

## Effect of Educational Program about Infection Control Precaution on Nurses, Practice in Pediatric Hemodialysis Units

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**Abstract: Background:** Infection is the most common cause of hospitalization in hemodialysis patients and has become the second major cause of death. Lack of hygiene by staff increases the chance of infection. **Aim of this study** was to evaluate the effect of educational program on the nurses' practices about infection control measures in hemodialysis units. **Research design:** Pre /post quasi experimental design was used in this study. **Sample:** A convenient sample of all nurses in hemodialysis units, were included setting: the study was conducted in pediatric hemodialysis units at Minia University and Minia General Hospitals. **Tools for Data Collection:** A structured interview questionnaire sheet in Arabic language was used for the studied nurses as pre/posttest. It composed of the following parts: Part I: Demographic data related to the nurses' age, sex, qualification, years of experience and previous attending courses in infection control. Part II: An observational checklist that was adopted from Control Diseases Center. (National Center for emerging and zoonotic infectious diseases division of health quality promotion). **Results:** the finding of the current study revealed that there were statistical significant differences between nurses' practices at pre and post- program. There were significance correlations between nurses' practice, residence and occupation respectively at pre- program. **Conclusion** the study concluded that there were statistical significant differences between nurses' practices at pre and post- program. **Recommendation the study** recommended that the developed program should be applied and repeated again every 6 months. As well as provision of continuing education programs on regular basis is suggested in order to refresh and update nurse's practice.

**KeyWords:** Infection Control, Pediatric Hemodialysis, Nurses Practice

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### I. Introduction

Hemodialysis places children at high risk for infection because of patient comorbidities and numerous human, environmental, and procedural factors. Establishing an infection prevention and control program which includes a bundle of strategies and interventions that are consistently performed will reduce the infection risk for both employees and patients (Hassona, Winkelman, El-Wahab, Ali & Abdeen, 2012).

Hemodialysis now is an important and a standardized treatment that is used as a life-saving treatment for more than 800,000 people worldwide who have end-stage renal disease (Silver, Thomas, Rathe, Robinson, Wald & et al. (2015). In Egypt, the annual incidence of ESRD is about 74 per million, and the prevalence of patients on dialysis is 264 per million population (Lotfy, Sakla & El-Naggar, 2015). Although effective hemodialysis and it gives patients hope for life indefinitely, there are many adverse events that may be life-threatening during it.

Patients who undergo hemodialysis have a higher risk of infection, due to the following factors: Frequent use of catheters or insertion of needles to access the bloodstream, weakened immune systems, frequent hospital stays and prolonged hospital stay, and increased medical treatment costs. Infectious complications are a serious clinical problem and they are associated with high rates of morbidity and mortality (Elsayed, El-Soreety, Elawany & Nasar, 2012).

The patient and the dialysis apparatus should be under supervision of nurses consistently, so that different potential complications can be detected. Dialysis nurses must have skills, because they considered important features of quality nursing care in the hemodialysis (Judith, Guzman & Karen, 2013).

Infection as a cause of hospitalization for Hemodialysis children. It increased in recent years, hospitalization rates for infection rose 34%, and the rate of hospitalization for vascular access infections in Hemodialysis patients more than doubled. (Emily, and Trish, 2011).

Exposure to blood borne pathogens, specifically hepatitis B (HBV), hepatitis C (HCV), and human Immunodeficiency virus (HIV) is a serious risk for hemodialysis patients and employees. There is always the risk of transmission of these pathogens. Standard precautions need to be rigidly observed in the hemodialysis facility. The risk of HBV acquisition in hemodialysis facilities remains despite the dramatic fall in HBV carriers because of the widespread use of HBV vaccine. (Judith et al, 2013).

Recent guidelines for the prevention of transmission of infection published in the United States and Canada are based on the principles that certain precautions are required for the care of all patients, regardless of diagnoses, and are determined by the task performed and that further measures are required for patients with certain infections, and are determined by the route of transmission of the infection (CDC, 2010b).

Healthcare associated infections (HAIs) are preventable through Implementation of best infection prevention and control practices. This will facilitate the delivery of high quality health care for patients and a safe working environment for our healthcare workers. These national guidelines are developed to provide a coordinated approach to the prevention and management of HAIs (Abou El-Enein & EL Mahdy, 2011).

The nurse is considering the first line to seek to improve clinical practice in the hemodialysis units. It was important to assess the ability of nurses to create positive change in the practice. The continuous advances in technology increased the complexity of hemodialysis treatment and put patients at a higher risk for infection due to several etiologies related to chronic disease (Abdelsatir, 2013).

Key Infection Prevention Practices: Perform hand hygiene frequently and change gloves, Maintain separate clean areas for supplies and medications and separate contaminated areas for used items, Practice proper handling and delivery of patient supplies and medications Perform effective cleaning and disinfection of dialysis equipment and environmental surfaces, Carefully handle medications and the patient's vascular access to avoid contamination (Chenoweth, Hines, Hall, Saran, Kalbfleisch, et al, 2015).

The role of the Nurse in Infection Prevention and Control Specialist is straight forward: identify, prevent, and control outbreaks of infection in health care settings and the community; however, the activities and skills required are exceptionally advanced and complex. While the role is straight forward, the span of activities to meet the responsibilities of the role is broad, and the methods are varied (Emily & Trish, 2011).

## **II. Significance of the study**

Chronic kidney disease (CKD) is an emerging global public health problem. The disease is a component of a new epidemic of chronic conditions that replaced malnutrition and infection as leading causes of mortality during the 20th century (Ahamed & Sallam, 2018).

The increasing risk of pediatric infections because of poor of infection control practices which causes significant children morbidity and mortality as well as increased hospitalization. pediatric patient admitted to hemodialysis unit as the last end stage of renal failure, routinely as two to three time at a week. Are routinely subjected to many procedures that invades (enters) the body (Abdelsatir, 2013).

Infection is the most common cause of hospitalization in hemodialysis patients and has become the second major cause of death. Lack of hygiene by staff increases the chance of infection (E Bagheban, SLakdizaji & Zamanzadeh, 2018).

So the pediatric nurses need technical information about infection control precautions in hemodialysis units. There for developing and applying nursing intervention for nurses about infection control of some procedure in the hemodialysis units, is very important and beneficial in terms of quality of care (Mabrouke, 2015).

## **III. Aim of the study**

The aim of the current study was to evaluate the effect of educational program about infection control precautions for nurses in pediatric hemodialysis units; through the following.

1. Assess the nurses' practices about infection control measures in the hemodialysis units before applying educational program.
2. Develop and apply an educational program about infection control practical precautions for nurses in pediatric hemodialysis units .
3. Evaluate the effect of the educational program on the nurses' practices about infection control precautions in pediatric hemodialysis.

## **IV. Research hypothesis**

- Pediatric hemodialysis nurses' practices mean score will increase after receiving an educational program than before.

## V. Subjects and Methods

### Research design:

Pre/post quasi experimental design was used in this study. A quasi experimental design is one type of experimental design that very similar to the true experimental design except there is loss one criteria which is control, manipulation or randomization (Burns & Grove, 2012).

**Research Setting:** The study was conducted in pediatric hemodialysis units at Minia University and Minia General Hospitals.

**Subject:** A convenient sample of all nurses in hemodialysis units (36) nurses; from Minia University Hospital and Minia General Hospital.

**Tools for Data Collection:** Tool 1:- A structured interview questionnaire sheet in Arabic language was used for the studied nurses as pre/posttest. It was designed by the research investigator after extensive review of the related literature. It composed of the following parts.

- **Part I-** Demographic data related to the nurses' age, sex, qualification, years of experience and previous attending courses in infection control.
- **Part II:-**An observational checklists that was adopted from Control Diseases Center (CDC, 2014) National Center for emerging and zoonotic infectious diseases division of health quality promotion) to assess the nurses, practices about infection control procedures in hemodialysis unites which include (hand washing(10 steps), wearing gloves(5 steps), administration intramuscular injection (7 steps), hemodialysis injectable medication administration preparation (7 steps), hemodialysis injectable medication administration (8steps), arteriovenous (AV) fistula graft cannulation (10 steps) and AV fistula graft decannulation (8 steps), hemodialysis catheter connection (9 steps) and hemodialysis catheter disconnection (10 steps), hemodialysis catheter exit site care (10 steps) and dialysis station routine disinfection before(8 steps) and after receiving patient (6 steps) .

The nurses' actual practices were assessed by the research investigator using the checklists by direct and indirect observation. The nurses, practices evaluated as done or not done where a score of 1 was given for done correctly, score of zero was given for not done practice these scores were converted in to a percentage score. The nurses, practice was considered satisfactory if the percent score is 60% or more and unsatisfactory if less than 60%. It was done during actual routine work in the morning shift.

### Scoring system:

The total score (96) was categorized into two levels unsatisfactory if scoreless 60%, and satisfactory for more than 60%For each part, the score of the items were summed up and the total divided by number of items, giving a mean score for the area. These scores were converted into a percent score and mean and standard deviations were computed. These scores were converted into a percent score. The nurse's practice was considered satisfactory if the percent score is 60% or more and unsatisfactory if scored less than 60%.

### Tool Validity and Reliability

Data collection tools related to nurses practices were adopted from Control Diseases Center (CDC.2014) National Center for emerging and zoonotic infectious diseases division of health quality promotion) to assess the nurses, practices about infection control procedures in hemodialysis, the tools are valid and reliable.

### Pilot study

A pilot study was carried out on (4) nurses from the selected units using the previously mentioned tools, to evaluate their applicability and clarity and to estimate time for each tool. According to results of the pilot study the necessary modification was done. Nurses involved in the pilot study were included from the main study subjects.

### The program

- The study work was conducted in the period from November 2016 to April 2017, the research investigator was available daily by rotation at each study setting, each group was given the freedom to choose their optimal time for receiving the program whenever they have minimal work load. Each session usually started by a summary of what has been taught during the preceding session. Giving praise / recognition to the studied nurses were used as motivation during program implementation.
- The session started by meeting the nurses throughout the morning shift, the research investigator first introduced herself to them and gave them a complete background about the study, its aim, and then the

pretest format was distributed in order to collect the required data. The research investigator was available for more clarification whenever needed. Then, the content of the program was designed based on actual educational need assessment of the studied nurses. Consequently, the subject content has been sequenced through practical sessions.

- Method of teaching involved modified lecture, group discussion, pictures, and data show on my personal computer and demonstration and re-demonstration. Suitable teaching aids were used especially for the program such as real equipment and facilities.
- It was designed in Arabic form of educational program by the research investigator based upon the actual need assessment of nurses. It was also supplemented with practice based on review of relevant literature (nursing textbook, journals and internet resources) about infection control in pediatric hemodialysis.

#### **Data collection procedure**

- Administrative approval was obtained from Faculty of Nursing, Minia University. An official permission was obtained from the concerned hospital authorities to conduct the study. The aim, and expected outcomes of the study was explained to the administrators, as well as participants nurses.
- Application of the program sessions was organized according to the time available to the nurses in each hemodialysis units, the time required for the program implementation was in six months, and the nurses will be interviewed two days /week from 9am: 12am. Nurses were divided into nine small groups. A copy of the program booklet was given to each participant. "Post-test" was carried out immediately and after six months after implementation of training program to assess the effect of the program on nurse's practices about infection control in hemodialysis units.
- The educational program for nurses working in hemodialysis unit included a guidance book which covered Practical parts through the following items: the application of procedures(hand washing, wearing gloves, administration intramuscular injection, hemodialysis injectable medication administration preparation ,hemodialysis injectable medication administration, arterio-venous fistula graft cannulation and arterio-venous fistula graft decannulation, hemodialysis catheter connection and hemodialysis catheter disconnection, hemodialysis catheter exit site care and dialysis station routine disinfection before and after receiving patient.

#### **Ethical consideration**

The researcher explained the purpose of the study and their rights as study participants, including anonymity, confidentiality, and their rights to withdraw from the study at any time. Oral consent was obtained from the nurses who participated in the current study.

#### **Statistical analysis**

Data entry was done using compatible personal computer. The statistical analysis was done using SPSS-22 Statistical Software Package. Data were presented using descriptive statistics in the form of frequencies and percentages for qualitative variables and mean and standard deviations for quantitative variables. The quantitative continuous data were compared by using student t-test in case of comparison between the mean scores of the study group. Qualitative studied variable were compared using chi-square test. Person correlation analysis used for assessment of the inter-relationships between the nurses, practices about infection control of procedures, statistical significance differences at value<0.05.

## **VI. Results**

**Table (1): Distribution of the Studied Nurses according To Their Demographics characteristics N=36**

Nurses Data		N=36	
		No	%
<b>Age</b>			
-	20 < 30	20	55.6
-	30 < 40	12	22.2
-	≥40	4	11.1
<b>Sex</b>			
-	Male	10	27.8
-	Female	26	72.2
<b>Years of experience:</b>			
	< 5	13	36.1
	5 < 10	13	36.1
	>10	10	27.8
<b>Qualification of nurses:</b>			
-	Diploma of Secondary Nursing School	17	47.2
-	Bachelor in Nursing Sciences	7	19.4
-	Technical Institute of nursing	12	33.3

Nurses Data	N=36	
	No	%
<b>Occupation:</b>		
- Technical	30	83.3
- Specialist	6	16.7
Previous attendance of training courses:		
Yes	36	100
<b>Residents</b>		
- Ruler	19	52.8
- Urban	17	47.2

Table (1) shows that more than half (55.6%) of the studied nurses are between 20 to less than 30 years old, more than two thirds (72.2%) of the studied nurses were female, while less than one third (27.8%) were male. Nearly one third of studied nurses (36.1%) have less than five years of experience, less than half (47.2%) of them has diploma of secondary nursing school. Regarding to their job description the majority (83.3%) are technical nurses. All the studied nurses (100%) had previous attendance of training courses affiliated to (ICU) and (WHO), more than half of them (52.8%) were from ruler area.

**Table (2): Comparison of the Studied Nurse’ Infection Control Practice Pre, Post and After 6 Months of the Program (N= 36)**

infection control practice	Pre program		Post program		After 6 months		$\chi^2$	P
	No	%	No	%	No	%		
<b>Hand washing</b>								
Unsatisfactory	24	66.7	4	11.1	35	97.2	86	0.001*
Satisfactory	12	33.3	32	88.9	1	2.8		
<b>Wearing gloves</b>								
Unsatisfactory	24	66.7	36	100	35	97.2	2.1	0.3
Satisfactory	12	33.3	0	0	1	2.8		
<b>Administration of intramuscular injection</b>								
Unsatisfactory	27	75	0	0	0	0	0.001	0.9
Satisfactory	9	25	36	100	36	100		
<b>Hemodialysis injectable medication administration preparation</b>								
Unsatisfactory	23	63.9	4	11.1	35	97.2	86.6	0.001*
Satisfactory	13	36.1	32	88.9	1	2.8		
<b>Hemodialysis injectable medication administration</b>								
Unsatisfactory	27	75	4	11.1	34	94.4	82.7	0.001*
Satisfactory	9	25	32	88.9	2	5.6		
<b>Total of nurses' practice about infection control.</b>								
Unsatisfactory	26	72.2	4	11.1	33	91.7	79.2	0.001*
Satisfactory	10	27.8	32	88.9	3	8.3		

It is clear from table (2) that there are statistical significance differences between pre, post and after 6 months of the educational program (p. <0.05) regarding to washing hands, hemodialysis injectable medication administration preparation, hemodialysis injectable medication administration. While there are no statistical significance differences between pre, post and after 6 months of the educational program and wearing gloves and administration of intramuscular injection. (p. > 0.05). So there are observed elevation in the infection control practice level in post educational program than in preprogram in relation to hand washing, hemodialysis injectable medication administration preparation, hemodialysis injectable medication administration. While decreases in the infection control practice level after six months of educational program.

**Table (3): Comparison of Mean Scores of the Studied Nurses' Practice Related to Universal Precaution of Infection Control Pre/Post Educational Program n= 36**

Items	Practice		t. test	P. value
	Pre program	Post program		
Hand washing	18.3±3.8	30.4±3.7	13.425	0.001*
Wearing gloves	7.5±2.1	13.9±2.1	12.820	0.001*
Administration of intramuscular injection	12.7±1.6	19.8±3.5	10.775	0.001*
Hemodialysis injectable medication administration preparation	13.3±2.3	25.1±4.4	14.053	0.001*
Hemodialysis injectable medication administration	11.7±2.3	22.4±4.1	13.275	0.001*
Total of nurses' practice about infection control.	63.7±8.7	99.1±17.3	14.859	0.001*

In comparison of means scores of the studied nurses' practice related to universal precaution table (3) illustrates that there are highly statistical significant differences between nurses' practice at pre and post-program ( $p < 0.05$ ). Regarding to hand washing, wearing gloves, administration of intramuscular injection, hemodialysis injectable medication administration preparation and hemodialysis injectable medication administration.

**Table (4): Comparison of Mean Scores of the Studied Nurses' Practice Related to Universal Precaution of Infection Control Pre/post after Six Months Educational Program n= 36**

Items	Practice		t. test	P. value
	Pre program	After six months		
Hand washing	18.3±3.8	30.4±3.7	5.868	0.001*
Wearing gloves	7.5±2.1	13.9±2.1	4.206	0.001*
Administration of intramuscular injection	12.7±1.6	19.8±3.5	4.151	0.001*
Hemodialysis injectable medication administration preparation	13.3±2.3	25.1±4.4	5.368	0.001*
Hemodialysis injectable medication administration	11.7±2.3	22.4±4.1	6.960	0.001*
Total of nurses' practice about infection control.	63.7±8.7	99.1±17.3	7.600	0.001*

In comparison of means scores of the studied nurses' practice related to universal precaution table (4) illustrates that there are highly statistical significant differences between nurses' practice at pre and after six months of program ( $p < 0.05$ ). Regarding to hand washing, wearing gloves, administration of intramuscular injection, hemodialysis injectable medication administration preparation and hemodialysis injectable medication administration.

**Table: (5) Comparison of Mean Scores of the Studied Nurses' Practice Related to Hemodialysis Procedure Pre/Post Educational Program N= 36**

Items	Practice		t. test	P. value
	Pre program	Post program		
Hemodialysis injectable medication administration	11.7±2.3	22.4±4.1	14.053	0.001*
Arteriovenous fistula graft cannulation	13.3±2.3	25.1±4.4	13.275	0.001*
Arteriovenous fistula graft decannulation	11.7±2.3	22.4±4.1	13.995	0.001*
Hemodialysis catheter connection	13.8±2.1	25.4±4.4	14.940	0.001*
Hemodialysis catheter disconnection	15.7±1.8	28.2±4.6	14.645	0.001*
Hemodialysis catheter exit site care	14.6±2.3	28.1±5.02	13.658	0.001*
Dialysis Station Routine Disinfection	25.6±3.1	37.5±4.2	14.669	0.001*
Total of nurses' practice about hemodialysis procedure.	94.9±11.9	167±26.9	14.7	0.001*

In comparison of means scores of the studied nurses' practice related to hemodialysis procedure table (5) illustrates that there are highly statistical significant differences between nurses' practices related to hemodialysis procedure at pre and post- educational program ( $p < 0.05$ ). Regarding to hemodialysis injectable medication administration, arteriovenous fistula graft cannulation, arteriovenous fistula graft decannulation, hemodialysis catheter connection, hemodialysis catheter disconnection, and hemodialysis catheter exit site care and dialysis station routine disinfection.

**Table: (6) Comparison of Mean Scores of the Studied Nurses' Practice Related to Hemodialysis Procedure Pre/after six months of Educational Program N= 36**

Items	Practice		t. test	P. value
	Pre program	after 6months		
Hemodialysis injectable medication administration	11.7±2.3	17.3±4.1	6.960	0.001*
Arteriovenous fistula graft cannulation	13.3±2.3	19.2±6.1	5.368	0.001*
Arteriovenous fistula graft decannulation	11.7±2.3	17.3±4.1	6.960	0.001*
Hemodialysis catheter connection	13.8±2.1	19.2±4.4	6.480	0.001*
Hemodialysis catheter disconnection	15.7±1.8	20.5±4.2	6.223	0.001*
Hemodialysis catheter exit site care	14.6±2.3	19.5±4.1	.661	0.5
Dialysis Station Routine Disinfection	25.6±3.1	25.1±3.9	7.246	0.001*
Total of nurses' practice about hemodialysis procedure.	94.9±11.9	120.9±17.9	7.2	0.001*

In comparison of means scores of the studied nurses' practice related to hemodialysis procedure table (6) illustrates that there are highly statistical significant differences between nurses' practices related to hemodialysis procedure at pre and after six months of educational program ( $p < 0.05$ ). Regarding to hemodialysis injectable medication administration, arteriovenous fistula graft cannulation, arteriovenous fistula graft decannulation, hemodialysis catheter connection, hemodialysis catheter disconnection, and dialysis station routine disinfection. While no statistical significant differences regarding hemodialysis catheter exit site care ( $p > 0.05$ ).

**Table (7): Correlation between Demographic Characteristic and Total Infection Control Practice among the Studied Nurses.**

	Total infection control practice correlation					
	Pre program		Post program		after 6 months	
	R	P	R	P	R	P
<b>Sex</b>	-0.12	0.1	0.02	0.8	0.05	0.7
<b>Residents</b>	0.005	0.9	0.04	0.8	0.05	0.7
<b>Age</b>	0.32	0.05	-0.25	0.1	-0.25	0.1
<b>Years of experience:</b>	0.24	0.4	-0.11	0.4	-0.05	0.7
<b>Qualification of nurses:</b>	-0.20	0.2	0.25	0.1	0.03	0.8
<b>Occupation:</b>	-0.33	0.04*	0.04	0.8	0.001	0.9

Table (7) shows that there is no significance correlations between demographic characteristics and infection control practice among the studied participants, while for age and occupation there are mild correlation at pre, post and after 6 months of the education program. Meanwhile there are significance correlation regarding to occupation ( $p > 0.05$ ) at pre- program, as well as regarding to qualification of nurses there is mild significance correlation at six months post education program.

- There were no significance correlation between demographic characteristics and hemodialysis practice among the studied nurses, while regarding to age and years of experience are mild correlation at pre education.
- There were significance correlation regarding age and years of experience ( $p < 0.05$ ).
- Regarding to qualification of nurses is mild correlation ( $r = 0.27$ ) at post education program.

## VII. Discussion

Patients with End Stage Renal Diseases (ESRD) are vulnerable to infectious diseases due to multiple comorbidities and reduced immune function. Due to the passive nature of dialysis therapy, hemodialysis patients can easily spread diseases through the narrow space between their beds. Therefore, appropriate infection control measures are very important to prevent the transmission of diseases in dialysis facilities (Hayne & Young-Ki 2018).

The current study's results revealed that more than two thirds of the studied nurses were female, while less than one third were male, and their ages were more than 20 and less than 30 years. This may be due to our culture was against male registration in nursing program so registration in nursing school started at the 21th country. This result was similar to demographics characteristics that were reported by Fawzy (2016) in hemodialysis at Alexandria University hospital who found that more than half of the nurses were between 20 and 30 years, while EL-moghazy (2013) found that most of the participants were female and the majority of them were more than 30 years.

This study's results were similar to demographic characteristics that reported by Basiony (2014) in Beni-sueff hemodialysis hospitals who found that the majority of nurses were female and their ages less than 34 years. On the other hand Ali (2013) found that the majority of the nurses' age ranged between twenty to fifty

years and near to three quarters of them were female. Regarding male admission in nursing faculties the ratio is still limited compared by female, as well as in technical institutes.

According to Kadium (2015) the proportion of male participants in his study was (7%), which was comparable to the (16.67%) reported by Deshmukh & Shinde (2014), and 33.8% reported by Bianco, Coscarelli, Nobile, Pileggi & Pavia (2013).

The present study showed that nearly one third of the participants had less than 5 years of experience and from 5 to less than 10 years of experience. It was detected that there were statistical significant relationships between nurses' overall practices and their years of experiences, as well as their qualifications and age. In other words, nurses with longer years of experience had better practice of infection prevention and control practices than the less experienced nurses.

These findings were congruent with Fawzy (2016) who reported that nurses with longer years of experience had better practice of infection control precaution at HD units. These results may be attributed to day to day activities that enhances nurses' experience and improves their practice. Nevertheless, Metwally, AbouDonia & Abdel Aziz (2016) indicated that nurses with 5 to less than 10 years of experience had higher mean percent practice score than those with more than 10 years of experience.

This finding is consistent with Basiony (2014) in Beni-suff hemodialysis hospitals and Fawzy (2016) Abd el fatah (2013). Bakey (2014), and Mohmmmed (2010) who reported highest percentages for the participants with less than 10 years' experience. However, the findings disagreed with Hassona. et al (2011) who reported that more than half of the participants had more than 10years experience.

Regarding nursing qualification the present study's results showed that less than half of the studied nurses have diploma of secondary nursing school, while almost one third had technical institute of nursing.

These results were consistent with the reality that nursing secondary schools graduates represent the majority followed by technical institute of nursing then nursing faculties.

This finding goes in the same line with Basiony (2014) in Beni-suef hemodialysis hospitals who found that all participants had technical nursing diploma, as well as Mohamed (2008) who reported that all participants had diploma level of education; Fawzy (2016), Ahmed (2011) and Abdelfatah (2013) in Assuit hospitals reported that less than half of nurses had diploma degree and less than one quarter of them had bachelor degree.

Hassona, et al (2011) found that all participants had technical nursing diploma except one who has associate degree in nursing while Ali (2013) found that more than three quarters of nurses had diploma level of education.

In addition, the study's results indicated that nurses with bachelor degree had significantly higher mean score of practice than those with diploma degree. This could be interpreted by the fact that bachelor degree nurses have more extensive undergraduate programs of infection control and microbiology than those with diploma of secondary nursing schools.

In the same context, Deghidi&Growder (2010) reported that education is a potential means for implementing prevention strategies as it alters perception, increases in turn changes work practice.

Finding of the present study indicated that all of participants were attending unit staff development programs, orientation programs, or attending conference during the past five years affiliated to (ICU), (EMOH) and (WHO). this finding disagree with Basiony (2014) in Beni-suef hemodialysis hospitals who reported that none of nurses attending unit staff development programs, orientation programs or attending conference during the past five years and observed there was limited source of education activities for nurses in the study sitting. Meanwhile Abdelfatah (2013) found that most of participants had no previous training.

Regarding nurses, practice related to universal precaution of infection control the study's result revealed that there was an increase in practice score in all practice at post educational areas. In the same field Bayoumi& Mahmoud (2017) studied the effect of education program on nurses' practice regarding care of central venous line in pediatric hemodialysis: evidence-based practice guidelines.

they found that there was a highly statistical significant improvement in nurses' practice such as hand washing, wearing mask, goggles, sterile gown, and gloves, use of disinfection, and dressing, when compared with that before and immediately after implementation and also before and 6 months after implementation of teaching guidelines.

In accordance with the study results, Abou El-Enein & ELMahdy (2011) concluded that none of the nurses washed hands before and after the deferent activities that required hand washing or the use of plastic aprons or face protection among nurses in the dialysis unit in a University Hospital in Alexandria. On the other hand in a study done by Chenoweth, et al (2015) observed patient care across hemodialysis facilitates enrolled in National Opportunity to Improve Infection Control in ESRD (end-stage renal disease) (NOTICE) project in order to evaluate adherence to evidence-based practices.

Many studies were agreed with Basiony (2014).Who found poor compliance to hand hygiene which might be attributed to lack of continuous and efficient in-service training and absence of supervision.



The current study's result showed that there were highly statistical significant differences in all of wearing gloves, administration of intramuscular, injection medication preparation, injection medication administration as pre and post educational program.

This result was consistent with Abd-Hady, Khalifa, Zein El-Dein, & Hemdan (2011) who observed that the nurses know well the importance of hand washing for infection control, so more than two thirds of the nurses inadequately or infrequently performed and there were statistical significant differences between their performance on pretest, posttest and retention test. The author added that this result could be attributed to nurses used to rub hands with alcohol due to work overload in that area.

The current study's result illustrated that on pre-test, the majority of nurses performed hand washing inadequately. This finding was consistent with National Health Service (2014). that reported that hand washing is a complicated task comprising not only choice of appropriate disinfecting agent, but also frequency, duration, appropriateness, and liability for skin irritation from frequent washing. These findings were consistent with Dawood (2011) who reported that lack of infection control equipment and supplies was one of the major factors to the application of precautions.

Regarding to nurses' practices in infection control precautions on starting hemodialysis procedure, it was found that there're high significant differences between pre and post program conduction ( $p$  valu.0.001), which might reflecting the effect of educational program. While decreased after six months. This result was supported by Bagheban, et al (2018). Who concluded that the average score of practices of the two groups before and after intervention was significantly different. Educational intervention increased practice in hand washing ( $P = 0.001$ ), disinfection of the dialysis unit ( $P = 0.001$ ), use of catheter ( $P = 0.011$ ), and needle insertion or removing of fistula ( $P = 0.001$ ) in the intervention group.

Our study's results indicated that more than two thirds of the studied nurses discard syringe in correct way in pre and post educational program, While in Abd-ElHady et al (2011) showed that nurses' application of infection control precautions during dialysis, and at terminating dialysis as well as after session, only (8.0%) of nurses discarded needles in sharp container on pre- test, all nurses applied sterile dressing on the shunt and wrapped it securely. Other studies done by Bakey (2014), Karkar, Bouhaha&Dammang (2014), Ebrahim (2009) and Dawood (2011) who reported that nurses threw out needles in leak-proof, puncture-resistant and color-coded boxes throughout all hemodialysis procedures. This could be attributed to lack of supervision.

For the nurses' practice about hemodialysis the current study revealed that the mean scores of the nurses' practice related to universal precaution of infection control pre/post educational program. This indicated the increase in practice mean score in all practice areas at the post program phase. However, this increase reached statistical significance for nurses' practice all of procedure are the same, about hand washing ( $p.0.001$ ), gloving( $p.0.001$ ), while in AbdEl-Hady, et al (2011) about the care of non-disposable equipment, removing mask and goggles, and sterile gowns, all nurses (100.0 %) didn't perform these procedures due to the unavailability of these supplies. These findings were consistent with Ebrahim (2009) and Dawood (2011) who reported that lack of infection control equipment and supplies were the major obstacles to apply infection control properly.

Our study's results illustrated that the mean scores of the nurses' practice related to arteriovenous fistula graft cannulation and de-cannulation pre/post educational program indicated that there was highly statistical Significance differences between pre/post-educational program phases; no one of nurses done correctly performs hand hygiene before or after arteriovenous fistula graft cannulation. This result was in harmony with the study done by Ashour (2016) Ramadan (2016) and Hassona. et al (2011) who reported that the highest percentage of their study nurses didn't comply with hand washing neither before nor after patients contact during IV fluid administration.

In the same context Erasmus et al (2010) concluded that Noncompliance with hand hygiene guidelines is a universal problem, which calls for standardized measures for research and monitoring. Theoretical models from the behavioral sciences should be used internationally and should be adapted to better explain the complexities of hand hygiene. Moreover Moursy&Sharaf (2017) indicated that the majority of the nurses were acquainted with the significance of hand washing, many nurses were carrying out hand hygiene inadequately in morning shifts and neglected it in the afternoon shifts either during cannulation or decannulation. This result could be referred to the lack of time, nurses' staff shortage and the workload in HD unit.

Personal protective equipment is compulsory to prevent cross infection. The present study showed that there were higher increases in percentages between steps done correctly pre/post educational programs phase.

However there are statistical significance differences between nurses' practice as pre/post educational programs. Moreover, the study results revealed that one third of the nurses choose the correct size glove in preprogram Wearing gloves are required whenever caring for a patient or touching patient's equipment. According to Bianco, et al (2013) revealed that all nurses used only clean gloves instead of sterile ones during the whole shifts. This result may be attributed to the cost of sterile gloves, lack of strict policies and supervision, as well as workload.

According to CDC (2010a) the use of sterile gloves during vascular access care is emphasized. In the same field Higgins & Evans (2011) reported that lack of infection control equipment and supplies were the main factor to the implementation of infection control practices.

Concerning care of vascular access site for prevention of infection, the present study indicated that only one who was apply skin antiseptic and allow it to dry in preprogram and there was highly statistical significance difference between pre and post educational program as regards to care of vascular access site correctly. As well in all procedures' steps it was observed that no one apply antimicrobial ointment in pre educational phase.

In the same context Ahmed et al (2013). Reported that the majority of the studied nurses in both shifts did not use to clean access arm for a minute with soap and water or antiseptic soap and placing access limb on a sterile drape or barrier was done inappropriately.

In this regard the National Health Service (2014). Emphasized that the nurse should wash the access site with soap and water then places the access limb on a sterile drape before cannulation to decrease the invasion of the micro flora into the blood stream. Bakey (2014). And Dawood (2011) postulated that HD vascular access infections can be prevented by in service education and training programs for nurses, as they are largely responsible for the care of vascular access.

The above findings were consistent with, Higgins & Evans (2011). Who reported that lack of infection control equipment and supplies was the main hindering factor to the implementation of infection control practices. In this context WHO (2012). Recommended wearing Personal protective equipment when splashing, spraying or splattering of blood or body fluid is expected, and during HD vascular access cannulation or de-cannulation.

Regarding Routine disinfection of the Dialysis Station after patient has left station of the dialysis pre/post educational program which indicate that there are highly difference in percentage between nurses' practices who done correctly all procedures' steps among pre and post –educational program and observed that no one follow the basic step in infection control ( hand hygiene ) . Although in Moursy & Sharaf (2017) showed that on pre-test, the majority of nurses (80.0 %) performed disinfection and rinsing for hemodialysis machine inadequately.

This finding was consistent with Bakey (2014) who reported that nurses rinsed fluid pathway after every dialysis with dialox or citrosteril for 30 minutes. Also, this result consistent with Ebrahem (2009) who reported that half of nurses disinfected external surfaces of hemodialysis machine.

In our study explain how the results support the hypothesis and how the explanation is consistent or fit in with previously and existing practice on the topic. And observed that practice improve after educational program and start to reduce after 6 months which indicate that continues training and education will prevent the transmission of diseases in dialysis station.

Therefore, nurses at HD units must possess an appropriate skills and experience to prevent and control infection for themselves and for their patients and the continues training will improve the skills.

## **VIII. Conclusion**

There were statistical significant relations between infection control practice pre, post and after 6 months of the program. The study's results indicated that there were improvement in control of infection in hemodialysis unites after educational program was applied .

## **IX. Recommendations**

Continuing education programs on regular basis is suggested in order to refresh and update nurse's practice. Written booklets, posters and videos should be available in each unit in hospital to acknowledge nurses about infection control procedures. Rules and regulation for hospital visitors and relatives must be settled and applied. Provision of adequate resources, facilities and equipment related to any procedures in hemodialysis units such as eating, change clothes or child support. Repeated this research on large sample to ensure generalizability of the study.

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