitation for staff. Cleaning schedules should progress from the least soiled to the most soiled to prevent the inadvertent transfer of dirt and organisms from the dirty to clean areas. Each health care worker should become familiar with his or her responsibilities to maintain a clean environment (National Center of Continuing Education, 2010).

Nurses serve an important role in preventing the transfer of organisms in two ways, first, as the health professionals who often spend the most time with neonates; nurses have a greater opportunity for spreading organisms. It is imperative that nurses disinfect their hands before and after contact with patients and after performing a potentially hand -contaminating activity. The second way that nurses reduce hand-to-hand spread is to serve as patient advocates with the number of health care worker involved in neonatal care each day. So, the nurses are challenged in hand-hygiene technique, to feasible the degree that should be observed during different activities with other professionals and discuss with them when lapses in technique are observed (Smeltzer and Bare, 2009).

According to (WHO, 2010) universal precautions are designed to reduce the risk of transmission of infection, particularly through blood borne diseases, to children and Health care personnel (HCP) in health facilities. Thus, in order to minimize the chance of transmission. Emphasis must be placed on factors that enhance compliance with universal precautions such as individual, organizational and environmental factors.

Infection control measures are therefore needed to ensure children safety and prevent cross-infection (patient to staff, staff to patient, patient to staff to patient); (Ferguson, 2009). Studies have shown that non-compliance not only put children but health care workers themselves at risk. Risks are potentially directly related to use of precaution measures and can be reduced by adherence to measures (Doebbeling et al., 2003).

Compliance with universal precautions requires initial and refreshing courses for all staff regarding the proper procedures and must be posted in a strategic location. Health care personnel need to be aware of the disease transmission cycle and the risks to which they are exposed. Studies have shown that health care personnel with a higher level of recognition of the universal precautions demonstrated a notably higher level of compliance than those who had a lower level of recognition (Pittet, Hugonnet and Harbarth, 2006).

Aim of the study:

The aim of this study was to examine the effect of instructional program on Nurses Compliance with Universal Precautions of Infection Control in Neonatal Intensive Care Units. This aim was achieved through the following objectives:

- Assessing nurses' knowledge and practices toward universal precautions of infection control.

- Developing instructional program according to nurses' needs.

- Examine the effect of the program on nurse's compliance with universal precautions of infection control.

Hypothesis: it was hypothesized that:

1- Nurses who will participate in the instructional program, their knowledge and clinical performance regarding the importance of universal precautions of infection control will be improved post program implementation than pre program implementation.

2. SUBJECTS AND METHODS

Research design: Quasi experimental deign was conducted for this study (pre and post).

Setting: The study was conducted in the Neonatal Intensive Care Units (NICU) at El Menoufia University Hospital and El-Gamia Sharaia in Shebien El kom city, Egypt.

Sample: A convenient sample of 60 registered nurses who were working in the above mentioned settings were selected.

Inclusion criteria:

All nurses working in the Neonatal Intensive Care Unit.

Tools of the study:

Two tools were used for data collection:

Tool I: A structured interview questionnaire sheet. It was developed by the researchers in Arabic language guided by the national Guide line for infection control, Egyptian Ministry of Health and Population (2008) to assess nurse's knowledge related to infection control in NICU. It comprised of the following parts:

Part one: Includes socio- demographic data of studied nurses as age, qualifications, years of experience, previous training in infection control field.

Part two : Includes 10 essay questions to assess nurses knowledge regarding infection control such as concept of infection control, mode of transmission, universal precautions, hand washing techniques when caring for neonates, importance of hand washing , correct steps of hand-washing and the application of protective personal equipment as gloving , growing, face mask , dealing with linen , waste, blood spots……..etc.

Part three: Was constructed to assess nurse's opinion about barriers to their compliance toward infection control.

Scoring system for nurse knowledge:

Scoring system for knowledge of the studied nurses was calculated   as the following:

- The total number of questions was 10 questions and the total score was 20.

- The studied nurses' answers were compared with a model key answer, where 2 = completely correct answer, 1= incompletely correct answer and 0 = don't know.

- According to the nurses' responses, their level of knowledge was categorized as the following:

Scoring system:

Item	Score	Total score
Complete correct answer.	2	Good (75 ≤ 100%).
Incomplete correct answer.	1	Average (60 <75%)
Don't Know	0	Poor (< 60%)

Tool II: An observational check list (Pre/Posttest format) It was developed by the researchers in English language guided by the national Guide line for infection control, Egyptian Ministry of Health and Population (2008) to assess nurse compliance to universal precautions such as techniques of hand washing, using protective personal equipment such as gloving, growing, masking, eye protective cover, disposal of waste, management of sharp and caring of solid linen.

Scoring system for nurse practice:

B- **An observational check-list: It covered the following skills:-**

1- **Hand washing,** it consisted of 11 observational items with total optimal score = 22

2- **Personnel protective equipment**, it consisted of 11 subtitles with total optimal score = 22.

3- **Disposal of waste, management of sharps, and caring for soiled linens**, it consisted of 13 subtitles with total optimal score = 26.

4- The nurses practice had been scored as 2= satisfactory done, 0 =unsatisfactory done.

5- According to the nurses' actual practice, their level of practice was categorized as the following:

Scoring system:

Item	Score	Total score
Satisfactory done	2	> 60%
Unsatisfactory done	0	< 60%

Program constructions:

The overall goal of the program is to reduce morbidity and mortality of infection in the neonatal intensive care unit.

Content of the program:

1. Concept of infection control.

2. Infection in health care settings.

3. Universal precautions:-

a- Hand washing.

b- Protective personal equipment.

c- Disposal of waste and dealing with linen.

d- Cleaning and disinfecting used objects and instruments.

e- Dealing and management of sharps.

f- Cleaning and disinfecting incubators.

Methods:

Written Permission:

An official permission to carry out the study was obtained from the administrators of each setting after submitting an official letter from the dean of the Faculty of Nursing, Menoufia University explaining the purpose of the study. Meetings were conducted first with the administrator of each setting to obtain permission for conducting the research and explaining aim and expected outcome.

Tools development:

Tools were developed by the researchers for data collection after a review of past and current local and international literature related to infection control using books, articles, periodicals and magazines to get acquainted with the various aspects of the research problem. Preparation of tools was carried out over a period of three months including expert's opinions, validity, and reliability test.

Validity assurance purpose: tools were submitted to a jury of three experts from Faculty of Nursing Staff "two professors in pediatric nursing and one professor in adult health nursing ".

Protection of human rights: Nurses were informed about the privacy of their information, the study was voluntary, harmless, and anonymous and confidentiality of responses would be respected. Nurses had the full right to refuse to participate in the study at any time. A formal consent was obtained.

Pilot study: A pilot study was carried out on 6 nurses "10 %" of the sample in order to test the applicability of tools and clarity of the included questionnaire as well as to estimate the average time needed to fill questionnaire. Those who shared in the pilot study were excluded from the main study sample.

Reliability of the tools: Reliability test was done by applying the questionnaire to 10 nurses using test-retest and Pearson Coefficient factor was 90.8%. The scale was applied on them and retested after 2 weeks. The degree of Spearman's rank correlation coefficient test was 0.82.

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Data collection procedure:

Data collection was carried out over a period of six months starting from January 2015 to June 2015.

Program constructions:

Assessment phase: Nurses were assessed individually at the beginning of the study for their knowledge regarding concept of infection control, intervention in exposure to acupuncture, hand washing, Personal Protective Equipment (PPE), dealing with linen, dealing with waste, criteria of safety box, dealing with blood spots and methods of cleaning surface. In addition, their practices also were assessed regarding hand washing, Gloving, Masking, Gowning, Eye cover, Universal precautions as disposal of waste, management of sharps and caring of solid linen (pre test).

Program development: Based on the results obtained from pretest which determined the weak points of the nurses' knowledge and practices toward infection control. Nurse's needs were identified and program were prepared after reviewed by specialized staff in the pediatric nursing field and modified by the researcher's according to their comments and the related literature. The program utilized in the current study was available in several forms (booklet, handouts and pamphlets). It was provided to the nurses during the teaching sessions as a reference. The program instructions were written in Arabic language to be easy understood by the nurses.

Planning phase: This program was planned to be provided in two days. The first day for theoretical part and the second day for practical part.

Implementation phase: Program was implemented at the Neonatal Pediatric Intensive Care Unit (NICU) of both settings. A clear and simple explanation was offered to nurses about aim of the study and its expected outcomes. Nurses were divided into 10 groups, 6 nurses in each group. This Program was provided in 6 sessions (two sessions for theoretical part and four sessions for practical part). Time for each session was ranged from one - two hours. Sessions given in two days a week (Mondays and Tuesday) over a period of two and half months. Explanation of the program was started by the theoretical part (general knowledge about infection control) then followed by the practical part (hand washing, protective personal equipment, disposal of waste, management of sharps and caring for solid linen) which took place inside the unit. Time was opened for subjects to ask questions and receive the corresponding answers as well as to express their feedback toward the teaching sessions. Program booklet was given to each nurse as an educational reference during program implementation and self-learning references after program implementation. Suitable teaching aids were used for the program by distributing color pictures, handouts and pamphlets. Positive reinforcement was provided for nurses in the form of psychological recognition through saying good, excellent, nodding and reward.

Evaluation phase: Nurses' knowledge and practices were reassessed immediately after program implementation (post test). Reassessment for the retention was carried out three months later (follow up test).

Limitation of the study:

Many of the nurses were overloaded with their work, and there were many interruptions during the time of answering the questionnaires.

Data analysis:

Data were statistically analyzed by SPSS version 16. Percentage, mean scores, standard deviation and t-test and paired t test were used for parametric data. Pearson's Correlation analysis was used to show the strength and direction associated between the two quantitative variables. P value <0.05 is considered significant.

3. RESULTS

Table 1 and Figure 1 showed that the mean age of nurses was 28.31 ± 4.97 years, while 51.7% of them had Bachelor degree. In addition, 53.3% had less than 5 years of experience, and only 31.7 % of nurses had previous training in infection control.

Table 2 illustrated that, there was a highly statistically significant difference between nurse's knowledge and practice at pre, post and follow up program implementation for infection control.

Table 3 illustrated that there was a highly statistically significant differences between total mean score of nurse's knowledge at pre, post and follow up program implementation regarding infection control. Also, this table showed a

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better improvement of nurse's knowledge on posttest and follow up test after the intervention specifically regarding concept of infection control, hand washing and methods of cleaning surface (18.86± 1.43, 16.13± 2.31, 10.28± 0.73, 8.40± 0.94 and 12.88± 1.74, 10.25± 1.71 respectively);(P<0.001).

Table 4 demonstrated that a highly statistically significant difference between nurse's practice at pre, post and follow up implementation of the program specifically regarding hand washing and total practice score

(9.45±0.92, 8.05±0.74 and 29.93±2.42, 24.25±2.52 respectively); (P<0.001).

Figure 2 showed that there was a better improvement of nurse's knowledge and practice at pre, post and follow-up program implementation.

Table 5 showed a highly positive correlation between nurses' knowledge and their practice at pre, post and follow-up instructional program.

Table 6 showed that 86.7% of nurses agreed that insufficient knowledge of blood borne disease, feeling uncomfortable when wearing the protective equipment (gloves & mask), Lack of supplies (soap, alcohol, gloves, paper towel & disinfectant solutions) and safety box are the main barriers to compliance with universal precautions of infection control. On other hand, 88.3% of them were agreed with absence of punishment and inability to follow universal precautions is barriers to compliance with infection control.

Table 7 showed that highly statistically significance differences between nurse's knowledge and practice at pre, post, and follow-up instructional program regarding their level of education. Also, the same table indicated that statistically significance differences between nurses practice and their previous training in infection control (P<0.001).

Table (1): Socio-demographic characteristics of the studied nurses

Items	(n=60)	N0 %
Age Mean ± SD Range	28.31±4.97 20-39	
Educational level: Bachelor Technical institute	31 29	51.7 48.3
Experience (years): Mean ± SD Range	4.03±2.53 0-10	
<5	32	53.3
≥5	28	46.7
Previous training in infection control: No % Yes No	19 41	31.7 68.3
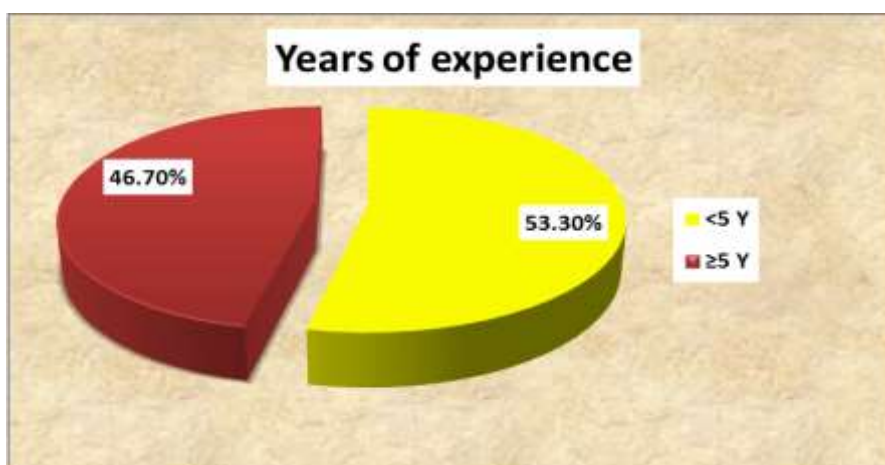
Figure (1) Nurses years of experience

Table (2): Number and percentage distribution of nurses knowledge and practice at pre, post and follow-up an instructional program

Items	Pre (I)		Post (II)		Follow-up(III)		χ^2	P value
	No	%	No	%	No	%		
-**Nurses knowledge:**								
Poor	60	100.0	0	0.0	13	21.7	120.0	I vs. II<0.001
Average	0	0.0	17	28.3	41	68.3	50.87	II vs.III<0.001
Good	0	0.0	43	71.7	6	10.0		
-**Nurses practices:**								
Satisfactory	5	8.3	60	100.0	55	91.7	101.54	I vs. II<0.001
Unsatisfactory	55	91.7	0	0.0	5	8.3	*5.22	II vs. III=0.028
Total	60	100	60	100	60	100		

*Fisher's exact

Table (3): Ccomparison between total mean scores of nurses knowledge at pre, post and follow-up an instructional program

Items of nurses knowledge	Pre (I)	Post (II)	Follow-up(III)	Paired t Test	P value
	Mean ± SD	Mean ± SD	Mean ± SD		
Concept of infection control.	7.78 ± 1.94	18.86 ± 1.43	16.13 ± 2.31	48.27 14.16	I vs. II<0.001 II vs. III<0.001
Intervention in exposure to acupuncture.	3.43 ± 0.92	6.68 ± 0.97	5.55 ± 0.92	37.04 15.49	I vs. II<0.001 II vs. III<0.001
Hand washing.	5.58 ± 1.23	10.28 ± 0.73	8.40 ± 0.94	27.88 16.85	I vs. II<0.001 II vs. III<0.001
Protective personal equipment.	2.90 ± 0.70	5.15 ± 0.65	4.13 ± 0.67	30.15 22.89	I vs. II<0.001 II vs. III<0.001
Dealing with linen.	2.65 ± 0.60	4.95 ± 0.59	3.80 ± 0.63	26.53 15.43	I vs. II<0.001 II vs. III<0.001
Dealing with waste.	3.38 ± 0.94	6.31 ± 0.59	5.23± 0.81	27.68 15.82	I vs. II<0.001 II vs. III<0.001
Criteria of safety box.	4.60 ± 0.99	8.28± 0.86	6.90± 0.83	26.38 16.73	I vs. II<0.001 II vs. III<0.001
Dealing with blood spots	3.88 ± 1.02	6.93± 0.89	5.80± 1.03	24.50 15.49	I vs. II<0.001 II vs. III<0.001
Method of cleaning surface.	6.40 ± 1.63	12.88± 1.74	10.25± 1.71	24.50 19.59	I vs. II<0.001 II vs. III<0.001
Total score.	39.93 ± 5.81	79.75± 5.83	65.60± 8.21	53.47 17.75	I vs. II<0.001 II vs. III<0.001

Table (4): Comparison between total mean scores of nurses practices at pre, post and follow-up an instructional program

Items of nurse practices	Pre (I)	Post (II)	Follow-up(III)	Paired t Test	P value
	Mean ± SD	Mean ± SD	Mean ± SD		
-**Hand washing.**	6.51 ± 1.39	9.45 ± 0.92	8.05 ± 0.74	20.60 15.63	I vs. II<0.001 II vs. III<0.001
-**Protective personal equipment:**					
• **Gloving**	2.40± 0.64	4.28 ± 0.55	3.40 ± 0.61	22.78 16.47	I vs. II<0.001 II vs. III<0.001
• **Masking**	1.40 ± 0.52	2.73 ± 0.44	2.05 ± 0.53	27.88 10.50	I vs. II<0.001 II vs. III<0.001
• **Gowning**	0.60 ± 0.49	1.0 ± 0.0	0.96 ± 0.18	4.89 1.42	I vs. II<0.001 II vs. III=0.159
• **Eye cover**	-	1.0 ± 0.0	0.58 ± 0.49	6.49	II vs. III<0.001
-**Universal precaution:**					

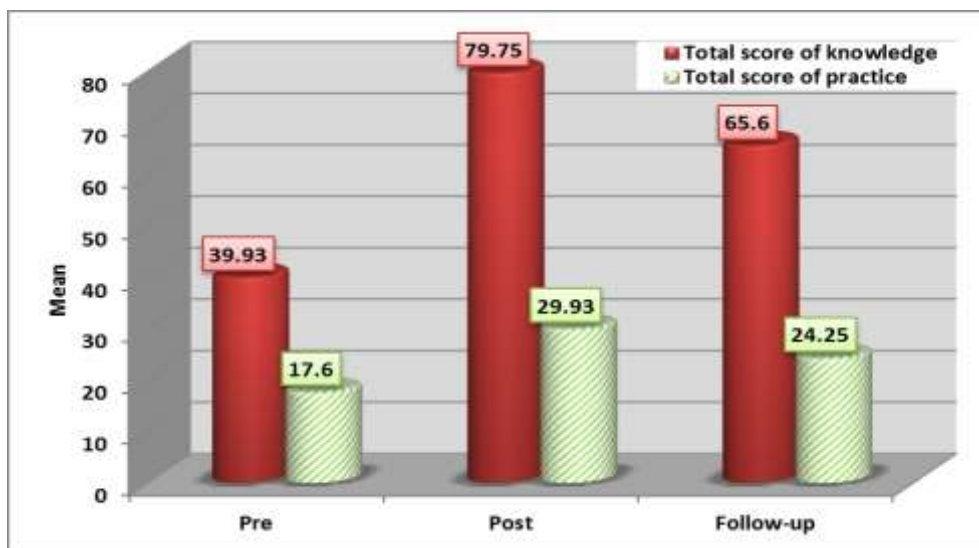|					
• **Disposal of waste.**	2.90 ± 0.65	5.20 ± 0.63	4.18 ± 0.56	28.78 27.09	I vs. II<0.001 II vs. III<0.001
• **Management of sharps.**	1.83± 0.41	2.98 ± 0.34	2.35 ± 0.48	20.04 9.44	I vs. II<0.001 II vs. III<0.001
• **Caring of solid linen.**	2.03 ± 0.48	3.36 ± 0.48	2.61 ± 0.64	21.72 12.25	I vs. II<0.001 II vs. III<0.001
Total score of practice	17.60 ± 3.21	29.93± 2.42	24.25± 2.52	34.85 27.33	I vs. II<0.001 II vs. III<0.001

Figure (2): Comparison between total mean scores of nurse's knowledge an practice at pre, post and follow-up an instructional program

Table (5): Pearson correlation between total mean scores of nurses knowledge and practice at pre, post and follow-up an instructional program

Practice	Knowledge					
	Pre		Post		Follow-up	
	r	P value	r	P value	r	P value
Pre	0.59	<0.001	-	-	-	-
Post	-	-	0.52	<0.001	-	-
Follow-up	-	-	-	-	0.50	<0.001

Table (6): Nurses opinions about barriers to compliance toward infection control.

Items	Agree		Disagree	
	No.	%	No.	%
I-Individual factors: Insufficient knowledge of blood borne disease.	52	86.7	8	13.3
Inadequate training.	47	78.3	13	21.7
Feeling uncomfortable with protective personal equipment.	52	86.7	8	13.3
II-Organization factors: Absence of follow-up.	45	75.0	15	25.0
Absence of punishment.	53	88.3	7	11.7
Work load.	47	78.3	13	21.7
III-Environmental factors: Unavailability of hand washing sink.	38	63.3	22	36.7
Lack of supplies.	52	86.7	8	13.3
Unavailability of booklet on infection control.	40	66.7	20	33.3
Inability to follow the universal precaution.	50	83.3	10	16.7

Table (7): Comparison between total mean scores of nurses knowledge and practice regarding their socio-demographic characteristics

Items	Total Knowledge score			Total Practice score		
	Pre	Post	Follow-up	Pre	Post	Follow-up
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
Education						
Bachelor.	42.25 ± 6.34	83.29 ± 6.34	68.83 ± 9.03	19.06 ± 2.97	31.19 ± 2.19	25.61 ± 1.89
Technical Institute.	37.44 ± 3.97	75.96 ± 4.70	62.13 ± 5.54	16.03 ± 2.71	28.58 ± 1.89	22.79 ± 2.30
P value	0.001	<0.001	0.001	0.001	0.001	<0.001
Experience						
<5 Y	38.53 ± 4.48	79.65 ± 5.91	64.71 ± 8.98	16.90 ± 3.32	29.21 ± 2.26	23.37 ± 2.40
≥5 Y	41.53 ± 6.77	79.85 ± 5.84	66.60 ± 7.26	18.39 ± 2.94	30.75 ± 2.38	25.25 ± 2.30
P value	0.052	0.896	0.379	0.074	0.013	0.003
Training						
Yes	42.31 ± 6.36	82.15 ± 6.27	67.68 ± 8.33	19.36 ± 2.79	31.26 ± 2.64	25.73 ± 2.60
No	38.82 ± 5.26	78.63 ± 5.33	64.63 ± 8.08	16.78 ± 3.09	29.31 ± 2.07	23.56 ± 2.19
P value	0.030	0.028	0.183	0.003	0.008	0.001

4. DISCUSSION

This study is a quasi experimental study which hypothesized that Nurses' knowledge and practices regarding the importance of universal precautions of infection control will be improved post program implementation. This study examined the effect of a designed instructional program on nurses compliance with universal precautions of Infection Control in the Neonatal Intensive Care Units. Accordingly, the significant findings of this study will be discussed. Therefore, the relationships between the instructional program and previously mentioned dependent variables will be the basis of discussion. However, the findings of this study will be discussed in terms of interpretations, agreement and disagreement with other studies and reasons for disagreements.

Regarding socio- demographic data of studied nurses, the result revealed that nurse's age were ranged between 20 to 39 years old. Such finding may be due to the unit nature, they prefer the newly graduate to work in the Neonatal Intensive Care Unit as they had the ability to acquire knowledge and change their behaviors based on submission of up to date knowledge. This finding came in line with Labrague, Rosales & Tizon (2012) who found in their study about "knowledge and compliance with standards precautions" that the mean age was slightly lesser. In this regards Alwutaib et al., (2012) revealed in their study about "Knowledge and attitude of the physicians and nurses regarding blood borne infections in primary health care" that older age is an important determinant of lower knowledge levels.

Moreover, more than half of them had bachelor degree (51.7%). This could be due to hospital policy as they prefer to hire highly qualified nurses in the NICU rather than other graduate to be able to carry up their responsibility. Also, more than half of them had less than 5 years of experience (53.3%).This short period may render them in experienced in dealing with neonates.

In addition, the result showed that less than one third of studied nurses (31.7 %) had previous training in infection control. This goes in the same line with Kable, Guest & McLeod (2011) who found in their study about "Organizational risk management and nurses' perceptions of workplace risk associated with sharps including needle stick injuries in nurses" that just less than one-third of their studied nurses attended in-service training courses about infection control. From the researcher's point of view attending continuing nursing education courses and training programs have the benefits of keeping nurses up-to-date and refining their practices especially in carrying out procedures that require strict aseptic techniques.

Concerning number and percentage distribution of nurses Knowledge and practice at pre, post and follow-up program implementation the result revealed that the majority had poor knowledge pre-program implementation (100%), while 71.7% had good knowledge after program implementation and more than two third had average knowledge at follow up test (68.3%). This finding came on the same line with Qayyum, Sattar & Waqas (2010) who found in their study about

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"Hospital acquired infections; Knowledge about it and its prevention" poor knowledge about infections control among their studied sample. However, contradicting findings were revealed by Ibrahim, Said & Hamdy (2011) who found in their study about" Assessment of infection control practices in neonatal intensive care unit" that the majority of their studied group aware with, what infection is, and how it is transmitted. Also, their knowledge decline in the follow-up test this may be due to knowledge retention.

Concerning their practice the study revealed that the majority had unsatisfactory level pre-program implementation. This may be due to working overload, nurses' carelessness, or ignorance about the importance of infection control as a major nursing role and improved tremendously to satisfactory level post program implementation (100%). This may be due to effectiveness of the training which indicates to what degree program objectives are met. This finding came in line with what Seada (2011) mentioned in his study about "the effect of the training program on nurses staff performance and empowerment in the emergency unit at El- Manial University Hospital", the study documented a significant increase in nurses mean scores of practice post training program.

Regarding mean scores of nurse's knowledge pre, post and follow-up program implementation. The study revealed that there is a better improvement in nurse's knowledge on post and follow up test acquainted especially with concept of infection control, hand washing and methods of cleaning surface. Such finding might be due to the effect of the instructional program. From researcher's point of view attending continuing nursing education courses will keep nurses knowledge up to date. In this regards Perry and Potter (2002) revealed that by understanding how infection is transmitted or spread, the nurse can intervene to prevent infections from developing.

In relation to mean scores of nurse's practice pre, post and follow-up program implementation. The result showed that there were highly statistical significant differences between pre, post and follow-up especially regarding hand washing and total practice score. Such finding may be due to effect of the training program. This finding came in line with what mentioned by Gould et al.,(2008) who found in a study on 'improving hand hygiene practices in patient care", that knowledge and compliance with hand washing increased following training. Similarly, Creedon (2005) found in his study about "Healthcare workers' hand decontamination practices: Compliance with recommended guidelines" that compliance with hand hygiene by health professionals increased from 51% to 83% following training program. In this regards Beder & Michel (2009) reported in their study about "Impact of university infection control intervention program for nurses" that the main cause of spread of infection in NICU is inadequate hand washing by the staff.

Also, the study shows a highly positive correlation between nurses' Knowledge and practice at pre, post and follow-up program implementation. This finding reflected that nurses 'performance is based on their knowledge. On the contrary, Chan (2009) reported in his study about "Nurses knowledge and compliance with universal precautions in an acute hospital" that no correlation between knowledge and practices of nurses. In other hand, Zatton (2012) mentioned in her study about" Assessment of knowledge and practice among nurses caring for patients with hepatitis" that there was a positive correlation between nurse's knowledge and practices. In this respect, Walsh (2010) emphasized on the fact that correct theoretical knowledge of under lying principles of the action is essential before practice has no effect.

Concerning Nurses opinions regarding barriers to compliance with infection control. Nurses attributed their lack of adherence to infection control and standard precautions to their lack of knowledge about blood borne disease, feeling uncomfortable when wearing the protective equipment (gloves- mask), Lack of supplies (soap, alcohol, gloves, paper towel, disinfectant solutions), safety box, absence of punishment, shortage of nursing staff as compared to workload; and difficulty of frequent hand washing after each intervention. This finding is in agreement with what of Ibrahim, Said & Hamdy (2011) mentioned in their study about "assessed infection control practices in a neonatal intensive care unit" that emphasis must be directed towered the importance of compliance to infection control standards to reduce hospital neonatal morbidity and mortality. The same authors attributed lack of compliance to infection control standards to lack of knowledge about standard procedures of infection control; poor design of the intensive care unit; high work load; lack of sustainable resources and arrangements; time of contacts (daytime or night shift); and lack of training and constructive supervision. Therefore, efforts are needed to correct unacceptable nurses' performance, especially where certain mismatching was noticed between what nurses know and what they actually do in the current study.

In relation to the total mean scores of nurse's knowledge and practice regarding their socio-demographic characteristics. The current study found that there was a highly statistical significant difference between nurse's knowledge, practices and

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their socio demographic data (level of education and previous training). This reflects the need for enhancing knowledge of all nursing qualification categories, and could emphasis the need for continuous training programs about infection control to facilitate adherence to infection control measures. In this regards Royal Collage of Nursing,(2012) emphasized that work places should have written policies about methods of utilizing standard precautions of infection control in order to provide guidance on all aspects of critically ill children care. As well, continuing education regardless of age can significantly improve infection control practices and reduces rates of infection. These findings are agreed with Youssef (2011) who found in a study done about "Nosocomial infection and fever of unknown origin in pediatric Hematology/ oncology unit" that there was highly significant relation between staff qualification knowledge and practices. On the contrary, Serag (2008) mentioned in a study done about "Impact of designed training program on nurses' knowledge, practice and on patient outcome at the ICU" that there is no relation between knowledge and practices of nurses.

5. CONCLUSION

 Based on the results of this study and research hypothesis, it concluded that, Implementation of instructional program for nurses improved their knowledge and practice toward compliance with universal precautions of infection control in neonatal intensive care unit.

6. RECOMMENDATIONS

Based on the findings of the current study, the following recommendations can be suggested:

1-Inservice educational and training programs about infection control for nurses should be conducted on regular basis to improve their knowledge and practice.

2-Written standard universal precautions guidelines for infection control should be available in NICU and should be updated periodically to suite the new trends.

3-All supplies and equipment needed for infection control should be available in NICU.

4-For generalizability purpose, the study should be conducted on large sample and in various setting.

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