

Effect of Educational program on Nurses' Knowledge and Practice Regarding Occupational Safety Strategies for Controlling Blood-Borne Infection in Pediatric Critical Care Units

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Abstract

Background: Blood Borne Pathogens (BBP) pose a significant infectious hazards for nurses, leading to unwanted health consequences and psychological stress. **The aim of the study** was to measure the effect of educational program on nurses' knowledge and practice regarding occupational safety strategies for controlling blood-borne infection in pediatric critical care units. **Research Design:** A quasi-experimental design was utilized. **Study settings:** The study was conducted at Neonatal Intensive Care Unit (NICU), Pediatric Intensive Care Unit (PICU), Pediatric Surgical Unit (PSU), and Pediatric Department Unit (PDU) in the children's hospital affiliated to Ain Shams University Hospitals. **The research Subject** included 60 nurses who were chosen by a simple random sample working in the previously mentioned settings. **Tools of the data collection:** A predesigned questionnaire sheet, concerned with nurses' characteristics and nurses' knowledge regarding blood-borne diseases (pre & post-test), Observational Checklists were used pre and post educational program fulfillment **Results:** The findings of the current study revealed that there was a statistically significant difference between nurses' knowledge and practice pre and post the educational program fulfillment for controlling blood- borne infection. **Conclusion:** The present study concluded that the fulfillment of the educational program regarding occupational safety strategies had a significant effect on the improvement of studied nurses' knowledge and practice for controlling the blood-borne infection. **Recommendation:** It could be recommended that further studies emphasize on fulfillment of educational program regarding occupational safety strategies for controlling blood-borne infection in different pediatric settings.

Keywords: Occupational Safety Strategies, Blood-Borne Infection, Pediatric Critical Care Units

Introduction

A blood-borne disease is spread through direct contact with contaminated blood and other body fluids. Three blood-borne pathogens are cited as of primary concern to health team members mainly nurses that include [Hepatitis B Virus (HBV), Hepatitis C Virus (HCV), and Human Immunodeficiency Virus (HIV)] (National Institute for Occupational Safety and Health, 2020).

Occupational safety strategies help to prevent environmental and occupational exposures to infection and subsequent diseases, that include elimination of the use of needle devices to reduce blood borne diseases transmitted via needle stick injuries, avoiding recapping needles that could be contaminated, and providing sharps containers to immediately place needles in after use. For instance, using safer sharps devices can prevent almost 83% of

injuries from hollow bores (El Ashmawy, 2017).

Following occupational safety strategies in the form of standard precautions helps in preventing the spread of blood-borne pathogens and other diseases. Standard precautions include using personal protective equipment through using disposable gloves during providing care and changing gloves when providing care to a new pediatric patient (The American National Red Cross, 2017).

Universal precautions are a set of guidelines that aim to protect laboratory worker and other Health Care Worker (HCWS) especially the nurses from blood-borne infections (Obeagu, et al., 2018).

Preventive measures for occupational exposure to blood-borne infection include standard precautions such as hand washing and sharp disposal containers, moreover, additional education leads to reducing the occupational

exposure to blood-borne disease (Arafa, et al., 2016) (National Institute for Occupational Safety and Health, 2017).

Nursing staff needs to yearly continue training education in different health care settings, moreover, blood-borne pathogens are always a topic for coverage. It serves as a reminder to established staff and an educational tool about the severity of infectious diseases and the means necessary to protect staff in a health care setting (Hunter, 2017).

Significance of the study:

Pediatric nurses must understand the mechanisms and pathways of exposure to environmental risk factors, basic prevention and control strategies, the nature of the effective intervention, and the role of research and advocacy. Pediatric nurses' activities in the three levels of prevention strategies are expected to assume an even more important role in the prevention and treatment of disease (Henderson et al., 2010).

Aim of the study

The aim of the study was to measure the effect of educational program on nurses' knowledge and practice regarding occupational safety strategies for controlling blood-borne infection in pediatric critical care units. This aim was achieved through:

- Assessing knowledge and practice of nurses regarding occupational safety strategies for controlling blood-borne infection in pediatric critical care units.
- Designing and implementing the educational program for studied nurses regarding occupational safety strategies for controlling blood-borne infection in pediatric critical care units.
- Measuring the effect of educational program on nurses' knowledge and practice regarding occupational safety strategies for controlling blood-borne infection in pediatric critical care units.

Research Hypothesis

The educational program has a positive effect on nurses' knowledge and practice regarding occupational safety strategies for controlling

blood-borne infection in pediatric critical care units.

Technical Design: It included research design, settings, subject, and tools for data collection.

Subject and Methods

Research design:

A quasi-experimental design (pretest – posttest) was utilized in conducting this study.

Settings:

This study was conducted at the neonatal intensive care unit (NICU), pediatric intensive care unit (PICU), pediatric surgical unit (PSU), and pediatric department unit (PDU) in children's hospital affiliated to Ain Shams University Hospitals.

Research subject:

The sample included 60 nurses were chosen by simple random sample working in the previously mentioned settings, 15 nurses from each setting.

Sample size: the following assumption of Power Analysis to define sample size.

$$n = \frac{t^2 \times P(P-1)}{m^2}$$

n = the required sample size.

t = the confidence level at 95% (standard value of 1.96).

p = estimated number of nurses in the previously mentioned settings.

m = the margin of error at 5% (standard value of 0.05).

Tools for data collection:

Data was collected through the following two tools:

Tool I: A predesigned Interviewing Questionnaire Sheet :(pre & posttest)

It was written in simple Arabic language to suit the nurses' categories by the researcher after reviewing related literature and it consists of the following 2 parts:

Part 1: It is concerned with nurses' characteristics including age, qualification, occupation, years of experience, and attendance of training courses.

Part 2: It is related to nurses' knowledge regarding blood-borne diseases (definition, types, and route of transmission, etiology, prevention and management, infection control standard precautions). Scoring System: Knowledge consisted of 35 items that were checked either Satisfactory or Unsatisfactory. The total score was 70 degrees as the following; Satisfactory = 2 score, Un Satisfactory = 1score, The sum of scores of each of the previous items as Satisfactory score for knowledge $\geq 65\%$. and Unsatisfactory score for knowledge $< 65\%$.

Tool II. Observational Checklist: It was adopted from the Ministry of Health and Population (MOH) especially during performing the invasive procedures or direct contact with blood or any bodily fluids and assesses unsafe conditions and practices within the work environment. The checklist was consisted of Accreditation Standards, (2005) and used to assess nurses' practice for the application of infection control standard precautions of 45 items which were checked correctly done, incorrectly done, and not done, as the following: Correctly done = 2 score., Incorrectly done = 1score, not done=0, the total score was (90 degree) equal 100% classified as: Competent $\geq 95\%$ and Incompetent $< 95\%$.

Operational Design: It included the preparatory phase, Ethical consideration, Pilot study, and fieldwork

Preparatory phase:

This phase included reviewing literature related to nurses' knowledge about blood-borne diseases and standard precautions for infection control. This served to develop and selected the study tools for data collection. During this phase, the researchers also visited the selected places to be acquainted with the personnel and the study settings.

Ethical consideration:

Informed consent was obtained from nurses before data collection, the nurses were informed about the purpose and the expected outcomes of the study, and they were assured that the study is harmless and their

participation is voluntary and they have the right wither to continue with the study or to withdraw it at any time. They were also assured that anonymity and confidentiality will be guaranteed, as well the collected data will be used for the research purpose only. Ethics, values, culture, and beliefs were respected.

A pilot study included 10% of the nurses (6 nurses) to test the applicability and feasibility of the study tools. Regarding modifications of the pilot study results, nurses included in the pilot study were excluded from the main study sample.

Validity and reliability

The nurse's assessment tool was submitted to a panel of five experts in the field of pediatric nursing to examine the content validity (covering, clarity, wording, length, format, and overall appearance). A minor modification was performed as a valid and reliable professional tool (Cronbach alpha was 0.84).

Fieldwork:

The actual fieldwork was conducted over 6 months from the beginning of Julie to the end of December 2019. The researcher was available in the study settings for 2 days/a week in each setting, two days in the afternoon shift (Monday and Wednesday) and another two days in the morning shift (Saturday and Thursday). the actual fieldwork was divided into four phases:

Assessment phase: (six weeks)

In this phase, the researchers were using the constructed tools to collect nurses' knowledge regarding the hierarchy of control for blood-borne disease prevention. (Pre-test), the aim of the study and its expectations were explained by the researchers to the studied nurses before starting interviewing and data collection. The pre-designed questionnaire was filled in by the nurses. The time needed to fill in the questionnaire depended on nurses' knowledge, the average time ranged between 15-20 minutes. The observational checklist was filled in by the researchers, in the nurses' workplace, during applying the care to the children in the previously mentioned settings. The time needed to fill in the checklist

depended on the time of the procedure, each procedure time ranged between 10 to 20 minutes.

Planning phase: (four weeks)

The collected data pre-assessment was analyzed to elect the nurse's training needs then the educational program was designed by the researcher in the Arabic language in the light of the literature review. It was revised and organized and the content of the guidelines was prepared according to nurses' educational needs. It is related to nurses' knowledge regarding the hierarchy of control for blood-borne diseases (definition, types, and route of transmission, etiology, prevention and management, infection control standard precautions, and occupational safety strategies for controlling the blood-borne infection. The practical aspects of the educational program included; nurses' practice for prevention of infection through control standard precautions and implementation the occupational safety strategies based on the baseline assessment (pretest).

Implementation phase: (ten weeks)

This phase consumed 10 weeks, four days per week (morning and afternoon shifts), to implement the educational program. The researchers inspected the roster of nurses to identify the number of nurses in each shift. Studied nurses were classified into 10 groups, each group involved 6 nurses. The educational program was applied in 40 sessions (4 sessions for each group, 1 session for theory & 3 sessions for practice). Each session ranged from 45 to 60 minutes. In the beginning, an introduction about the importance of the educational program was done, and the researchers used group discussions with the studied nurses to cover the theoretical aspects of the educational program related to blood-borne diseases. Different methods of teaching were used as group discussion, demonstration, and re demonstration. Suitable media was used such as; real equipment, posters, and guidelines.

Evaluation phase (four weeks)

The same tools were used immediately post fulfillment of the educational program for all studied nurses as an indicator to determine the level of enhancement.

Administrative Design:

An official permission to conduct the study was sustained through an issued letter from the Dean of the Faculty of Nursing, Ain Shams University, to the medical and nursing directors of the previously mentioned study settings to obtain their approval to conduct the study.

Data analysis

The collected data were organized, revised, scored, tabulated, and analyzed using the number and percentage distribution. Statistical analysis was done through the computer using the Statistical Package for Social Sciences (SPSS) version 18. Qualitative variables were compared using Chi-square (X²) test and quantitative variables were compared using the Pearson correlation coefficient (r). The significance of the results was considered as follows: When $p > 0.05$: it is a statistically insignificant difference; while $p < 0.05$ or $p < 0.001$: it is a statistically significant difference

Result

Table (1): As observed from this table, the mean age of the studied nurses was 35.4 ± 8.43 , 71.67%, and 41.67% of them are female and have diplomas in nursing respectively. Moreover, the mean years of experience are $.67 \pm 2.92$.

Figure (1): This figure reveals that 48% of the studied nurses attended previous training courses related to infection control while only 20% of them attended courses about Hepatitis B and AIDS diseases (15%, 12%) respectively.

Table (2): This table shows that there were statistically significant differences between the studied nurses' knowledge of pre- and post-educational program at

($p = 0.002$).

Table (3): This table reveals that the studied nurses have satisfactory knowledge regarding their Perceived Knowledge of Infection Control measures in PCCU after fulfillment of the educational program, there is a highly statistically significant difference ($p < 0.001$).

Figure (2): This figure shows that there is marked improvement in nurses' knowledge after fulfillment of the educational program, with a highly statistically significant difference at ($p < 0.001^{**}$).

Table (4): As noticed in this table, there was marked improvement in nurses' practice immediately after fulfillment of the educational Program compared to before intervention with a highly statistically significant difference at ($p < 0.001^{**}$) in relation to universal safety precaution measures in PCCUs.

Table (5): In relation to nurses' practice related to precaution of safety injection in PCCUs, it was clear from this table that, there is a marked

improvement in all items of nurses' practice after fulfillment of the Educational Program, with a highly statistically significant difference at ($p < 0.001$).

Table (6): It is observed from this table that, there is marked improvement in total nurses' practice regarding blood-borne diseases controlling in PCCUs, after fulfillment of the educational program with a highly statistically significant difference with Chi-square test = 16.116 & $p < 0.001$.

Table (7): This table illustrated that there is a positive correlation between total nurses' knowledge and their total practice regarding blood-borne disease control.

Table (1): Distribution of studied nurses according to their characteristics

Items	Total number	
	No = 60	100%
Age in years		
< 20	11	18.33
20 < 40	36	60
≥ 40	13	21.67
X ± SD	35.4 ± 8.43	
Gender		
Male	17	28.33
Female	43	71.67
Qualification:		
Diploma School	25	41.67
Technical Ng Diploma	17	28.33
Bachelor	15	25
Postgraduate studies	3	5
Occupation:		
Staff Nurse	46	76.67
Head Nurse	14	23.33
Experience (years):		
< 5	13	21.67
5 < 10	39	65
≥ 10	8	13.33
X ± SD	7.67 ± 2.92	

Figure (1): Distribution of Studied Nurses according to their Attendance of Training Courses

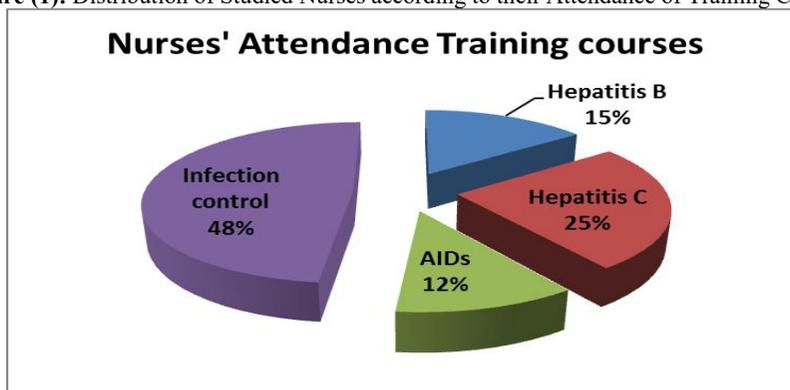


Table (2): Distribution of the Studied Nurses’ knowledge regarding the diseases transmitted through blood in PCCUs.

Items	Total number = 60 (%100)							
	Before Educational program				After Educational program			
	Unsatisfactory		Satisfactory		Unsatisfactory		Satisfactory	
	NO	%	NO	%	NO	%	NO	%
- Diseases transmitted through blood	45	75	15	25	10	16.67	50	83.33
- Factor leading to infection	55	91.67	5	8.33	14	23.33	46	76.67
- Breaking the chain of infection	33	55	27	45	24	40	36	60
- Precaution in case of infective child	44	73.33	16	26.67	7	11.67	53	88.33
Chi-square test	26.5439							
P value	0.002 **							

Table (3): Distribution of the studied Nurses regarding their Perceived Knowledge of Infection Control measures in PCCU.

Items	Total number = 60 (%100)							
	Before educational program				After educational program			
	Unsatisfactory		Satisfactory		Unsatisfactory		Satisfactory	
	NO	%	NO	%	NO	%	NO	%
- Hand Washing	39	65	21	35	6	10	54	88.9
- Aseptic Technique	44	73.33	16	26.67	7	11.67	53	86.67
- Disposal of waste product	54	90	6	10	9	15	51	85
- Isolation precautions	34	56.67	26	43.33	10	16.67	50	83.33
- Protective equipment for professional risks	44	73.33	16	26.67	13	21.67	47	78.33
- Protective equipment for dealing with blood	16	26.67	44	73.33	2	3.33	58	96.67
- Waste Disposal	48	80	12	20	10	16.67	50	83.33
Chi-square test	63.699							
P value	<0.001**							

Figure (2): Percentage Distribution of studied Nurses according to their Total knowledge Regarding blood-borne diseases controlled in PCCUs Before and After the educational Program.

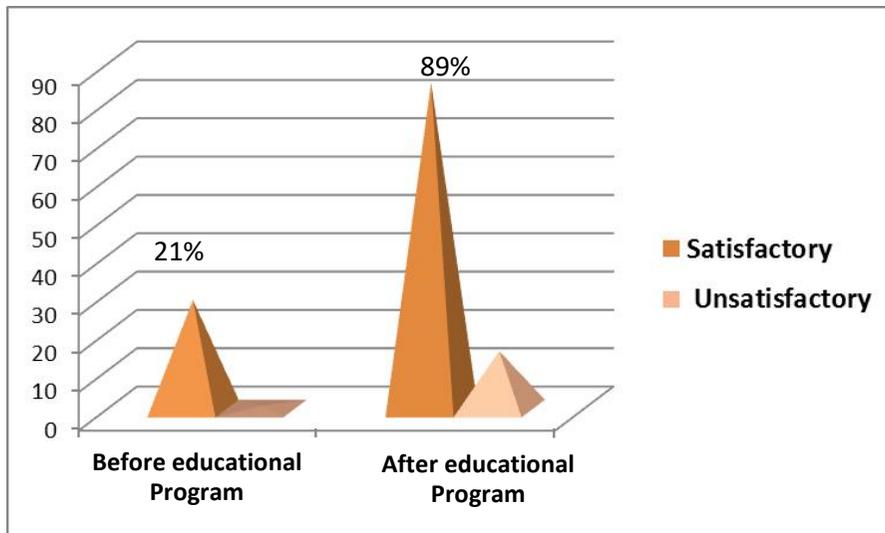


Table (4): Distribution of studied Nurses' practice related to universal safety precautions measures in PCCUs.

Items	Total number = 60 (%100)							
	Before educational program				After educational program			
	Competent		Incompetent		Competent		Incompetent	
	NO	%	NO	%	NO	%	NO	%
- Hand washing after PPE removal	6	10	54	90	48	80.0	12	20.0
- Wear gloves	10	33.33	40	66.67	51	85	9	15
- Wear gown	3	5	57	95	29	48.33	31	51.67
- Wear Facial protection	7	11.67	53	88.33	33	55	27	45
- Wear Mask	17	28.33	43	71.67	39	65	21	35
Chi-square test	38.46							
P value	<0.001**							

Table (5): Distribution of Studied Nurses' practice Related to Precaution of Safety Injection in PCCU.

Items	Total number = 60 (%100)							
	Before Educational program				After Educational program			
	Competent		Incompetent		Competent		Incompetence	
	NO	%	NO	%	NO	%	NO	%
- Wash hands	20	20	48	80	50	83.33	10	16.67
- Needle for one pediatric patient	54	90	6	10	58	96.67	2	3.33
- Disinfecting rubber septum	8	13.33	52	86.67	51	85	9	15
- New needle for Vial	3	5	57	95	53	88.33	7	11.67
- Single dose for one pediatric patient	6	10	54	90	56	93.33	4	6.67
- Tubing for one pediatric patient	55	91.67	5	8.33	57	95	3	5
Chi-square test	170.982							
P value	<0.001 **							

Table (6): Distribution of Studied Nurses According to their Total Practices Regarding blood-borne diseases controlled in PCCU.

Nurse's Total practice	Total number = 60 (%100)			
	Before Educational program		After Educational program	
	No.	%	No.	%
- Competent	15	25	36	60
- Incompetent	45	75	24	40
Chi-square test	16.116			
P value	<0.001 **			

Table (7): Correlation between Studied Nurses' Total Knowledge and their Total Practice regarding blood-borne diseases controlling.

Nurse's Total practice Score	Nurse's Total Knowledge = 60(%100)			
	Satisfactory (n=51)		Unsatisfactory (n=9)	
	No.	%	No.	%
- Competent (n=41)68.33%	40	78.43%	1	11.11%
- Incompetent (19)31.67%	11	21.57%	8	88.89%
R	0.712			
P value	0.003 *			

Discussion

Concerning characteristics of studied nurses, the results of the current study revealed that, three-fifths of the studied nurses were at the age group 20 to less than 40 years, with a mean age of 35.4 ± 8.43 years, more than two thirds and more than two-fifths of them were female and had a diploma in nursing

respectively. Moreover, nearly two-thirds of them had less than 10 years of experience.

In the same context *El-Shafey, et al., (2019)*, showed that one-third of the studied nurses were at the age group 25 to < 30 years, and less than half of them had nursing school diploma and had less than 10 years of experience. On the other side line *Sadawy, et al., (2014)*, found that the age of all studied

nurses was 25 to < 30, and more than half of them had a nursing diploma, also nearly half of them had less than 10 years of experience.

Regarding the attendance of training courses, findings of the current study illustrated that nearly half of the nurses attended previous training courses related to infection control while only less than one-fifth of them attend courses about Hepatitis B and AIDS diseases. These results were parallel with El-Shafey, et al., (2019), who mentioned that more than two-fifths of the studied subjects attended training program about infection control.

Concerning studied nurses' knowledge, there were statistically significant differences between the studied nurses' knowledge pre- and post-educational program regarding the diseases transmitted through blood in PCCUs at ($p=0.002$). These results were supported by the results of *Swetharani, (2016)*, who proved that more than half of the studied nurses had awareness about diseases transmitted through blood including HIV and hepatitis B as a result of awareness programs conducted in the hospital. In the same line, *Benjamin, (2012)*, stated that the successful prevention strategies of viral infections require a high level of awareness of the infected individuals as a detailed knowledge among healthcare professionals.

The current study showed that more than one-third of the nurses had satisfactory knowledge about hand washing before the program, this finding was improved in knowledge after program fulfillment to be most of them. This result was in agreement with *Saleh, (2008)*, who found that despite, the wide spread of knowledge about the importance of hand washing among most nurses who had a satisfactory level of knowledge regarding hand washing; it was not practiced by most of them. Regarding standard precautions, it was observed from the current study, that less than one-fifth had satisfactory knowledge before the program, compared with improved knowledge of the studied nurses to be the majority of them with satisfactory knowledge after program fulfillment. This result was in agreement with *Sreedharan, (2011)*, who reported that more than two-fifths of studied nurses agreed that standard precautions (SP) are protective of the

health of HCWs and patients. This result is conformable to *Abd-Alla, (2008)*, who found that inadequate practices related to standard precautions of infection control could be due to a lack of nurses' awareness of the importance of infection control and safe health practice.

As regards total nurses' knowledge about infection control measures in PCCUs, it was observed that there were marked improvements in nurses' knowledge after fulfillment of the educational program, with a highly statistically significant difference at ($p<0.001^{**}$). This finding is supported by *Hamid, et al., (2019)*, who reported excellent knowledge but rather poor compliance with the practice of infection control measures and standard precautions. **The U.S. Centers for Disease Control and Prevention (CDC)** emphasizes the need for healthcare workers (HCWs) especially nurses to have sound Knowledge of Healthcare-associated infections (HAIs) and their different types to ensure adequate prevention and control.

About universal safety precaution measures in PCCU., there was marked improvement in nurses' practice immediately after fulfillment of the educational Program for all items compared to before intervention with a highly statistically significant difference at ($p < 0.001^{**}$). These results were parallel with *El-Shafey et al., (2019)*, who mentioned that more than two-thirds of the nurses had adequate practice scores about wearing mask steps after fulfillment of the program. In the same context *El-Shafey et al., (2019)*, revealed that significant enhancement immediately after the intervention and at follow-up related to hand washing, gloving, gowning, and masking.

This finding was compatible with *Hasnaa, et al., (2018)*, who reported that the health care workers showed good understanding regarding disposal of sharps, and the use of masks and gowns. In the same context, *Parmeggiani, et al., (2010)*, mentioned that Nurses had higher knowledge, perceived risk, and appropriate health care-associated infections (HAIs) control measures than physicians and healthcare workers (HCWs), and all nurses answered correctly and used appropriately control measures after receiving information from educational courses and scientific journals.

In relation to nurses' practice related to the precaution of safety injection in PCCUs, the findings of the current study cleared that, there was a marked improvement in all items of nurses' practice after fulfillment of the educational program, with a highly statistically significant difference at ($p < 0.001$). These results are supported by the results of *Yeshitila, et al., (2015)*, who reported that the one-year self-reported prevalence of injury from needle sticks was 62.8%. These findings were in accordance with the findings of *Sharma, (2010)*, who reported that large percentage of Health Care Workers (HCW) reported having had one or more incidents related to needle stick injuries in their career. More than half ascribed fatigue as a cause of their injury. Most of the injuries occurred during recapping. In response to their most recent needle stick injuries, three-fifths washed the site of injury with water and soap while one-fifth did nothing. Only a few of the HCWs took post-exposure prophylaxis (PEP) against HIV/AIDS after their injury.

As regards total nurses' practice regarding blood-borne diseases controlling in PCCUs, it was observed that there was marked improvement after fulfillment of the educational program with a highly statistically significant difference with Chi-square test = 16.116 & $p < 0.001$. The studied nurses had unsatisfactory practice regarding infection control before fulfillment of the educational program. This may be due to a lack of facilities, guidance, reinforcement, and inadequate training educational program about infection control.

Concerning the correlation between studied nurses' total practices and their total knowledge, the findings of the study current showed that there was a positive correlation regarding blood-borne infection control. In the same line *Abolwafa et al., (2013)*, stated that an improvement among the majority of nurses' knowledge and practice occurred after fulfillment of the educational program about infection control.

Conclusion

The present study concluded that the fulfillment of the educational program regarding occupational safety strategies had a significant effect on the improvement of studied nurses' knowledge and practice for controlling

blood-borne infection, with a positive correlation between studied nurses' total practices and their total knowledge regarding blood-borne infection controlling.

Recommendation

Based on the study results, the following recommendations are proposed:

- Performed routinely training program regarding occupational safety strategies for controlling blood-borne infection in current study settings.
- Further studies emphasize on fulfillment of educational program regarding occupational safety strategies for controlling blood-borne infection in different pediatric settings.

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