Infection Control Guidelines: Its Impact on the infection Rate at Hemodialysis Unit

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Abstract

Background: End-stage renal disease (ESRD) has emerged as a major public health problem around the world. Infection is potentially preventable; yet, it remains the second most common cause of death in hemodialysis patients and still remains a major problem among patients on hemodialysis (HD) especially in Egypt. In recent decades, several important advances have been made in the therapy of HD with guidelines to ensure the delivery of optimum care to HD patients. **Aim:** to evaluate the impact of infection control measures as specified in guidelines on infection rate at hemodialysis unit. **Study Design:** a quasi-experimental study design was utilized to meet the aim of the study. **Setting:** It was conducted in the hemodialysis unit in Minya University hospital. **Subjects:** The study group was a convenience sample which included all health team staff in the hemodialysis unit. **Data collection tools: 1)** Self-Administered Questionnaire, **2)** Infection Control Associated Practices Observational Checklists, **3)** Polices and Resources' Assessment Tool and **4)** Infection Assessment Tool for Patients in hemodialysis unit. **Results:** The study results revealed an obvious improvement in knowledge and practice of the studied health team staff in hemodialysis unit with a statistically significant differences pre, post and follow up the guidelines application. Also, the results revealed a decrease in signs and symptoms of infection and decrease in infection rate post guidelines application. **Conclusion**: Application of infection control guidelines improves health team staff knowledge and practices with positive impact on the infection rate for patients and health team staff in hemodialysis units. **Recommendation:** Continuous education and training of both new and current health team staff in hemodialysis unit about infection prevention and control guidelines should be enhanced.

Key words: Guidelines, Hemodialysis, Infection control & Infection rate.

Introduction

Hemodialysis patients are uniquely vulnerable to the development of healthcare-associated infections because of multiple factors including exposure to invasive devices, immunosuppression, the lack of physical barriers between patients in the outpatient hemodialysis environment and frequent contact with healthcare workers during procedures and care. Compliance with standard precautions measures is essential to prevent and control health-care-associated infections *(Abou El-Enein & El-Mahdy, 2011).*

The incidence of infection in HD unit is important to be evaluated. The main reasons for high incidence of nosocomial infections are lack of standards of infection prevention precautions and effective vaccination, inadequate disinfection procedures of dialysis machines and other medical equipment, as well as spread of infection from patient to patient, especially in dialysis centers with a high percentage of infected patients *(Yassin, El Dib & Roshd, 2012).*

Hemodialysis patients are exposed to different types of infection, which include bloodstream infections and localized infections of the vascular access. Blood-borne infections as viral hepatitis C (HCV) and viral hepatitis B

(HBV) infections remains highly prevalent both in developed and less-developed countries. In spite of considerable decline in the incidence and prevalence of HCV infection among HD patients in many countries, this infection still remains a major problem among patients on long-term maintenance HD especially in Egypt. Clearly, strict adherence to standard precautions including isolation precautions is the key stone in the prevention of nosocomial transmission of HCV in hemodialysis units *(Karkar, Bouhaha & Dammang, 2014; Duong & McLaws, 2017).*

Nurses are at the center of patient care and are the healthcare professionals most likely to intercept errors and prevent harm to patients. They can directly prevent infections by performing, monitoring, and assuring compliance with infection control guidelines *(Ezz Eldeen, Abd-Elaziz, Moghazy, Shahin, & Abo El-Ata, 2016).*

Significance of the study:

Infection control is a key component of practice for all healthcare professionals including nursing, not only for their health team staff but also to reduce infections transmission and thus improve the patient safety. Infection control standards become an integral part of the accreditation program for all medical settings in Egypt *(Eskander, Morsy & Elfeky 2013; Atalla, Aboalizm & Shaban, 2016).* Infectious complications are a serious clinical problem and they are associated with high rates of morbidity of HD patients and mortality, prolonged hospital stay and increased medical treatment costs *(Kadium, 2015).*

Non-compliance with infection control guidelines poses a serious risk to patients receiving HD treatment and includes serious breaches in infection control practice resulting in several viral hepatitis outbreaks in HD units worldwide. Yet, such outbreaks should be precluded with the adherence to standard and contact precaution guidelines *(Duong & McLaws, 2017).* Hence, nurses should receive additional infection control training and periodic evaluations of aseptic care as a planned patient safety activity. This is of particular importance in HD units. There is evidence that

implementation of infection control training program as part of quality management in the health sector will reduce the cost and provide higher quality *(Ezz Eldeen, etal., 2016).*

Aim of the Study:

The study aimed to evaluate the impact of infection control measures as specified in the guidelines on infection rate at hemodialysis unit: This has been achieved through the following the specific objective:

1) Assess staff's level of knowledge regarding the infection control measures as specified in the guidelines.

2) Assess staff's level of practices regarding the application of infection control measures as specified in the guidelines.

3) Assess the infection rate among hemodialysis patients.

4) Revise, update and implement infection control guidelines based on needs assessment (pre, post and follow up the implementation of the guidelines at hemodialysis unit.

5) Assess the impact of infection control guidelines implementation through comparing:

a) Staff's level of knowledge and practices.

b) Infection rate among hemodialysis patients (pre, post and follow up the implementation of the guidelines).

Research hypothesis:

This study assumes that:

1- Staff level of knowledge and practice regarding infection control measures will be improved with a statistically significant difference between pre and post guidelines implementation.

2- There will be a statistically significant difference between pre and post guidelines

implementation as regard to infection control rate among hemodialysis patients.

Subject and Methods
Research design:
A quasi-experimental study design was utilized to meet the aim of this study.

The Study was portrayed under four main designs as follows:-

I- Technical design.
II- Operational design.
III- Administrative design
IV- Statistical design.

I. Technical design
The Technical design includes setting, subjects, and tools for data collection.

A. Setting
This study was conducted in the hemodialysis unit at El-Minya University Hospital. The hemodialysis unit consists of eight rooms (six rooms for hemodialysis sessions, divided into 2 rooms for negative patients and four rooms for positive patients, one room for central venous catheter insertion and store room for supplies). There are 44 hemodialysis machines divided to 17 machines for negative patient and 27 machines for positive patients. There is no enough space between the machines and no separation (sector) between the machines. There is one sink with water tap at each room. No treatment room for preparation of the medications and nurses prepare the medication at a tray beside the patient place.

Subjects
Convenience sample which included all health team staff working in the hemodialysis unit at El-Minya University Hospital [30 nurses, 8 physicians, 7 auxiliary personnel (workers), 6 technicians].

B. Tools of data collections
The study tools included:
A. Self-Administered Questionnaire
B. Infection Control Associated Practices Observational Checklists.

C. Polices and Resources' Assessment Tool

D. Infection Assessment Tool for Patients in Hemodialysis unit.

A- Self-Administered Questionnaire:
It was developed by the researcher based on review of the related literature *(WHO, 2009, El-Senousy & Gomaa., 2009; Ahmed, et al., 2010 & WHO, 2016).* The questionnaire included two sections:

Section I
It was concerned with assessment of the demographic characteristics of the health team staff in hemodialysis unit such as: age, sex, level of education, years of experience and previous training courses.

Section II
It was developed to assess health team staff's level of knowledge regarding infection control measures as specified in the guidelines at the hemodialysis unit. It included 209 questions distributed on 6 parts as the following:

Part 1: Health team basic knowledge about infection (as nosocomial infection, chain of infection, method of infection transmissions, most common infectious diseases in hemodialysis unit etc…It included of 12 multiple choice questions (MCQ).

Part 2: Nurses' knowledge about their role regarding the application of infection control measures in hemodialysis unit. It included 13 MCQ questions distributed as the following: before hemodialysis session (4 Q), during hemodialysis session (4 Q), and after hemodialysis session (5 Q).

Part 3: Physician' knowledge about their role regarding the application of infection control measures in hemodialysis unit. It included 25 true and false questions distributed as the following: before the session (15 Q), during hemodialysis session (6 Q) and after hemodialysis session (4 Q).

Part 4: Technician knowledge about their role regarding infection control measures in hemodialysis unit. It included 19 true and false questions distributed as the following:

maintenance of the hemodialysis machines (4 Q), dialysate & water storage tanks (5 Q), sterilization of the machine (3 Q) and microbiological monitoring of water and water quality (7 Q).

Part 5: Workers ' knowledge about their role regarding infection control measure in hemodialysis unit. It included 28 true and false questions distributed as the following: cleaning the environment (16 Q), linens management (7 Q) and waste management (5 Q).

Part 6: Health team staff knowledge about their role regarding the application of infection control measures and universal precaution guidelines in hemodialysis unit. Included 112 true and false questions distributed as the following: Importance of infection control (5 Q), impact of hand washing on patient's care (10 Q), wearing personnel protective equipment (21 Q), aseptic technique (17 Q), hemodialysis machine cleaning and disinfection (7 Q), cleaning spills (6 Q), linens management (6 Q), waste management (18 Q), blood sampling (7 Q), disinfection and sterilization of equipment (11 Q), isolation measures and vaccination system (4 Q).

Scoring system

Regarding the scoring system for the questionnaire, the correct answer was given (2) grades while, incorrect answer was given (1) and so, the total score was 418 grades which distributed on its 6 parts as the following: -

Part 1. 24 grades, **Part 2.** 26 grades, **Part 3.** 50 grades

Part 4. 38 grades, **Part 5.** 56 grades, **Part 6.** 224 grades

Total score represented 100%. It was evaluated as following:

✓ Satisfactory level of Knowledge ≥ 85% (335.3 grades).

✓ Unsatisfactory level of Knowledge < 85% (335.3 grades).

B- Infection Control Associated Practices Observational checklists:

It was developed by the researcher based on review of the related literature *(El-Senousy & Gomaa, 2009; Ahmed, et al., 2010; Abou El-Enein & El Mahdy, 2011; WHO, 2016).* It was used to assess hemodialysis staff level of practices regarding the application of infection control measures as specified in the guidelines at hemodialysis unit. It was divided into two parts:

Part I: It was used to assess health team staff's practice regarding application of infection control measures pre, during and post hemodialysis sessions at hemodialysis unit. It included 91 steps distributed into the following: Pre-dialysis session (44 steps), intra-dialysis session (17 steps) and at the terminating the dialysis session (30 steps).

Part II: It was used to assess health team staff's practice regarding application of infection control measures and universal precaution at hemodialysis unit. It included 126 steps distributed into the following: Hand washing (33 steps), personnel protective equipment (29 steps), unit cleaning (14 steps), safe management of the waste (11 steps), linen management (10 steps), the water treatment system and sterilization of the water system (29 steps).

Scoring system

Regarding the scoring system of the observational checklists, the correct practice step was given (2) grades while, incorrect or not done step was given (1) grade, the total steps was 217 steps, so, the total score (434) which distributed into 2 parts as the following: -

Part I: The total grades are (182) which distributed into the following: Pre dialysis sessions (88 grades), intra-dialysis session (34 grades) and terminating dialysis session (60 grades).

Part II: The total grades are (252) which distributed into the following: Hand washing (66 grades), personnel protective equipment (58 grades), unit cleaning (28 grades), safe waste management (22 grades), linen management (20 grades) and the water treatment system and sterilization of the water system (58 grades).

Total score represented 100%. It was evaluated as following:

✓ Satisfactory level of practice ≥ 85% (369 grades).

✓ Unsatisfactory level of practice < 85% (369 grades).

C- Polices and Resources Assessment Tool

It was developed by the researcher based on review of literature *(PIDAC, 2009 & APIC, 2010& Environmental Cleaning Guidelines for Healthcare Settings, 2013 & Abd El-Hady, 2015),* to assess polices, resources, and unit design in hemodialysis unit that may affect infection control measures application in hemodialysis unit.

D- Infection Assessment Tool for Patients in Hemodialysis unit.

It was adopted from *(Abd El-Hady, 2015)* and modification was done by researcher based on the recent literature *(Michael, 2012, & Hughes, Tunney &Bradley, 2013, & Kanda, 2014 & Al Qahtani& Almetrek, 2016).* It was used to assess the exposures of the patients to infection pre guidelines application (6 months previous guidelines application and 6 months post guidelines application) in hemodialysis unit which included; assessment of White Blood Cells counting [WBCs], Virus Markers [VMs], and signs and symptoms of fistula infection. Also, infection rate was calculated by using the following equation:

$$\text{Rate of infection} = \frac{\text{The number of infection}}{\text{The number of those into population that area at risk of infection}}$$

(Centers for Disease Control and Prevention, 2016, Utah Department of Health, 2017).

Infection Control Guideline

Infection control guidelines was adopted from *(WHO, 2008 & Ahmed, et al., 2010)* modification was done by the researcher based on the recent literature and written in simple Arabic language using illustrated pictures *(WHO, 2008, El-Senousy & Gomaa., 2009; Ahmed, et al., 2010 & WHO, 2016).* It's included; two parts as the following:

Part I: the theoretical part; it covered the following items;

✓ Definition of infection in general and nosocomial infection.

✓ Chain of infection, the high-risk person liable for infection.

✓ Principles of disinfection and sterilization, the standard precautions.

✓ The importance of applying the standard precaution.

Part II: the practical part; it was concerned with the following:

✓ Application of infection control precautions regarding hand washing, personal protective equipment, aseptic technique, hemodialysis machine disinfection and cleaning, spills management, linens management, disinfection and cleaning of equipment

✓ Health team' practices in maintenance of hemodialysis unit environment, isolation measures and vaccination system.

✓ Patient's preparation

✓ Demonstrate hemodialysis procedure (pre, during and post the sessions) safely.

Infection control guidelines were revised by a group of experts in medical surgical nursing field for the content validity. Based on the opinion of a panel of expertise some modifications were done, and then the final forms were developed.

II- Operational design

The operational design included preparatory phase, pilot study and field work.

Preparatory phase

It included reviewing of the current and relevant related literature and theoretical knowledge of the various related aspects using books, articles, internet, and periodical magazines in order to develop the data collection tools. Exploring prevalence of patient at dialysis unit and incidence of infection at hemodialysis unit. Patient's rates of infection prior to the guidelines implementations were assessed retrospectively from the patient's file 6 months prior to the implementation phase.

Tools Validity & Reliability

To achieve the criteria of trustworthiness of the tools of data collection in this study. Validity was ascertained by a group of experts in the branch of medical surgical nursing, their opinion was elicited regarding the format, layout, consistency, accuracy and relevance of the tools. Tools of data collection were test to face validity of content, by seven professions and experts, three assistant professors of medical surgical nursing, four lecturers of medical-surgical nursing in the faculty of Nursing, at Ain Shams University. Reliability was ascertained statistically by using Alpha Cronbach test to ensure that the study tools are reliable. Reliability of knowledge assessment self-administered questionnaire and infection control associated practices observational checklist were .85& .89 respectively.

Pilot Study

The pilot study commenced once ethical approval was obtained. The pilot study was conducted on five staff members from the unit to test the clarity, feasibility and applicability of the determent tools. Based on the results of the pilot study, modifications and omissions of some details were done and then the final forms were developed. The nurses who included in the pilot study were excluded from the study sample and not substituted.

Field work

Field work included two phases: implementation and evaluation phase.

Implementation phase:

Data collection from health team staff for this study took about 12 months, started from January 2016 to December 2016. The observation checklist was filled out by the researcher who was available 3 days per week alternatively in the study setting while health team staff was involved in patient's care during morning and afternoon shifts, the time needed to fill in the questionnaire was about (30 minutes to 1 hour). Then, The questionnaire formats were filled in the clinical area by the health team staff included in the study in the presence of the researcher, the time needed to fill in the knowledge questionnaire was about (30 minutes to 1 hour). The total numbers of health team staff were 51 personnel. It divided into small groups (3-5 personnel/session) each group from the same categories received the guideline content using the same teaching strategies and handout.

Implementations of the guidelines were carried out at the previously mentioned study settings for each group separately. Each group took three theoretical and six practical sessions. The duration of each session took approximately 1 to 1.5 hours. Sessions started according to nurses' available time. Arabic language was used to suit the nurses' level of understanding. The used methods of teaching were lectures, group discussion, and demonstration and re-demonstration. An instructional media was used which included the guidelines handout and audiovisual materials as videos and real object that available in the setting as syringe, PPE. All of the studied health team in study setting was cooperative with the researchers.

The staff were interested in the topic. Educational sessions were carried out including theoretical sessions to cover knowledge about the general and specific objectives of guidelines regarding infection in the general and nosocomial infection, high risk persons for infection and universal precautions and practical sessions to cover practical part to improve health team staff practices regarding the application of infection control measures in hemodialysis unit; 4 sessions were given to the physician regarding hand washing, uses of personnel protective equipment, waste management and patient care, 6 sessions were given to the nurses regarding hand washing, uses personnel protective equipment, aseptic technique, waste management, linen

management and patient care, 3 sessions were given to the technicians regarding hand washing, uses of personnel protective equipment, machine maintenance, disinfection and sterilization and waste management and also, 5 sessions were given to workers regarding hand washing, uses of personnel protective equipment, waste management, linen management and environment cleaning.

Each health team staff in study group was seen continuously by the researcher to be sure that the instructions were followed correctly. Correction, reinstruction and re-demonstration were offered. Missed or unclear points were re-emphasized by the researcher. Infection control teaching guidelines booklet was given to each health team staff's in the study group to grasp attention, motivation and help for reviewing at home and support teaching and practicing.

Evaluation phase:

It was emphasized on estimating the effect of educational guidelines on health team staff knowledge and practices regarding infection control guidelines measures application as specified in the guidelines at hemodialysis unit to determine the level of improvement immediately post guidelines implementation and six months follow up post guidelines implementation. Also, evaluate the impact of infection control guidelines implementing on hemodialysis patients by comparing infection rate which confirmed by viruses markers in retrospectively during 6 months before implementation and prospectively for 6 months period after the implementation. As well, WBCs counts and signs and symptoms of fistula infection also compared.

III- Administrative designs:

A litter was issued from Faculty of Nursing El-Minya University to the director of El-Minya University Hospital to conduct the study, explaining the purpose of the study and requesting the permission for data collection from the studied health team staff and patients groups.

Ethical consideration:

The ethical research considerations in this study included the following:

▪ The research approval of protocol was obtained from the Scientific Research Ethical Committee in faculty of Nursing in Ain Shams University before starting the study.

▪ The research was clarified the objectives and aims of the study to health team staff and patients included in the study.

▪ The research assured maintaining anonymity and confidentiality of subject's data.

▪ Heath team staff and patients were informed that they are allowed to choose to participate or not in the study and they have the right to withdrawal from the study at any time without giving reasons.

IV- Statistical designs:

Data analysis: The collected data were organized, categorized, tabulated and analyzed using the statistical package for social science "SPSS" the computer program "version 20". Data were presented in tables and charts using actual percentages.

Significance of the results: The tests used to summarize the data as mean and stander deviation test, t-test to compare mean scores for numerical data, correlation coefficient (r-test).

▪ The value of $\leq .0.05$ was used as a cut-off point for determination of significance.

▪ The value of > 0.05 was used as a cut-off point for determination of non-significance.

Results

Table (1) shows that, regarding physician characteristics, 100% of them were aged less than 30 years old, 62.5% of them were female, 100% of them had experience less than 5 years and 62.5% of them attended one training course about infection control. Concerning nurses' characteristics, 73.3% of them were

aged less than 30 years old, 56,6% of the were female, 46.6% had bachelor degree in Nursing sciences, 66.7% of them had experience less than 5 years and 65.6 % of them attended one training course related to infection control.

In relation to technician's characteristics, 83.3% of them were aged less than 30 years old, 66.6% of them were male, 50% had bachelor degree in Medical Engineering sciences, 66.6% of them had experience less than 5 years and 0% of attended training course about infection control. Worker's characteristics showed that, 71.4% of them were aged ranged between 30-45 years old, 100% of them were female, 57.1% can read and write, 42.9% of them had experience less than 5 years and 71.4% of them attended training course about infection control.

Table (2) Illustrates the nurses' satisfactory level of knowledge pre/post the guidelines application and follow up infection control regarding their role before, during and after hemodialysis sessions. As before hemodialysis session knowledge in pre, post the guidelines application and follow up were 23.3 %, 93.3% and 83.3% respectively. In relation to nurses' level of knowledge about their role during hemodialysis session in pre, post the guidelines application and follow up were 36.6 %, 96.7% and 76.7% respectively. Finally, regarding nurses' knowledge about their role after hemodialysis session in pre, post the guidelines application and follow up were 30 %, 96.7% and 76.7% respectively with statistically significance differences regarding the all items.

Shows that, the physicians' satisfactory level of knowledge regarding their role before hemodialysis session knowledge in pre, post the guidelines application and follow up were 50%, 87.5% and 75% respectively. In relation to the physicians' levels of knowledge regarding their role during hemodialysis session were 62.5 %, 87.5% and 75% respectively. Regarding the physicians' levels of knowledge regarding their role after hemodialysis session were 75 %, 100% and 100% respectively with statistically significance differences regarding the all items.

Shows that, technicians' satisfactory level of knowledge about their role regarding infection control in relation to care of the hemodialysis machine & maintenance, 83.3% of them had satisfactory level of knowledge pre the application of the guidelines compared with 100% post guidelines application and 83.3% follow up. Regarding the proper use of the disinfect solutions in hemodialysis unit, 66.7% of them had satisfactory level of knowledge pre application of the guidelines compared with 83.3% post guidelines application and 66.7% at follow up. Concerning sterilization techniques by using the autoclave, 66.7% of them had satisfactory level of knowledge pre the guidelines application compared with 100 % post guidelines application and 83.3% at follow up. Moreover, performing microbiological test of water and filters uses, 83.3% of them had satisfactory level of knowledge pre the guidelines application compared to 100% post the guidelines application and follow up with no statistical significance difference regarding the all items.

Finally, illustrates workers' satisfactory level of knowledge pre the application of the guidelines for routine cleaning was 57.1%, compared to 85.7% post the guidelines application and 71.4% follow up. In relation to hemodialysis environment weekly cleaning, 42.8% of them had satisfactory level knowledge pre the application of the guidelines compared to 85.7% post the guidelines application and 71.4% follow up. Concerning linen management, 71.4%, of them had satisfactory level knowledge pre the application of the guidelines compared to 100% post the guidelines application and 85.7% follow up. Regarding waste management, 71.4% of them had satisfactory level knowledge pre the application of the guidelines compared to 85.7% post the guidelines application and follow up with no statistical significance difference is regarding the all items.

Table (3) shows that, 12.5% of physicians had satisfactory practice regarding routine hand washing and surgical hand scrub pre the application of the guidelines, compared to 50% post the guidelines application and 62.5% & 50% at follow up respectively with statistically significant differences (P=.001& P=.03 respectively). In relation to wearing personnel protective equipments, 0% of them had satisfactory practice pre guidelines, compared to

75% post the guidelines and 75% at follow up with a statistically significant difference (P=.001). While, concerning correctly management the waste, 87.5% of them had satisfactory practice pre guidelines, compared to 100% post guidelines and at follow up with no statistically significant difference (P=.542).

Table (4) shows that, 23.3% of the studied nurses had satisfactory practice regarding routine hand washing pre guidelines application, compared to 53.3% post guidelines and 33.3% at follow up with a statistically significant difference (P=.02). Concerning nurses' alcohol- based hand rub, 40% of them had satisfactory practice pre guidelines, compared to 76.7% post guidelines and 70.0% at follow up with a statistically significant difference (P=.05). In relation to nurses' wearing personnel protective equipments, in pre guidelines 36.7%, compared with 83.3% post guidelines and 70% at follow up with a statistically significant difference (P=.03). Also, before beginning routine disinfection and cleaning environment, 46.7% of the nurses had satisfactory practice pre guidelines, compared with 58.3% post guidelines and 60% follow up with a statistically significant difference (P=.001). While, regarding linen management, 20% of the nurses had satisfactory practice pre of the guidelines application, compared to 63.3% post guidelines application and 50% at follow up with a statistically significant difference (P=.003). Finally, correctly management the waste, 56.7% of the nurses had satisfactory practice pre of the guidelines application, compared to 90% post guidelines application and 60% at follow up with a statistically significant difference (P=.004).

Table (5) shows that, regarding technicians' practice for routine hand washing, 33.3%, of them had satisfactory practice pre guidelines application compared to 83.3% post guidelines application and 50% at follow up with a statistically significant difference (P. 0.05). Concerning technicians' alcohol-based hand rubs, 33.3%, of them had satisfactory practice pre application of the guidelines, compared with 83.3% post guidelines and 100% at follow up with a statistically significant difference (P. 0.02). In relation to technicians ' wearing of personnel protective equipment, 33.3% of them had satisfactory practice pre guidelines compared with 83.3% post guidelines application and 66.7% at follow up with a statistically significant difference (P. 0.04). In relation, care of water treatment system, 50% of them had satisfactory practice pre guidelines, compared with 100% post

guidelines application and 100% at follow up with a statistically significant difference (P. 0.001).

Table (6) shows that, 28.6% of the studied workers had satisfactory practice regarding routine hand washing pre guidelines application, compared to 42.9% post guidelines and 57.1% at follow up with a statistically significant difference (P. 0.02). Also, Alcohol-based hand rub pre guidelines application 14.3%, compared with 85.7% post guidelines and follow up 71.4% with a statistically significant difference (P. 0.004). In relation to worker' wearing of personnel protective equipments in pre guidelines 71.4% of them had satisfactory practice compared with 100% post guidelines and follow up. While, concerning linen management, 42.9% of them had satisfactory practice pre-guidelines compared with 85.7% post guidelines and 71.4% at follow up. In relation, waste management 42.9% of them had satisfactory practice pre-guidelines compared with 100% post the guidelines application and 85.7% at follow up.

Table (7) shows that, rate of infection in hemodialysis unit pre guidelines application, was 2.7 % infected as 4 patient's transmission from negative to positive with virus C in the period of the 6 months pre guidelines application compared with 0.6% infected as one patient in the period following 6 months post guidelines application. Concerning of patient's, 100% didn't acquiring virus B and HIV in hemodialysis unit during guidelines application.

Shows that, body temperature among patient's in hemodialysis unit during the sessions guidelines application, 42 % of patients were hyperthermic pre guidelines application compared with 20.2% post guidelines application with a statistically significant difference (P.00). Concerning white blood cells counting, 26.% increase than normal in pre guidelines application, compared 19.5% post guidelines application with a statistically significant difference.

While, regarding patients' signs of arteriovenous (AV) fistula infection, 37.3% of them were redness, 32.7% were swelling, 33.3% hotness signs, 32% of them had pain and 19.3% had pus infected fistula signs in pre guidelines application, compared with post guidelines application patients' signs of AV fistula infection, 27.8% of them were redness signs, 24.3% of the

were swelling, 31.9% hotness signs, 25% of them had pain and 15.3% had pus infected fistula signs. Also, there were no statistically significant regarding swelling (P.081), hotness (P.113), pain (P.800) and pus (P.185) but found statistically significant differences for redness infected AV fistula signs (P.000)

Table (1): Frequency distribution of the studied group characteristics (Health Team No. = 51)

Characteristics of the Study group		Physician (No.= 8)		Nurses (No.= 30)		Technician (No.= 6)		Workers (No.= 7)	
		Frequency (No. =)	Percent %	Frequency (No. =)	Percent %	Frequency (No. =)	Percent %	Frequency (No. =)	Percent %
- Age	- Less than 30	8	100	22	73.3	5	83.3	1	14.3
	- 30 - 45	0	0	6	20	0	0	5	71.4
	- More than 45	0	0	2	6.7	1	16.7	1	14.3
	Mean ±SD	25.4±1.3		29.1 ±8.2		31.5 ±10.1		39.0 ± 6.1	
- Genders	- Male	3	37.5	13	43.3	4	66.6	0	0
	- Female	5	62.5	17	56.6	2	33.3	7	100
-Health Team & Education Level	- Bachelor Degree of Medicine Science	8	100	0	0	0	0	0	0
	- Bachelor Degree of Nursing Sciences	0	0	14	46.6	0	0	0	0
	- School level **(Technical institute)**	0	0	10	33.3	2	33.3	0	0
	- Secondary School level **(Diploma)**	0	0	6	20	1	16.6	3	42.8
	- Bachelor Degree of Medical Engineering	0	0	0	0	3	50	0	0
	- Read & write (workers)	0	0	0	0	0	0	4	57.1
-Years of Experience	- Less than 5	8	100	20	66.7	4	66.6	3	42.9
	- 5 - 10	0	0	3	10	1	16.7	3	42.9
	- More than 10	0	0	7	23.3	1	16.7	1	14.2
	Mean ±SD	2.5 ± 1.2 years		8.3 ± 7.3 years		6.8 ± 4.3 years		9.0 ± 7.4 years	
- Attending training course for infection control	- Yes	5	62.5	17	65.6	0	0	5	71.4

Table (2): Health Team Staff satisfactory level of knowledge regarding their role before, during and after the hemodialysis sessions pre/post and follow up infection control guidelines application (no.=51)

		Staff satisfactory level of knowledge						T-test	P
		Pre		Post		Follow up			
		No	%	No	%	No	%		
Nurses role	- Before hemodialysis session	7	23.3	28	93.3	25	83.3	10.846	.000**
	- During hemodialysis session	11	36.6	29	96.7	23	76.7	8.455	.000**
	- After hemodialysis session	9	30	29	96.7	23	76.7	11.404	.000**
Physicians Roles	- Before hemodialysis session	4	50	7	87.5	6	75	3.416	.004**
	- During hemodialysis session	5	62.5	7	87.5	6	75	3.144	.007**
	- After hemodialysis session	6	75	8	100	8	100	2.183	.047*
Technician Role	- Care of the hemodialysis Machine & maintenance	5	83.3	6	100	5	83.3	.877	.401
	- Disinfect Solutions uses in hemodialysis unit	4	66.7	5	83.3	4	66.7	.277	.787
	- Sterilization Technique (Autoclave)	4	66.7	6	100	5	83.3	.210	.838
	- Microbiological Test of the water and Filters	5	83.3	6	100	6	100	1.000	.341
Worker Roles	- Routine cleaning	4	57.1	6	85.7	5	71.4	1.327	.209
	- Weekly cleaning	3	42.8	6	85.7	5	71.4	.346	.735
	- Linen and sheets management	5	71.4	7	100	6	85.7	.522	.611
	- Waste management	5	71.4	6	85.7	6	85.7	.420	.682

Table (3): Satisfactory level of physicians' practices pre/post and follow up guidelines application regarding the application of infection universal precaution in hemodialysis unit (No. = 8)

Items	Physicians' Practices						T-test	P
	Pre		Post		Follow Up			
	No	%	No	%	No	%		
- Hand washing								
• Routine Hand washing	1	12.5	4	50	5	62.5	3.754	.001
• Surgical Hand Scrub	1	12.5	4	50	4	50	2.125	.03
• Alcohol hand rub	2	25	7	87.5	8	100	4.750	.001
- Wearing Personal Protective Equipment	0	0	6	75	6	75	3.912	.001
- Management of the waste	7	87.5	8	100	8	100	1.452	.542

Table (4): Satisfactory level of nurses' practices pre/post and follow up guidelines application regarding the application of infection universal precaution in hemodialysis unit (No. = 30)

Items	Nurses' Practices						T-test	P
	Pre		Post		Follow Up			
	No	%	No	%	No	%		
- **Hand washing**								
• Routine Hand washing	7	23.3	16	53.3	10	33.3	2.745	.02
• Surgical Hand Scrub	6	20	15	50	11	36.7	2.478	.04
• Alcohol-based hand rub	12	40	23	76.7	21	70	2.145	.05
- **Wearing Personal Protective Equipment**	11	36.7	25	83.3	21	70	2.745	.03
- **Cleaning Environment**								
• Before Beginning Routine Disinfection	14	46.7	21	58.3	18	60	3.745	.001
• Routine Disinfection After Patient Left the station	19	63.3	23	76.7	27	90	4.125	.004
- **Linen Management**	6	20	19	63.3	15	50	4.550	.003
- **Correctly Management the waste**	17	56.7	27	90	18	60	4.663	.004

Table (5): Satisfactory level of technicians' practices pre/post and follow up guidelines application regarding the application of infection universal precaution in hemodialysis unit (No. = 6)

Items	Technicians' Practices						T-test	P
	Pre		Post		Follow Up			
	No	%	No	%	No	%		
- **Hand washing**								
• Routine Hand washing	2	33.3	5	83.3	3	50	2.145	.05
• Surgical Hand Scrub	2	33.3	4	66.7	3	50	2.345	.05
• Alcohol-based hands rub	2	33.3	5	83.3	6	100	3.745	.02
- **Wearing Personal Protective Equipment**	2	33.3	5	83.3	4	66.7	3.980	.04
- **Care of the water Treatment System**	3	50	6	100.0	6	100	7.125	.001

Table (6): Satisfactory level of workers' practices pre/post and follow up guidelines application regarding the application of infection universal precaution in hemodialysis unit (No. = 7)

Items	Workers' Practices						T-test	P
	Pre		Post		Follow Up			
	No	%	No	%	No	%		
Hand washi -Routine Hand washing	2	28.6	3	42.9	4	57.1	2.745	.02
-Alcohol-based hand rub	1	14.3	6	85.7	5	71.4	7.450	.004
- **Personal Protective Equipment**	5	71.4	7	100	7	100.0	2.471	.05
- **Cleaning Environment**								
- Before Beginning Routine Disinfection	5	71.4	7	100	5	71.4	3.780	.04
- Routine Disinfection After Patient Left the station	4	57.1	7	100	7	100.0	2.971	.003
- **Linen Management**	3	42.9	6	85.7	5	71.4	4.125	.002
- **Waste Management**	3	42.9	7	100	6	85.7	3.784	.03

Table (7): The patient's Signs and symptoms of infection and rate infection pre & post guidelines application among the patient's in hemodialysis unit.

Infection Rate & Items	Pre (No.= 150)		Post (No.=144)		X^2	P
	No	**%**	**No**	**%**		
[1] Acquire Hepatitis C Viruses						
- **Yes**	4	2.7	1	0.6	1.025	.113
- **No**	146	97.3	0	0%		
[2] Body temperature						
- Normal	60	40	105	72.9	5.540	.000**
- Hypothermia	27	18	10	6.9		
- Hyperthermia	63	42	29	20.2		
Mean± SD	37.7 ± 1.7		37.1 ± 1.2		......	......
[3] White Blood Cells Counting						
- Normal	93	62	104	72.2		
- Decreased	18	12	12	8.3	3.499	.01*
- Increased	39	26	28	19.5		
Mean ± SD	9.03 ± 3.4		6.6 ± 2.1		......	......
[4] AV fistula Signs of infection						
- Redness	56	37.3	40	27.8	5.449	.000**
- Swelling	49	32.7	35	24.3	1.750	.081
- Hotness	50	33.3	46	31.9	1.588	.113
- Pain	48	32	36	25	.253	.800
- Pus	29	19.3	22	15.3	1.328	.185

NB: 6 patients die during guidelines application.

Discussion

The finding of the present study revealed health team staff characteristic regarding physician characteristics, all of them were aged less than thirty years old, this is supported by *Abdel-Rasoul, et al (2016)*. Also, two-third of the physicians was female, this finding in concordance with *Asadpour, Vazirinejad, Esmaeili, Bazyar, Fallah, (2013).* All of them had experience less than 5 years; this finding is congruent with *Eid and Abd el–Aziz (2013).* In study titled *"Proposed Developed Standards: Staff Nurses Compliance at Dialysis Unit ".* The present study also showed that, more than one-third of studied group weren't trained previously on infection control guidelines and universal precautions, this is supporting the result by *Fashafsheh, Ayed, Eqtait & Harazneh, (2015).* But the previous finding in disagreement with *Abou El-Enein and El Mahdy (2011)* reported that, none of the subjects of physicians had received training in the field of infection control. In study titled *"Standard precautions: a KAP study among nurses in the dialysis unit in a University Hospital in Alexandria, Egypt."*

On other hand, regarding nurses' characteristics, based on the results of the present study, more than two-third of the nurses aged, less than thirty years old, which might be related to their new graduation. This is in concordance with *Ahmed, (2011)* found that, the majority of the nurses ages, ranged from twenty to twenty-nine years old. This study is also in agreement with *Hassona, Winkelman, El-wahab, Ali & Abdeen, (2011)* stated that, the majority of the nurses between ages of twenty to less than thirty years old. While this is in disagreement with *Hassan, Sorour, Eldahsha & Moghazy, (2013),* stated that, more than half of nurses aged more than thirty years old. The present study revealed that, more than half of studied nurses were females, due to the tendency of females to enter the nursing faculties who find it difficult to enter the Medical Schools in Egypt. In study titled' *"Nurses Knowledge and Practice Regarding Intradialytic Complications for Hemodialysis Patient".*

Concerning to level of education, less than half of nurses in the current study had bachelor degree of nursing sciences, this finding may be due to that HD unit as a critical unit

need high qualified nurses'; this is in agreement with **Thomas-Hawkins, Flynn & Clarke, (2008),** reported that, half of the studied nurses had baccalaureate degree in nursing and **Abd-El Hady, Khalifa, Zein El-Dein & Hemdan, (2011)** stated that, two-thirds of the studied nurses had bachelor degree of nursing sciences; while this is in disagreement with **Al-Mawsheki, Ibrahim & Taha (2016),** stated that most of nurses had diploma in nursing, Also **Ali (2013)** reported that most of nurses had diploma of nursing. In study titled *"Assessment of Nurses' Knowledge and Practice Provided to the Patients Under Going Hemodialysis at Cairo University Hospital."*

As regarding years of experience, it was noticed that two-third of the studied nurses had experience from one year to less than five years; this is in agreement with **Bakey (2014)**, stated that, more than two-third of the studied nurses' had experiences ranged from one year to less than 5 years, with regarding of attended training course. The current study revealed that, more than one-third of the studied nurses' did not attended training course about infection control in HD unit. This is in agreement with **Abd-Alfatah, Ahmad & Mohamed (2013),** stated that, the majority of the studied nurses' did not attend training course about infection control and patients care in HD Unit. This result was inconsistent with **Molan, Sands, Neighbors, Marck & Green (2009)** reported that, majority of nurses' must attended an infection control training program. In spite of head of dialysis unit reported that nurses' prior to work in the HD units usually had an orientation program prior to at the starts their work in the unit. The researcher notice their no orientation program was started with the newly coming nurses prior to work with patients at the HD unit every new nurse's stick to one of the experience nurses' working in the unit to imitate her during the work not based on scientific orientation program. Regarding physicians, nurses, technicians and workers level of the basic knowledge, approximately (less than two-third, half, one-third and the minority respectively) had satisfactory level of the basic knowledge pre-guidelines application that may be due to lack of infection control training courses prior to work in HD unit. This finding is in agreement with **Abd El-hady, (2015)** who found that, the

lowest scores of knowledge about basic infection control pre-guidelines application compared with highest knowledge scores in all areas post the application of infection control guidelines also at the follow up period.

In the current study, also shown a statistically significant improvement for the total knowledge about infection control in HD unit after the guidelines application, this is in congruence with **Abo El-wafa, (2013)** who stated that, improvement of health team staff knowledge was found for the majority of health team staff after implementation of the educational guidelines about infection control measures in unit.

The results of the present study revealed that, less than two-third of physicians had satisfactory level of basic knowledge about infection control pre-guidelines application compared with all of them had satisfactory level of knowledge the post the guidelines application and at the follow up period. This is in congruence with **Tarko, Azazh & Abebe (2015)** who stated that, medical staff had better knowledge in infection control measures. In his study titled "*Assessment of the Knowledge, Attitude and Practice of Fourth, Fifth and Sixth Year Medical Students on Standard Precaution in Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia* ".

While, regarding nurses' level of knowledge, half of them had satisfactory level about infection control the application after pre-guidelines, while the majority them had a satisfactory level of knowledge post the guidelines application and at the follow up. This is supported by **Abd El-Hady, (2015)**. In his study titled *"Impact of teaching guidelines on improving nurse's performance and patient's safety regarding nosocomial infection in dialysis unit".*

Also, the current study revealed that, one-third of the technicians' had satisfactory level of knowledge about the basic infection control pre-the guidelines application compared with the majority of them at the post and follow up after the application of the guidelines.

Finally, the results revealed also that, the

minority of workers' had satisfactory level of knowledge about the basic infection control pre-the guidelines application compared with more than two-third of them get the satisfactory level of knowledge at the post and follow up period of the guidelines application; this is supported by **Suchitra, Lakshmi, & Devi, (2007)** in his study titled *"Impact of education on knowledge, attitudes and practices among various categories of health care workers on nosocomial infections"*. However, this improvement of the knowledge level reached to highly statistical significance difference between the level of knowledge among the physicians', nurses', technicians' and workers' pre- application of the guidelines compared with post and follow up period, and this result was in congruence with **Abo El wafa, (2013).**

Regarding nurses' satisfactory level of knowledge about their role before, during and after HD sessions, according to the present study findings, it was showed that, in pre-guidelines application before HD session, less than quarter of them had satisfactory level of knowledge regarding their role compared with the majority of them post-the application and at follow-up period. As regarding nurses' knowledge about their role during HD session, more than one-third of them had satisfactory level pre-application of the guidelines, compared with the majority of them post-the application and more than two-third of them at the follow up period; this is in agreement with **Hassan, Sorour, Eldahshan & Moghazy, (2013),** who reported that nearly two-thirds of total nurses had satisfactory knowledge regarding care of patients during hemodialysis sessions. But this is disagreement with **Hassona, Winkelman, El-wahab, Ali, & Abdeen, (2011)**, who stated that most of nurses had unsatisfactory knowledge, regarding hemodialysis care. This finding may be due to many factors including: nurses are including in the study new graduated and not attending training courses.

Finally, regarding nurses' knowledge about their role after HD session, less than one-third of them had satisfactory level pre-the application of the guidelines compared with the majority of them post-application and more than two-third of them at the follow up period.

However, these improvements lead to highly statistical significance differences between nurse's knowledge about their role before, during and after HD sessions. This finding is supported by **Dawood, El- sebai, Salem & Hussein, (2016)** who stated that, poor baseline knowledge and practices noticed among nurses might be attributed to that, after graduation, nurses abandon reading and neglect updating their professional knowledge. Another possible reason might be the absence of any resources or programs for continuing nursing education that are essential to upgrade and improve the nurses' level of knowledge and practices in care of HD patients. Also, this finding was supported by **Issa (2013)** who mentioned that patient' outcomes were improved after the application of educational programs for the nursing staff. In study titled *"An education intervention to improve nurses 'knowledge to reduce catheter-related bloodstream infection in hemodialysis unit".*

In relation to, the physicians' satisfactory level of knowledge regarding their role before, during and after HD sessions; the present results revealed that, half of them had satisfactory level of knowledge regarding their role before HD session pre-application of the guidelines, compared with the majority of them post-the application and more than two-third of them at follow up period. While the studied group gained higher scores of knowledge level post and follow up guidelines application. This finding goes in the same line with **Asadpour, Vazirinejad, Esmaeili, Bazyar, Fallah, (2013),** who stated that, the level of knowledge scores of physicians was desirable, but the practice scores were not desirable. While, the current results showed that, regarding their role during and after HD session two-third of them had satisfactory level of knowledge pre-guideline application compared with the majority of them in post and follow up period of the guideline application. This finding is supported by **Amoran & Onwube, (2013)** who stated that healthcare team had inadequate knowledge about infection control. Nevertheless, the results of their research showed a desirable knowledge score. This finding in agreement with **Ghofranipour, Asadpour, EftekharArdebili, Niknami & Hajizadeh, (2009)** who stated that, the results of this study showed that, the

knowledge score was desirable but attitude and practice scores were not desirable. In study titled *"Needle Sticks/Sharps Injuries and Determinants in Nursing Care Workers"*.

Regarding technicians' level of knowledge about their role in maintenance of HD machines, using of disinfect solutions, application of the sterilization technique and performing the microbiological test of the water and filters, approximately (the majority, more than two-third, more than two-third and the majority respectively) of the technicians' had satisfactory desirable level of knowledge pre-guidelines application that may be due to the importance of this critical part in the dealing of machines in HD which reflect on the quality and safety of patients care in HD units. Also, the present finding revealed an improvement of technician's level of knowledge post and follow up application of the guidelines with no statistical significance difference. This finding was supported by **Mudedla, Tej, Reddy & Sowribala, (2014)** who stated that, technicians exhibited knowledge levels are better than the medical staff and nurses. In study titled *"A study on knowledge and awareness of standard precautions among health care workers at Nizam's institute of medical sciences Hyderabad"*.

Regarding workers' satisfactory level of knowledge about their role; the results showed that, workers' satisfactory level of knowledge pre-guidelines for routine cleaning, weekly cleaning, linen and sheets management and waste management, showed (more than half, less than half, more than two-third and more than two-third respectively) of them had satisfactory desirable level of knowledge pre-the guidelines application. Comparing to post and follow up guidelines application had improvement and highest scores in level of knowledge. This is supported with **Abdel-Rasoul, Al Bahnasy, Mohamed, Abdel-Aziz, Mourad & Youssef (2016)** who found that, educational guidelines had positive effect and improve workers level of knowledge.

Regarding Nurses' satisfactory level of knowledge about universal precaution; the results showed that, more than half of them had satisfactory level of knowledge about aseptic technique and safe injection pre-the application of the guidelines, compared with the majority of them post-its application and follow up period. This finding was supported by **Reda, Fisseha, Mengistie & Vandeweerd, (2010),** who stated that, previous studies have shown inadequate adherence to preventive measures, such as recapping needles, routine use of gloves, and hand washing after gloves removal. On the same line, **Kotwal &Taneja (2010).** Who stated that, previous studies have shown that some misconceptions persist regarding the application of the universal precautions. In titled *"Health Care Workers and Universal Precautions: Perceptions and Determinants of Noncompliance "*.

In relation to technician's characteristics, included in the study, the majority of them were aged, less than thirty years old, two-third of them were male, half of them had bachelor degree of Medical Engineering sciences, two-third of them had experience, less than 5 years and all of studied group of them didn't attend training course related to infection control in the HD unit.

Concerning characteristics of the worker's included in the study, two-third of them were aged, ranged between thirty to forty five years old, all of them were female and more than half of workers can read and write only, this finding is in agreement in with **Abdel-Rasoul, Al Bahnasy, Mohamed, Abdel-Aziz, Mourad & Youssef (2016)** stated that, low level of education among workers is alarming for the risk of spread of hospital associated infections, as it indicates that safety measures are hardly followed by such studied categories. Also, less than half of the workers had experience less than 5 years and two-third of them attended training as one course only. In study titled *"Effect of an educational health program on the knowledge, attitudes and practices of healthcare workers with respect to nosocomial infections in the National Liver Institute, Egypt, Menoufia"*.

In relation to patient infection rate in hemodialysis unit pre & post guidelines application, based on the results of the present study, four patients infected and changed from negative HCV to positive HCV in the period of

the 6 months pre guidelines application compared with one patient only infected in the period following 6 months post guidelines application. Also, there were no patients acquiring HBV and HIV in hemodialysis unit during guidelines application. This finding is in agreement with *Ibrahim & Elawady (2017)* who stated, that a high prevalence of HCV among HD patients in Egypt is coinciding with that Egypt has the largest epidemic for hepatitis C virus worldwide with significant risk factors for HCV as contaminated blood products, needles and instruments were considered as major sources for transmission of HCV. Also, inadequate application and or breakdown of infection control policies in HD units (as contamination of dialysis machines and improper decontamination and sterilization or inadequately trained staff and unawareness of the value of hand washing) increase the transmission of HCV. Nosocomial infections increase patients' morbidity, mortality, as well as length of hospital stay and treatment cost.

As regarding to sign and symptoms of infection, the current study revealed that there is a highly statistically significant difference between the studied patients pre/post and follow up guideline application regarding sign and symptoms of infection including body temperature, increase white blood cells counting (WBCs) or AV fistula infection site as redness. Additionally, there is no statistically significant difference between studied patients' AV fistula sign of infection site as swelling, hotness, pain or present of pus discharge. This finding is supported by *Bakke (2010)* who revealed a significant decrease in catheter-related infections (CRI) by implementing published guidelines with a significant cost savings to the healthcare system. In a similar study *Meddings, Rogers, Krein, Fakih, Olmsted & Saint, (2014)* who stated that changing practice is not easy and can be costly, but it will cost healthcare organizations more financially without adequately educating nurses about best practices. In addition, lack of prevention strategies knowledge jeopardizes patient safety and the quality of care. In study title *"Reducing Unnecessary Urinary Catheter Use and Other Strategies of Prevent Catheter-Associated Urinary Tract Infection: An Integrative Review".*

This finding on the same line with *Gomah (2013)* who referred to the presence of significant differences between all patients in both groups related to complications of infection. Besides Aiken, Cimiotti, Sloane, *Smith, Flynn & Neff (2012)* stated that better hospital nurse staffing, more educated nurses, also improve nurse work environments have been shown to be associated factors with lower hospital infection and mortality rate. Also, Ibrahim & *Elawady (2017)* stated that, the prevalence of HCV infection among HD patients is generally much higher than general population due to underlying impaired cellular immunity which increases their susceptibility to infection. Also hemodialysis requires prolonged vascular access and exposure to contaminated equipment.

Regarding vascular access's assessment of pain, the present study emphasized that more than quarter of the patients' had access's pain before the application of guidelines as compared to very low percentage of the patients' suffering after the application of the guidelines that could be attributed to that dialysis staff become adequately educated and trained in how to decrease access's pain, as proper needle puncture injected by a well trained nurses whit high level of knowledge regarding how patients keep access arm elevated during dialysis session; and this was supported by the results of *Deborah (2010).* In study titled *"Cannulation camp, basic needle cannulation training for dialysis staff."*

Conclusion

The results of this study concluded that:

Application of infection control guidelines improved health team staff knowledge and practices with positive effect on the infection rate for patients and health team staff in hemodialysis units.

Recommendations

The results of this study recommended that:

1.Developing strategies to promote the use of infection control measures, universal precautions and guidelines in HD unit.

2.Unit needs obligatory training programs in guidelines for health team staff and systems for monitoring the appropriate use of equipment and supplies, infection control measures in HD unit.

3.Continuous education and training of both new and current health team staff in hemodialysis unit about infection prevention and control guidelines should be enhanced.

4.Comprehensive booklets includes instructions to improve long-term care for improvement health statues for patients as hemodialysis access, infection signs HD access to all hemodialysis patients and in HD unit.

5.Further research, replication of the study on large representative probability sample is highly recommended to achieve more generalization of the results.

6.Staff and Patients' vaccination against hepatitis B is recommended among health team staff and patients in the HD units.

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