Original Article **Egyptian Journal of Health Care, 2019 EJHC Vol.10No.3**

Effect of a Blood-Borne Diseases Prevention Program on Nurses' Performance in Pediatric Critical Care Units

Radia Abd El Satter, Iman Ibrahim Abd Al-Moniem, Mediha Amin Morsy
Pediatric Nursing Department, Faculty of Nursing - Ain Shams University- Cairo- Egypt

ABSTRACT

Background: Prevention of percutaneous injuries and other blood exposures is an important step in preventing the transmission of blood-borne viruses to healthcare personnel. **Aim of Study** was to assess the effect of a prevention program for blood-borne diseases on nurses' performance for infection control standard precautions. **Research Design**: A quasi-experimental design was utilized. **Study settings**: the study conducted at Critical area (Neonatal Intensive Care Unit, Pediatric Intensive Care Unit in Children's Hospital affiliated to Ain Shams University Hospitals. **Research Subject**: included 45 nurses selected by simple random sample working in the previously mentioned settings. **Tools of the data collection**: A predesigned questionnaire sheet, Observational Checklists were used pre and post program implementation **Results**: revealed that there was a statistical significant difference between nurses' performance pre and post program for blood-born diseases. **Conclusion** a prevention program for blood-borne diseases had significant effect on nurses' performance for infection control. **Recommendation** it could be recommended that implement the designed prevention program for blood-borne diseases to all nursing staff in all pediatric settings.

Key words: Pathogen; Infection control; Standard Precautions

Introduction

A blood-borne disease is one that can be spread through contamination by blood and other body fluids. The most common examples are the Human Immunodeficiency Virus (HIV), hepatitis B virus (HBV), hepatitis C virus (HCV), and Viral Hemorrhagic Fevers (VHFs). Diseases that are not usually transmitted directly by blood contact, but rather by insect or other vector, are more usefully classified as vector-borne disease, even though the causative agent can be found in blood **(Encyclopedia, 2016 A).**

Many blood-borne diseases can also be contracted by other means, including high-risk sexual behavior or intravenous (IV) drug use. These diseases have also been identified in sports medicine. Blood and Body Fluid precautions are a type of infection control practice that seeks to minimize this sort of disease transmission. Blood poses the greatest threat to health in a laboratory or clinical setting due to needle-stick injuries (e.g., lack of proper needle disposal techniques and/or safety syringes). Blood for blood transfusion is screened for many blood-borne diseases. Needle exchange programs are an attempt to reduce the spread of blood-borne diseases between IV drug users **(Goodrich et al., 2006; Jason & Donald, 2007; Goodrich et al., 2009 and Encyclopedia, 2016A).**

Prevalence of HIV/Acquired Immune Deficiency Syndrome (HIV/AIDS) in Egypt

is low – ranging from 2, 900 to 13, 000 individuals. Most reported HIV cases are transmitted through unprotected heterosexual sex. 90% of Egyptian women who live with HIV were infected within marriage. Girls and women are particularly vulnerable to HIV as societal norms in Egypt can hinder them from accessing information about sexuality (United Nations International Children's Emergency Fund **[UNICEF], 2015).**

Surveys of healthcare personnel indicate that 50% or more do not report their occupational percutaneous injuries (CDC, 2015). The Centers for Disease Control and Prevention (CDC) estimated that between 800, 000 and 1 million needle-sticks and other sharps injuries occur each year in the United States (U.S). However, these injuries tend to be dramatically underreported, by anywhere from 40 to 70% **(The National Institute for Occupational Safety and Health [NIOSH], 2015).**

Pediatric nurses must understand the mechanisms and pathway of exposure to environmental health hazards, basic prevention and control strategies, the interdisciplinary nature of effective intervention and the role of research and advocacy. Pediatric nurses' activities in primary, secondary, and tertiary prevention strategies are expected to assume an even more important role in the prevention and treatment of disease in the future **(Lundy & Jeans, 2012).**

Significance of the study:

Hepatitis B is now preventable due to the vaccine that must be offered to health care workers and is given to children at birth. Following regulatory and legislative efforts, including the Occupational Safety and Health Administration (OSHA) Blood-borne Pathogens Standard, cases of hepatitis B in health care nurses dropped from 17, 000 annually to 400 annually–and Continue to drop (transmission rate: 2–40 %) **(Moyer & Hodgson, 2014).**

Hepatitis B vaccination should be administered to adults in the deltoid muscle. Antibody response may be measured by anti-HBs levels 1 to 3 months after completing the basic course of vaccine, but this testing is not routine and not currently recommended. People at high risk, including nurses and other health care personnel exposed to blood or blood products, should receive active immunization **(Smeltzer et al., 2015).** The pediatric nurse emphasizes the importance of keeping follow-up appointments and participating in other health promotion activities and recommended health screenings (World Health Organization **[WHO], 2016).**

Aim of the study:

The Aim of this study is to assess the effect of a prevention program for blood-borne diseases on nurses' performance for infection control standard precautions through:

*Assessing nurses' performance toward infection control standard precautions for blood-borne diseases.

*Designing, implementing and evaluating the effect of a prevention program for blood-borne diseases on nurses' performance for infection control standard precautions.

Research Hypothesis

There will be a statistical significant difference between nurses' performance pre and post program for blood-borne diseases.

Subjects:

A simple random sample included 45 nurses selected by simple random sample working in the previously mentioned settings (5 nurses in PDU, 15 nurses in PSU, 15 nurses in NICU, 10 nurses in PICU).
Data were collected by using the following tools:

Tool: A predesigned Interviewing Questionnaire Sheet:

It was developed by the researcher after reviewing related literature and it was written in simple Arabic language to suit the nurses' categories.

❖ **Scoring System**

Knowledge consisted of 35 items which were checked either Satisfactory or Unsatisfactory. The total score was 70 degree as the following;

- Satisfactory = 2 score.
- Un Satisfactory = 1score.

The sum of scores of each of the previous items as:

- Satisfactory score for knowledge > 65%.
-Unsatisfactory score for knowledge< 65%.

Design program:

The program was designed by the researcher, revised and modified by supervisors based on extensive review of related literature. The content was prepared according to nurses' knowledge and performance. So the program was contained the following four phases:

1- Assessment Phases: This phase was assessing the nurses' Performance (baseline assessment) standard precautions for infection control such as (hand washing, wearing gloves, masks, gowns, patient care equipment, proper sharps disposal, wound care, invasive procedure).

2- Planning Phase: The aim of this phase include designing a prevention program for blood-borne diseases on nurses' performance for infection control standard precautions based on the baseline assessment (pretest). Implementation Phase: Implementation of program content through number of sessions.

3- Evaluation Phase: After the completion of the program content, the post test was done immediately after implementation of the program by using the same pretest format to assess the effect of a prevention program for blood-borne diseases on nurses' performance for infection control standard precautions.

The same tools was applied twice pre and post implementation of the program. Tools will be validated by five experts in the pediatric medicine and nursing field and the final form of tool will be obtained

Field work:

The actual field work started from October 2013 up to the end of September 2014. The researcher was available in the study setting 2 days/week in each setting, two days in the afternoon shift (Monday and Wednesday) and another two days in the morning shift (Saturday and Thursday). At the beginning the researcher individually interviewing the nurses at the previously mentioned setting, introduced herself, explained the aim of the study and gave clear and brief idea about it. The each nurse was interviewed (for 20- 30 minutes) and was observed through the shift before and after program to collect data plus 9 times for

observational checklist during the program. The program divided into 10 sessions over 6 month's period.

Ethical Considerations:

The ethical considerations in this study included the following:

- The research approval was obtained from ethical research committee/Faculty of nursing/Ain shams University.
- The researcher clears the objective and aim of the study to each study subject and the study is harmless.
- The researcher maintains anonymity and confidentiality of subjects.

III. Administrative Design:

An official letters to conduct the study was obtained from the Dean of Faculty of Nursing, Ain Shams University to Pediatric Hospital.

IV. Statistical Design:

The collected data were organized, tabulated, categorized and analyzed by the computer program "SPSS". Data were presented in tables using number and percentage.

Result

Table (1): As observed from this table that, the mean age of the studied nurses was 34.5±7.36 % and more than two thirds (91.1%) of them had diploma in nursing (secondary schools). Also, it was found that, (91.1%) of nurses were staff nurse and the mean years of experience were 7.02±3.83.

Table (2): As noticed in this table, there was marked improvement in nurses' knowledge immediately after implementation of the nursing intervention program compared to before implementation of the nursing intervention program with a highly statistical significant difference with Chi-square test t= 38.459& p < 0. 001**, in relation to universal precaution measure in PCCU.

Table (3): Table (14): It was observed from this table that, a marked significant improvement of nurses' Performance Related to Principle of Hand washing in PCCU after implementation of the nursing intervention in all items of the procedure regarding Correct Hand washing, Short nail, No watches, Rubbing with alcohol, Hand washing between contact, Hand washing on leaving unit, Not touching uniform, Rinse and Dry and Closing tap, and a statistical significant differences were observed before and after implementation of the of the nursing intervention with Chi-square test = 45.768& p < 0. 001.

Table (4): Table (15): It was observed from this table that, a marked significant improvement of nurses' Performance after implementation of the nursing intervention in all items of the procedure Related to Aseptic Precautions in PCCU, As noticed from this table that, There was marked a statistical significant difference before and after implementation of the nursing intervention program for all steps of the procedure with Chi-square test =17.760&p<0.031.

Table (5): In relation to nurses' Performance Related to Invasive procedure in PCCU, it was clear from this table that, there was a marked improvement in all items of nurses' Performance after implementation of nursing intervention program with high statistical significant difference with Chi-square test =22.194&p<0.009.

Table (6): In relation to nurses' Performance Related to Wound Care in PCCU, it was clear from this table that, there was a marked improvement in all items of nurses' Performance after implementation of nursing intervention program with high statistical significant difference with Chi-square test =14.944&p<0.033.

Table (7): In relation to nurses' Performance Related to Precaution of Injection Safety in PCCU, it was clear from this table that, there was a marked improvement in all items of nurses' practice after implementation of nursing intervention program with high statistical significant difference with Chi-square test =170.982&p<0001.

Table (8): As regards total nurses' practice Performance Related to gloving in PCCU, it was observed from this table that, there was marked improvement in nurses' Performance in Glove use immediately after implementation of the nursing intervention with a highly statistical significant difference related to total nurses Performance with Chi-square test = 60.826& p < 0.001.

Table (9): In relation to nurses' Performance Related to collection of blood specimen in PCCU, it was clear from this table that, there was a marked improvement in all items of nurses' Performance Related to collection of blood specimen in PCCU after implementation of nursing intervention program with high statistical significant difference with Chi-square test =23.375&p<0.05.

Table (10): In relation to nurses' Performance Related to disposal sharps devices and waste in PCCU, it was clear from this table that, there was a marked improvement in all items of nurses' Performance Related to Disposal sharps and waste in PCCU after implementation of nursing intervention program with high statistical significant difference with Chi-square test =29.124&p<0.028.

Table (11): In relation to nurses' Performance Related to personal protective equipment in PCCU, it was clear from this table that, there was a marked improvement in all items of nurses' Performance Related to Personal Protective Equipment after implementation of nursing intervention program with high statistical significant difference with Chi-square test =50.581&p<0.001.

Table (1): Distribution of the Nurses Studies According to Socio- demographic Characteristic

Items	Total number	
	No = 45	100%
Age in years		
< 20	8	17.8.
20 <39	26	57.7
40 years and more	11	24.5
X ±SD	34.5±7.36	
Qualification:		
Diploma School	41	91.1
Technical Ng Diploma	4	8.9
Occupation:		
Staff Nurse	41	91.1
Head Nurse	4	8.9
Experience (years):		
0 < 10	28	62.2
10 and more	17	37.8
X ±SD	7.02±3.83	

Table (2): Distribution of Nurses Performance related to universal precaution measure in PCCU Before and After Intervention Program.

Items	Total number = 45 (100)							
	Before				After			
	Competence		Incompetence		Competence		Incompetence	
	NO	%	NO	%	NO	%	NO	%
- Hand washing after PPE removal	5	11.1	40	88.9	36	80.0	9	20.0
- Wear gloves	15	33.3	30	66.7	38	84.4	7	15.6
- Wear gown	2	4.4	43	95.6	22	48.9	23	51.1
- Wear Facial protection	5	11.1	40	88.9	25	55.6	20	44.4
- Wear Mask	13	28.9	32	71.1	29	64.4	16	35.6
Chi-square test	38.459							
P value	**<0.001 (HS)**							

Table (3): Distribution of Nurses Performance Related to Principle of Hand washing in PCCU Before and After Intervention Program.

Items	Total number = 45 (100)							
	Before				After			
	Competence		Incompetence		Competence		Incompetence	
	NO	%	NO	%	NO	%	NO	%
- Correct Hand washing	15	33.3	30	66.7	35	77.8	10	22.2
- Short nails	10	22.2	35	77.8	25	5.6	20	44.4
- No watches	5	11.1	40	88.9	20	4.4	25	55.6
- Rubbing with alcohol	10	22.2	35	77.8	19	2.2	26	57.8
- Hand washing between contact	12	26.7	33	73.3	39	6.7	6	13.3
- Hand washing on leaving unit	15	33.3	30	66.7	35	7.8	10	22.2
- Not touching uniform	6	13.3	39	86.7	37	2.2	8	17.8
- Rinse and Dry	9	20.0	36	80.0	34	5.6	11	24.4
- Closing tap	14	31.1	31	68.9	35	7.8	10	22.2
Chi-square test	45.768							
P value	**<0.001 (HS)**							

Table (4): Distribution of Nurses Performance Related to Aseptic Precautions in PCCU Before and After Intervention Program.

Items	Total number = 45 (100)							
	Before				After			
	Competence		Incompetence		Competence		Incompetence	
	No.	%	No.	%	No.	%	No.	%
- Unsterile should never touch sterile parts during any procedure - Clean should never touch unclean parts during any procedure - Items are unsterile if dropped on the floor - Items are unsterile if crossed over	12 14 15 15	26.7 31.1 33.3 33.3	33 31 30 30	73.3 68.9 66.7 6.7	35 30 37 37	77.8 66.7 82.2 82.2	10 15 8 8	22.2 33.3 17.8 (17.8
Chi-square test	17.760							
P value	**0.031 (S)**							

Table (5): Distribution of Nurses Performance Related to Invasive procedure in PCCU Before and After Intervention Program.

Items	Total number = 45 (100)							
	Before				After			
	Competence		Incompetence		Competence		Incompetence	
	No	%	No	%	No	%	No	%
- Prepare all equipment needed	13	8.9	32	71.1	30	6.7	15	33.3
- Wash hands	10	22.2	35	77.8	37	82.2	8	17.8
- Wear clean gloves	5	1.1	40	88.9	40	88.9	5	11.1
- Scrub the skin of insertion site with antiseptic solution.	3	6.7	42	93.3	35	77.8	10	22.2
- Do not recap used needles	5	1.1	40	88.9	30	66.7	15	33.3
- Remove and discard of soiled items by proper method.	5	11.1	40	88.9	35	7.8	10	22.2
Chi-square test	22.194							
P value	**0.009 (S)**							

Table (6): Distribution of Nurses Performance Related to Wound Care in PCCU Before and After Intervention Program.

Items	Total number = 45 (100)							
	Before				After			
	Competence		Incompetence		Competence		Incompetence	
	NO	%	NO	%	NO	%	NO	%
- Prepare necessary sterile items	13	28.9	32	71.1	30	66.7	15	33.3
- Wash hands	7	15.6	38	84.4	37	82.2	8	17.8
- Wear sterile gloves	15	33.3	30	66.7	35	77.8	10	22.2
- Aseptically clean the wound with sterile anti-septic solution.	20	44.4	25	55.6	39	86.7	6	13.3
Chi-square test	14.944							
P value	**0.033 (S)**							

Table (7): Distribution of Nurses Performance Related to Precaution of Injection Safety in PCCU Before and After Intervention Program.

Items	Total number = 45 (100)							
	Before				After			
	Competence		Incompetence		Competence		Incompetence	
	NO	%	NO	%	NO	%	NO	%
- Wash hands	10	22.2	35	77.8	37	82.2	8	17.8
- Needle for one patient	40	88.9	5	11.1	45	100.0	0	0.0
- Disinfecting rubber septum	6	13.3	39	86.7	38	84.4	7	15.6
- New needle for Vial	2	4.4	43	95.6	40	88.9	5	11.1
- Single dose for one patient	5	11.1	40	88.9	42	93.3	3	6.7
- Tubing for one patient	41	91.1	4	8.9	45	100.0	0	0.0
Chi-square test	170.982							
P value	**<0.001 (HS)**							

Table (8): Distribution of Nurses Performance Related to gloving in PCCU Before and After Intervention Program.

Items	Total number = 45 (100)							
	Before				After			
	Competence		Incompetence		Competence		Incompetence	
	NO	%	NO	%	NO	%	NO	%
Glove use								
- Wearing gloves before touching any body fluid and contaminated items	3	6.7%	42	93.3%	38	84.4%	7	15.6%
- Wearing gloves before performing any invasive procedure	5	11.1%	40	88.9%	36	80.0%	9	20.0%
- Change gloves between children	7	15.6%	38	84.4%	35	77.8%	10	22.2%
- Wash hands & dry them carefully before wearing of gloves	15	33.3%	30	66.7%	38	84.4%	7	15.6%
- Use aseptic technique while opening sterile gloves package	2	4.4%	43	95.6%	20	44.4%	25	55.6%
- Use correct method for wear and remove of gloves	2	4.4%	43	95.6%	22	48.9%	23	51.1%
- Washing hands after removing gloves	5	11.1%	40	88.9%	25	55.6%	20	44.4%
Chi-square test	60.826							
P value	**<0.001 (HS)**							

Table (9): Distribution of Nurses Performance Related to collection of blood specimen in PCCU Before and After Intervention Program.

Items	Total number = 45 (100)							
	Before				After			
	Competence		Incompetence		Competence		Incompetence	
	No	%	No	%	No	%	No	%
- Prepare all equipment needed.	13	28.9	32	71	30	66.7	15	33.3
- Wash hands.	10	22.2	35	77	37	82.2	8	17.8
- Wear clean gloves.	5	11.1	40	8.9	40	88.9	5	11.1
- Aseptic inset the vein puncture device	3	6.7	42	933	35	77.8	10	22.2
- Withdraw the specimens and inject them in sterile specimen	5	11.1	40	88.9	35	77.8	10	22.2
- Remove and discard of soiled items by proper method.	13	28.9	32	71.1	39	86.6	6	13.3
- Wash hand	4	8.8	41	91.2	29	64.5	16	35.5
Chi-square test	23.375							
P value	**0.05 (S)**							

Table (10): Distribution of Nurses Performance related to disposal sharps devices and waste in PCCU Before and After Intervention Program.

Items	Total number = 45 (100)							
	Before				After			
	Competence		Incompetence		Competence		Incompetence	
	No	%	No	%	No	%	No	%
*** Disposal sharps and waste**								
- Hand washing	2	4.5	43	95.5	30	66.6	15	33.4
- Wear gloves	4	8.8	41	91.2	30	66.6	15	33.4
- Don't recapped of needle	5	11.1	40	88.9	37	82.2	8	17.7
- Disposal at sharp devices in sharp box	5	11.1	40	88.9	38	84.5	7	15.5
- Hand washing	7	15.5	38	84.5	36	80	9	20
*** waste management at Health center**	12	26.6	33	73.4	35	77.7	10	22.3
- All used syringes or any other sharps are discarded immediately in a secure sharps container								
Chi-square test	29.124							
P value	**0.028 (S)**							

Table (11): Distribution of Nurses Performance related to personal protective equipment in PCCU Before and After Intervention Program.

Items	Total number = 45 (100)							
	Before				After			
	Competence		Incompetence		Competence		Incompetence	
	No.	%	No.	%	No.	%	No.	%
Personal Protective Equipment								
- Is removed and discarded prior to leaving the patient's room	3	6.7	42	93.2	38	84.4	7	15.6
- Hand washing is performed Immediately after removed.	5	11.1	40	88.9	36	80	9	20
Glove: -								
- Wears gloves for potential contact with blood, or contaminated equipment.	7	15.6	38	84.4	35	77.8	10	22.2
- Don't wear the same pair of gloves for the care of more than one patient.	15	33.3	30	66.7	38	84.4	7	15.6
Gowns: -								
- Wear gowns to protect skin and clothing during. procedures	2	4.4	43	95.6	22	48.9	23	51.1
- Don't wear the same gown for the care of more than one patient.	2	28.9	32	71.1	29	64.4	10	35.6
Facial protection - Wear a facemask	13	4.4	43	95.6	20	44.4	25	55.6
Chi-square test	50.581							
P value	**<0.001**							

Discussion

Regarding the characteristics of the studied nurses, it was observed that, more than one third of nurses' their age ranged from 25 to less than 39 year. This might be due to that age group is the common age of nurses' who give care for the children and communicate positively with their parent. This finding was not accordance with finding of **Sayed et al., (2014)** who reported that the age group 20 < 25 represented the highest percentage of studied nurses in her study entitled drug administration practice of nurses in pediatric care setting in children university hospital.

Regarding to years of experience of nurses under study, the result showed that nearly one third of nurses had more than five years of experience. This finding was in accordance with finding of **Sayed et al., (2014)** who reported that more than third of nurses had years of experience more than five years. As well, a similar result was reported by **Raghieb, (2016)** who found that the majority of nurses had almost the same years of experience.

Regarding nurses' Performance about Related to Principle of Hand washing in PCCU after implementation of the nursing intervention in all items of the procedure regarding correct hand washing, short nail, no watches, rubbing with alcohol, hand washing between contact, hand washing on leaving unit, not touching uniform, rinse and dry and closing tap, the findings of the present study revealed that approximately more than two thirds of the studied nurses had unsatisfactory knowledge regarding their role in principle of hand washing in PCCU

before implementation of the nursing intervention program, which significantly improved immediately after implementation compared to before implementation of the program. This may be due to lack of in-service training programs for nurses. This finding were contradicted with the study done by **William (2015)** who found in his study about short practice surgery that more than half of nurses' had good knowledge regarding Principle of Hand washing in PCCU. Meanwhile, this result supported by children's hospital **Boston (2015),** who mentioned that good Hand washing care is essential for prevention of further short and long term problems.

In the present study, it was observed that the majority of studied nurses had unsatisfactory knowledge regarding to aseptic precautions in PCCU before implementation of the nursing intervention programs, which significantly improved immediately after implementation with Chi-square test =17.760&p<0.031. These findings were supported by **Algren and Anow (2016)** who found in his study regarding to Aseptic Precautions in PCCU in pediatric surgery that, non of nurses knew about aseptic precautions in PCCU before implementation of nursing intervention program, while after implementation of the nursing intervention program, there was marked improvement in nurses' knowledge.

In relation to nurses' performance related to invasive procedure in PCCU, it was clear that, there was a marked improvement in all items of nurses' performance after implementation of nursing intervention program with high statistical significant difference with chi-square test =22.194 & p<0.009.

As regards total nurses' practice performance related to gloving in PCCU, it was observed that, there was marked improvement in nurses' performance in glove use immediately after implementation of the nursing intervention with a highly statistical significant difference related to total nurses performance with Chi-square test = 60.826 & p < 0.001.It is also clear that although, all centers have a system for waste disposal; contaminated and medical wastes are put in plastic bags with different color, nurses touched medical wastes without wearing any PPE (Gloves) in majority of centers. In this respect **WHO (2014)** recommended that, these wastes requires appropriate, safe and reliable handling. It further added that, there should be a person or persons responsible for the organization and management of waste collection, handling, storage and disposal. Waste management should be conducted in coordination with the infection control team.

In spite that, all centers were equipped with un-penetrable safety box provided by ministry of health according to standards yet all these safety box are torn and not at the proper level of hand reach in the majority of centers. Whereas in half of centers, non-medical wastes bags were collected from its containers every twenty hours. In the same respect, **WHO, (2014)** recommended that long stored wastes must be avoided and a sound waste management system needs to be developed and closely monitored.

It is worth saying that, all units didn't have clearly communicated policies or procedures for risk hazards exposure, infectious diseases or injuries. As such, there were no nurses' safety programs that routinely follow nurses especially vulnerable to infections in almost all **units (WHO, 2004),** recommends that nurse should be reviewed at recruitment, including immunization history and previous exposures to communicable diseases (e.g. hepatitis) and immune status. Immunization recommended for staff includes: hepatitis A and B, influenza, measles, mumps, rubella, tetanus,

and diphtheria. Specific post-exposure policies must be developed, and compliance ensured for a number of infectious diseases for example: human immunodeficiency virus (HIV) and viral hepatitis were also recommended by **WHO, (2014).**

Regarding nurse's performance related to collection of blood specimen in PCCU, it was found that, the majority of nurses had incompetent performance before implementation of nursing intervention program nurses' Performance. This may be due to shortage of staff, work over load, and limited hospital supplies, after implementation of the nursing intervention program, nearly all almost of them were able to perform competent in their practices and provide the required nursing care. These results with consistent to the results of **Koop A, (2015)** who studied the gastro intestinal obstruction in children part 1 and **Huband & Trigg (2012),** who studied practices in children's nursing guidelines for hospital and community. All the researchers confirmed that the majority of nurses had improved their knowledge and practices immediately after implementation of the program.

On investigating nurses' performance regarding Performance Related to disposal sharps devices and waste in PCCU, it was clear that, there was a marked improvement in all items of nurses' performance related to disposal sharps and waste in PCCU after implementation of nursing intervention program with high statistical significant difference with Chi-square test =29.124 & $p<0.028$. Regarding nurses' immediate actions after needle-sticks or splash exposure around one quarter of nurse squeezed wound site although researches didn't found any scientific relevance to wound squeezing in minimizing the probability of acquiring **BBP CDC (2015).** Moreover, washing wound site with water only was reported by (one fifth) and disinfecting reported by (around one third). Furthermore, another quarter of nurse reported that they washed wound site with soap and water and this is right but together with notification.

As regards, notification of performance related to disposal sharps devices and waste in PCCU and splash exposure, it was reported by nurse that (more than half) of the study group and (majority of control group) didn't notify needle-sticks or blood exposure due to lack of knowledge about notification procedures. Clearly these finding are reflecting an extremely unsafe practices which might be significantly contributed to the experience of exposure to blood-borne diseases and needle-sticks among family health nurses working in different clinics.

In relation to nurses' performance related to personal protective equipment in PCCU, it was clear that, there was a marked improvement in all items of nurses' performance related to personal protective equipment after implementation of nursing intervention program with high statistical significant difference with Chi-square test =50.581 & $p<0.001$. As such, unavailability of PPE (less than one third) of the study group and one third) of the control group, lack of monitoring. It is also worth saying that, all the previous responses were not mutually exclusive; more than one reason was mentioned by many of nurses as factors for exposure many of them had to buy PPE on their own to protect themselves. All these factors were reported by nurses as barriers to practice nursing duties safely.

In the light of the study findings, it was observed that, there was marked improvement in nurses' practice immediately after implementation of the nursing intervention with a highly statistical significant difference related to total nurses

practice with Chi-square test = 16.116& p < 0.001.

The findings of the current study indicated that the highest percentage of nurses had unsatisfactory knowledge, regarding infection control measures. This might be due to lack of in-service training programs carried out by infection control team of the hospital who are responsible for teaching and monitoring the nurses' application of infection control standards. This result is in agreement with the study done by **Ismail, (2014)** about assessment of nurses' awareness and attitude toward infection control concept at El-Manial University Hospital and confirmed that all nurses have lacking knowledge related to universal infection control precautions as reflected to their mean score. Also, these findings is supported by **Mahmoud, (2014)** who found that lack of nurses' knowledge and performance regarding principles of infection control contributes to the overwhelming number of infection in surgical ward unit. On other hand, these findings were contradicted with the study done by **Abu Negy, (2012)** who found in her study that half of nurses have good level of knowledge and competent performance related to prevention of infection and identification of infection. Moreover, as stated by **American Association Care, (2015)** the second line of protection in addition to hand washing is clean or sterilization of equipment. The nurse should recognize the methods used in cleaning and sterilizing the equipment and precautions taken to avoid contamination. The nurse must follow the hospital recommendations for infection control.

Standards, and shortage of staff nurses. Therefore, the nurses become overloaded which resulting in poor level of knowledge and practice **(Rosenthalet al., 2012).**

Conclusion

Based on the study findings, it could be concluded that, implementation of the nursing intervention program had a positive effect on the improvement of nurses' knowledge and practice regarding to nurses' performance toward infection control standard precautions for blood-borne diseases.

Recommendations

Based on the study finding, improving health care worker's knowledge and performance through the following recommendations can be deduced:

- Immunization programs for the working staff, as well as pre-employment examination would help minimizing the risk of infections among staff.

- Regular training program for nurses (especially newly employed) regarding blood borne diseases, as well as compliance with infection control & standard precautions.

- Adopt further nursing interventions for better quality of care for children with blood-borne diseases.

- A protocol for universal blood precautions, needle-stick injuries and infection control should be used in both government and private units.

References

Abu Negy, Y. (2012): Hospital nurses' occupational exposure to blood: prospective, retrospective, and institutional reports. American J of Public Health; 87(1): 103-107.

Algren, G. & Anow, A. (2016): Systematic review and economic model of switching from non-glycopeptide to glycopeptide antibiotic prophylaxis for surgery. Health Technology Assessment; 12(1):35– 361. .

American Association Care [AAC], (2015): Evaluation of safety devices for preventing percutaneous injuries among health-care workers during phlebotomy procedures--Minneapolis-St. Paul, New York City, and San Francisco, MMWR-Morbidity & Mortality Weekly Report; 46(2): 21– 25.

Boston, D. (2015): A case-control study of HIV seroconversion in health care workers after percutaneous exposure. Centers for Disease Control and Prevention. Needle-stick Surveillance Group. New England J of Medicine; 337(21):1485– 1490.

Centers for Disease Control and Prevention (CDC], [2015): Cytomegalovirus-virus. Circumstances when CMV infection could be problem. Atlanta: CDC fax information service; 12(11): 212- 219.

Encyclopedia, (2016A): Blood-borne disease. Available at: https://en.wikipedia.org/wiki/Blood-borne_disease

Huband, G. & trigg, R. (2012): Clinical practice: prevention of hepatitis B with the hepatitis B vaccine. N Engl J. Med; 351: 2832– 2388.

Ismail, S.; Abdel-**Wahab, El Said; Aly, Ohn. & Wagida, A. (2014):** The role of parenteral antischistosomal therapy in the spread of hepatitis C virus in Egypt. Lancet; 355: 887– 891.

Ismail, W. (2014): Essentials of Research Methods in Health, Physical Education, Exercise Science, and Recreation. 2nd ed., Philadelphia: Lippincott, Williams& Wilkins, p.187.

Koop, A. (2015): randomized study comparing a transparent polyurethane dressing to a dry gauze dressing for peripheral intravenous catheter sites. Infection Control. Guideline; PubMed.; 6 (9): 361– 366.

Lundy, S. & Jeans. S. (2012): Community health nursing For the Public's Health. 2nd ed.; London, Barb House Co; pp. 576- 560.

Mahmoud, E. (2014): Viral Hepatitis A to E in South Mediterranean Countries. Mediterranean. J of hematology and infectious diseases; 2(1): 5- 6.

Moyer, LA. Hodgson, (2014): Incidence of hepatitis B virus infection in the United States, estimates from the National Health and Nutrition Examination Surveys. J Infect Dis.; 178(4): 954– 959.

Occupational Safety & Health Administration [OSHA], (2015): Blood-borne Pathogens and Needle-stick Prevention. Occupational Safety & Health Administration. Available at: www. osha. gov/ SLTC/ bloodbor-nepatho gens/ index. html.

Raghieb, N. (2016): Skin irritation and dryness associated with two hand-hygiene regimens: soap-and-water hand washing versus hand antisepsis with an alcoholic hand gel. Infection Control & Hospital Epidemiology; Guideline Ref ID BOYCE, PubMed; 21(7): 442– 448.

Rosenthal, S.; Guzman, V. & Safdar, N. (2012B): Effect of Education and Performance Feedback on Rates of Catheter- Associated Urinary Tract

Infection in Intensive Care Units Iin Argentina, Infection Control and Hospital Epidemiology; 25(1): 47- 50.

Sayed; Giuseppe, G.; Albano, L. & Angelillo. M. (2014): An Investigation of Nurses' Knowledge, Attitudes, and Practices Regarding Disinfection Procedures in Italy, BMC Infectious Diseases; 11: 148-157.

Smeltzer, C.; Bare, G.; Hinkle, L. & Cheever, H. (2015): Brunner and Suddarth's Medical Surgical Nursing; 12th ed., Philadelphia, USA: Lippincott-Raven Publishers, pp. 443- 447, 2122- 2125.

United Nations International Children's Emergency Fund [UNICEF], (2015): Public health guidelines for management of occupational exposure to HIV and recommendation for post-exposure and the US public health service guidelines for management of occupational exposure to HBV, HCV, and HIV and recommendations for post- exposure prophylaxis.

Williams, M. & Geswel, M. (2015): Fundamentals of Nursing Collaborating for Optimal Health.USA: Appleton Lange Bodzewich, S.H. & Molshek, D. Lippincott Manual of Nursing Practice Series Assess-ment. 8th ed., USA: Lippincott Co., pp. 156- 198.

World Health Organiz-ation [WHO], (2016): practical Guidelines for infection control in health care Facilities, World Health Organization, Regional Office for Western Pacific, Manila Regional Office for South-East Asia, New Delhi.