

## Nurses' Knowledge and Practice Assessment Regarding Hand Hygiene and Its Opportunities Application in Hemodialysis Units

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**Abstract:** Hemodialysis patients are high risk to the development of healthcare-associated infections because of various predisposing factors, as they under invasive procedures, depressed their immune system, they not have physical barriers between patients in the outpatient Hemodialysis environment, and recurrent contact with healthcare workers during procedures and care. Performance of proper hand hygiene technique before and after contact with dialysis catheter site or during the dressing reduces the possibility of infection. Proper hand hygiene performed by nurses lead to remove most of harmful microorganisms; and break the chain of infection. If Hemodialysis nurses have knowledge about correct hand hygiene technique, and its opportunities; these influence their good practices in infection control measures.

**Aim of the study:** To assess nurses' knowledge and practice regarding hand hygiene and its opportunities application in hemodialysis units.

**Methodology:** A descriptive comparative design was used.

**Subjects & Setting:** 50 nurses divided into two groups each group 25 nurse who works at Hemodialysis unit in Menoufia university hospital and Shibin El-kom teaching hospital. **Tools:** three tools; **Tool I:** Structured interview questionnaire; which included nurses' knowledge about hand hygiene and its opportunities. **Tool II:** Observational guide for hand hygiene opportunities. **Tool III:** Observational checklist for hand hygiene technique.

**The results:** Most of nurses from both setting had Diploma degree in nursing, their experience years were more than 5 years, and they aged between 26-30 years old. A majority from nurses working in Hemodialysis unit of Menoufia university hospital (setting 1) had good level of knowledge and practices about hand hygiene technique and its opportunities, presence of positive relationship among some socio-demographic characteristics of nurses and their knowledge and practices for hand hygiene technique and its opportunities.

**Conclusion:** A proper Hand hygiene technique provides a hospital safety atmosphere for patients and nurses' knowledge about hand hygiene technique and its opportunities very essential for sound practice.

**Recommendation:** Hemodialysis (HD) nurses need to basic training and periodic retraining to reinforce nurses' knowledge and practice about it. Establishment of hand care program for staff should be a key component of improving effective and safe hand hygiene practices to protect staff and clients/patients/visitors from infections.

**Keywords:** Hand hygiene, Hand hygiene opportunities, Hemodialysis.

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### I. Introduction

Hemodialysis is the most effective treatment of renal failure, by using of a machine to filter the patient blood outside the body. Hemodialysis not cure the renal failure, but removing of wastes and extra fluid from patients' blood so increase extended survival rates and maintains patients' [1]. Hemodialysis as a process need to nurses have skills and knowledge about the influence of technology, equipment, machines, and needles [2]. Sharif, et al., (2016) [3], documented that; WHO reported about 1,400,000 from worldwide had healthcare-associated infections and 40% from this number occurred in developed countries [4&5].

In 2011, Kugler, et al., [6] reported that, annually about 74 from each millions of Egyptian population had renal failure in its end stage. While, El-Naggar, et al., (2015) [7], documented that, about 264 per million of renal patients underlying dialysis. Egyptian Health Survey showed that about 10% from Hemodialysis patients at high risk of infections as HCV infection [8]. About 330 per million populations in Menoufia governorate which consider rural areas in Egypt complained of end stage of renal failure, and received Hemodialysis therapy [9].

Hemodialysis (HD) units are not similar to other hospital sections, the probability of infection transmission to patients is more by extended blood exposures, and they receive care from more than nurse

during the same session. So, it is important application of infection control measures as; hand hygiene in each one of its opportunities at Hemodialysis unit [7].

Inadequate hand hygiene among dialysis patients associated with transmission of infection and destroys patient safety; which is the basic outcomes of nursing care [10]. Hand hygiene is the solitary mainly practice in preventing the spread of infection. It is the mainly central and effectual infection control measure against incidence and spread of health care-associated infections (HAIs) in any health care facility [11]. Nurses' knowledge and practice about hand hygiene are very essential in preventing the transport of harmful microorganisms by them to patients during providing care [12]. More than 75% of healthcare-associated infections can be prevented by hand hygiene [13]. Patient safety is a critical worldwide health concern. Prevent Infection or control it are the greatest important element in patient safety [14]. Dirty Hands carry two types of flora microorganisms can transport to patients [15].

Hand hygiene means cleaning of hands with ordinary soap and water, to eliminate of observable dirt and kill of transient bacteria carried by the hands, even as maintaining skin intact. Hand hygiene is the simplest successful and less costly way in decreasing of health care-associated infection rates among all hospital patients, especially Hemodialysis patients due to depressed in immune system by uremia effect [16&17]. Nurses are good model for performance of hand hygiene among other hospital staff. The correct hand hygiene is one of the main techniques in infection control measures. If it is performed accurately possibly will lower lot of operating expense and sufferers [3]. World Health Organization (WHO), established two approaches for hand hygiene; first by cleaning hands with soap and water, also stated international guidelines for hand hygiene technique; so the nurses and others health care providers must followed it through; wet all surfaces of soiled hands and fingers with warm water; apply enough amount of soap to covered the all; then cleansed them strongly on one direction for 40-60 seconds by friction technique. After that rinsing the lathered hands and finger nails under stream of running water, finally drying by one use towel or tissue paper [18]. Furthermore, the second method is hand decontaminant by Alcohol-based hand rub; recommended by WHO & Centers for Disease Control Infection (CDC) against wide variety of microorganisms, it can use if not obviously dirty hands, it not need to water, it can use in its available products as liquid, gel or foam, cleaning the hands by alcohol through rubbing technique for 20-30 seconds [19, 20&21]. Other products may use in hand hygiene as antimicrobial soap; antiseptic agent; antiseptic hand wipe and surfactant components. All these products have directly effective action on microorganism growth [22]. Hand hygiene opportunities in Hemodialysis unit recommended by HICPAC & WHO guide, which classified into five opportunities or moments, indicated to break the chain of infection and prevent transmission of pathogens into patients. They categorized into two before and three after indications [23&24].

### **Significance of the study**

Hemodialysis patients need to three sessions per week for renal dialysis, so they always search for the best hospital has professional team to receive safe therapy. Menoufia University hospital and Shebin El Kom Teaching hospital are the largest hospitals provide the Hemodialysis therapy in Shebin El Kom city. Hemodialysis patients need to qualified nurses, who have specific knowledge and skills. Hemodialysis nurse should be knowledgeable about disease, dialysis, and patients' complications during it, good understanding of hemodialysis technology. Otherwise, they skillful in venipuncture for hemodialysis patients, application of proper hand hygiene as an important and effective infection prevention and control measure to prevent multiply of microorganisms resulting in HAIs among HD patients and finally provide their care of hemodialysis patients safely [2].

**Aim of the study:** To assess nurses' knowledge and practice regarding hand hygiene and its opportunities application in hemodialysis units.

### **Research question:**

Q1: What is the nurses' knowledge about hand hygiene to ensure patient safety?

Q2- Is there difference between both setting in knowledge, hand hygiene technique and its opportunities application?

Q3-Is the relationship among hand hygiene technique, its opportunities application, knowledge and level of education, experience years of nurses?

## **II. Methods**

### **2.1 Design:**

A descriptive comparative design was used.

### **2.2 Setting:**

This study was conducted in two Hemodialysis unit, Menoufia University hospital, and Shibin El-kom Teaching hospital, Menoufia governorate, Egypt.

### **2.3 Duration of study:**

Data were collected during the period from the second week of June 2017 to the end of first week of the September 2017 (12 week) (10 week for assessment of study practical part) (other two weeks, the first week for taken official permission, pilot study and other preparations) (the second week for filling tool 1 (two parts) by nurses.

### **2.4 Sample Size:**

The purposive sample for this study was 50 nurses, from total number was 60 nurses, who working in both hemodialysis unit within both setting, it divided into 25 nurses working in Menoufia University hospital, and another 25-nurse working in Shibin El-kom Teaching hospital, Egypt at the time of the study.

### **Inclusion criteria:**

Nurses whom were willing to participate at the time of the study.

Age between 20 - 60 years old.

Both sexes if available.

### **Exclusion criteria:**

Nurses were excluded from the study if they:-

Not willing to participate in the study.

### **Tools for data collection:**

Data were collected through using three tools; **Tool I**; it is a structured interviewing questionnaire, it developed by research; it divided into two parts as follows: Part one: it included nurses Scio-demographic data as gender, age, qualification, the setting and experience years. Part two: which included 19 question to assess nurses knowledge about hand hygiene and its opportunities as hand hygiene definition, types, hand hygiene opportunities with examples, duration of hand hygiene by soap and water and by alcohol-based hand rub, the difference between colonized and infected, nosocomial infection definition, routes of cross infections among patients by nurses, the precautions to prevent cross infection, how maintaining patient safety, infection control measures etc... **Tool II**; (Observational guide for hand hygiene opportunities); it developed by **WHO & HICPAC, [23&24]**, which included 17 points, divided into 5 items, 12 sub-items (indications), the five opportunities were; two before moments as hand hygiene before touching a patient; as before entering station to provide patient care, hand hygiene before any aseptic procedures, as before performing catheter site care, and three after moments; after body fluid exposure risk; as after handling used dialyzers, or blood tubing, after touching a patient; as when leaving station after performing patient care, after touching patient surroundings; like after touching dialysis machine and removing gloves. **Tool III**; (Observational checklist for hand hygiene technique); it developed by **Taylor, et al., (2015) [25]**, it had 15 steps for proper hand hygiene technique.

### **Scoring system:**

**Hand hygiene and its opportunities Knowledge questionnaire:** Total score ranged from (1-19) grade. It's defined as follows; from 1-9 grade or < 50% that indicated poor knowledge, from 10-14 grade or 50 - < 75% that indicated fair knowledge, and from 15-19 grade or  $\geq 75\%$  that indicated good level of knowledge.

**Observational guide for hand hygiene opportunities application:** Total score ranged from (1 to 17) grade. It divided into three levels as follows; 1-8 or < 50% that meant unsatisfactory application of hand hygiene opportunities, 9-12 grade or 50 - < 75% that meant satisfactory application of hand hygiene opportunities and 13-17 grades or  $\geq 75\%$  that meant good application of hand hygiene opportunities.

**Observational checklist for hand hygiene technique:** Technique includes 15 step, each proper step taken one grade, if no taken zero grade, total score ranged from (1-15) grade, classified as 1-7 or < 50% that had unsatisfactory level of practice, 8-11 grade or 50 - < 75% that had satisfactory level of practice, 12-15 grade or  $\geq 75\%$  that had good level of practice of hand hygiene.

### **Reliability of the tools:**

Reliability was applied by the researcher for testing the internal consistency of the (tool I) by administration of the tool to the same subjects before collecting the data actually to assess clarity and simplicity of the questions. Reliability was estimated among 6 participants by using test retest method with two weeks apart between them. Pearson correlation coefficient was 0.89 which indicates that the questionnaire is reliable to detect the objectives of the study.

**Validity of the tools:**

The tool was tested for its content by a jury of five experts in the field of Medical Surgical Nursing to ascertain relevance and completeness. The validity of the questionnaire was assessed using content validity by an Expert. The relevancy, clarity, fluency, and simplicity of each component in the questionnaire were examined by the expert and they found the questionnaire is valuable and helpful.

**Pilot sample:**

A pilot study was carried out on 10% of studied sample (6 nurse) to assess the clarity, applicability and time needed to fill the tool. The necessary modifications were done as revealed from the pilot study. The sample of pilot study was excluded from the total sample to assure the stability of the result.

**Ethical considerations:**

For ethical reasons, the official permission obtained from the directors of both Hemodialysis unit in Menoufia University Hospital and Shebin Elkom Teaching Hospital, after explained the study aim.

**Data collection process:**

Before data collection the researcher selected two hospital, Menoufia University Hospital and Shebin Elkom Teaching Hospital and explained the aim of the study to the participants in both setting, obtain their agreement for sharing in the study, each participant has a right to withdrawal from the study when he/she want, then distributed the knowledge questionnaire (Tool I) to them. The needed time for completing questionnaire was about 20-30 minutes. After the participants completed of the questionnaire, the researcher makes sure that all questionnaire sheet was being filled completely, the researcher collected them. Regarding to assessment for application of hand hygiene opportunities and hand washing technique by both setting nurses, the research presented at the unit 5 day/ week from 7am clock to 2 pm clock , the research divided 25 nurse in each setting into 5 group/ setting, assess 5 nurse / week, one nurse/day, the research assessment started from the beginning of hemodialysis session to the end, assess nurse application of hand hygiene opportunities during hemodialysis session and hand hygiene technique by using observational checklist. Then the researcher performs a comparison between two settings.

**Statistical analysis**

The data collected were tabulated & analyzed by SPSS (statistical package for the social science software) statistical package version 20 on IBM compatible computer. Two types of statistics were done: **Descriptive statistics:** were expressed as mean and standard deviation (X+SD) for quantitative data or number and percentage (No & %) for qualitative data. **Analytic statistics:** as Pearson Chi-square test ( $\chi^2$ ) & Fisher's Exact Test, Mann-Whitney test (non-parametric test), ANOVA test, Kruskal-Wallis test (non-parametric test), and Spearman correlation.

**P-value at 0.05 was used to determine significance regarding:**

- P-value > 0.05 to be statistically insignificant.
- P-value ≤ 0.05 to be statistically significant.
- P-value ≤ 0.001 to be highly statistically significant.

**III. Results**

**Table (1):** Distribution of study groups according to their Socio-demographic data:

Socio-demographic characteristics	Studied groups				$\chi^2$	P value
	Setting I University hosp. (n=25)		Setting II Teaching hosp. (n=25)			
	No.	%	No.	%		
<b>Age categories:</b>						
21-25	4	16.0	3	12.0	7.53	0.18 NS
26-30	9	36.0	13	52.0		
31-35	7	28.0	5	20.0		
36-40	3	12.0	0	0.0		
41-45	2	8.0	1	4.0		
>46	0	0.0	3	12.0		

<b>Gender:</b>							
Male	4	16.0	0	0.0	4.34*	0.11	NS
Female	21	84.0	25	100.0			
<b>Qualification:</b>							
Diploma	13	52.0	23	92.0	9.92	0.002	S
Bachelor	12	48.0	2	8.0			
<b>Experiences years:</b>							
Less than 5 years	4	16.3	3	12.0	0.16*	1.0	NS
More than 5 years	21	84.7	22	88.0			

**Table (1):** illustrated that distribution of sociodemographic characteristics for both setting (I, II), which documented that, about 36.0% from setting (1) and 52.0% from setting (II) were aged in between twenty-six to thirty years old. Concerning to nurses' gender, all nurses in setting (1) were female except four; while setting (II) nurses were all female. With respect to professional educational qualification, it was observed that around 52% from setting (1) and 92% from setting (II) had Diploma degree in nursing. In relation to years of experience, most of studied sample had more than 5 years of experience. There was no statistically significant difference between both studied groups regarding to all their Socio-demographic data except professional educational qualification.

**Table (2):** Comparison between assessment of nurses' knowledge about hand hygiene and its opportunities in study groups:

Knowledge score	Studied groups				Test of sig.	P value
	Setting I University hosp. (n=25)		Setting II Teaching hosp. (n=25)			
	No.	%	No.	%		
<b>Knowledge score:</b>						
Mean ± SD	13.16±5.67		7.32±5.58		U=3.28	0.001 HS
Range	0-19		0-19			
<b>Knowledge categories:</b>						
Poor knowledge	7	28.0	15	60.0	χ <sup>2</sup> = 10.84	0.004 S
Fair knowledge	4	16.0	7	28.0		
Good knowledge	14	56.0	3	12.0		

**Table (2):** This table illustrates the comparison between both setting regarding their knowledge about hand hygiene and its opportunities, it showed that, more than half of nurses in setting (1) had good level of knowledge about hand hygiene and its opportunities; while sixty percentage from setting (II) nurses had poor knowledge about the same issue; with mean of knowledge 13.16±5.67 & 7.32±5.58 respectively. There was statistically significant difference between both setting regarding to knowledge about hand hygiene and its opportunities. P (0.004).

**Table (3):** Comparison Between Hand Hygiene Opportunities Application In Study Groups:

Hand hygiene opportunities	Studied groups				Test of sig.	P value
	Setting I University hosp. (n=25)		Setting II Teaching hosp. (n=25)			
	N	%	No.	%		
<b>Hand hygiene opportunities score:</b>						
	13.56±3.11		6.48±5.11		U=4.37	≤0.001 HS

Mean ± SD	8-17		0-14		$\chi^2=$ 20.09	≤0.001 HS
Range						
<b>Hand hygiene opportunities categories:</b>						
Unsatisfactory	1	4.0	16	64.0		
Satisfactory	9	36.0	3	12.0		
Good	1	60.0	6	24.0		

**Table (3):** This table showed the comparison between both setting related to hand hygiene opportunities application, which reported that, sixty percentage from nurses in setting (1) had good level of hand hygiene opportunities application, while sixty-four percentage from nurses in setting (II) had unsatisfactory level of opportunities application of hand hygiene. Also, there was statistically highly significant difference between both studied settings regarding to their application of hand hygiene opportunities during hemodialysis session P (<0.001).

**Table (4):** Comparison between assessments of hand hygiene technique among study groups:

Hand hygiene technique	Studied groups				Test of sig.	P value
	Setting I University hosp. (n=25)		Setting II Teaching hosp. (n=25)			
	No	%	No.	%		
<b>Hand hygiene technique score:</b>					U=4.29	≤0.001 HS
Mean ± SD	11.76±3.23		5.96±4.30			
Range	2-15		1-15			
<b>Hand hygiene technique categories:</b>					$\chi^2=$ 21.77	≤0.001 HS
Unsatisfactory						
Satisfactory	2	8.0	16	64.0		
Good	7	28.0	7	28.0		
	16	64.0	2	8.0		

**Table (4):** This table documented that, the mean hand hygiene technique scores between both setting were 11.76±3.23 & 5.96±4.30 respectively. There was a highly statistically significant difference between both settings regarding to their performance technique of hand hygiene.

**Table (5):** Relation between nurses' knowledge and their characteristic regarding to hand hygiene in study groups:

Socio-demographic characteristics	Studied groups	
	Setting I University hosp. (n=25)	Setting II Teaching hosp. (n=25)
	Mean ± SD	Mean ± SD
<b>Age categories:</b>		
21-25	18.0±2.0	14.0±4.58
26-30	16.56±2.35	9.69±3.81
31-35	9.29±5.25	3.0±2.12
36-40	12.67±2.08	----
41-45	2.50±3.53	0.0
>46	----	0.0±0
<b>Test of sig.</b>	K=13.97	K=17.16
<b>P Value</b>	0.007 S	0.002 S
<b>Gender:</b>		
Male	16.75±2.63	----
Female	12.48±5.87	7.32±5.58

<b>Test of sig.</b>	t=1.40	NA
<b>P Value</b>	0.17 NS	NA
<b>Qualification:</b>		
Diploma	11.0±6.05	7.04±5.58
Bachelor	15.50±4.33	10.50±6.36
<b>Test of sig.</b>	t=2.11	U=0.85
<b>P Value</b>	0.04 S	0.39 NS
<b>Experiences years:</b>		
Less than 5 years	18.0±2.0	14.0±4.58
More than 5 years	12.24±5.70	6.41±5.14
<b>Test of sig.</b>	t=3.61	U=2.05
<b>P Value</b>	0.003 S	0.04 S

Table (5): This table illustrated the comparison between both setting according to relationship between knowledge of study groups & their Socio-demographic data, it approved that, there was a statistically significant difference among both setting regarding to knowledge about hygiene and its opportunities & socio-demographic characteristics as age, experiences years and level of education only in setting (1).

**Table (6):** Relation between hand hygiene technique and Socio-demographic characteristic in study groups:

Socio-demographic characteristics	Studied groups	
	Setting I University hosp. (n=25)	Setting II Teaching hosp. (n=25)
	Mean ± SD	Mean ± SD
<b>Age categories:</b>		
21-25	12.75±2.87	4.0±3.0
26-30	11.11±3.06	3.77±3.89
31-35	10.57±4.27	9.40±3.05
36-40	13.67±0.57	----
41-45	14.0±1.41	10.0±0
>46	----	10.33±0.57
<b>Test of sig.</b>	F=0.90	K=11.80
<b>P Value</b>	0.47 NS	0.01 S
<b>Gender:</b>		
Male	13.50±1.91	----
Female	11.43±3.35	5.96±4.30
<b>Test of sig.</b>	t=1.18	NA
<b>P Value</b>	0.24 NS	NA
<b>Qualification:</b>		
Diploma	9.92±3.40	5.26±3.70
Bachelor	13.75±1.35	14.0±1.41
<b>Test of sig.</b>	t=3.74	U=2.32
<b>P Value</b>	0.002 S	0.007 S
<b>Experiences years:</b>		
Less than 5 years	12.75±2.87	4.0±3.0
More than 5 years	11.57±3.32	6.23±4.43
<b>Test of sig.</b>	t=0.66	U=0.80
<b>P Value</b>	0.51 NS	0.44 NS

**Table (6):** showed that, there was statistically significant difference among performance of hand hygiene technique and nurses qualification in both setting, P=0.002, 0.007 respectively and age categories only in setting (II), P= 0.01.

**Table (7):** Relationship between hand hygiene opportunities of study groups & their Socio-demographic data:

Socio-demographic characteristics	Studied groups			
	Setting I University hosp. (n=25)		Setting II Teaching hosp. (n=25)	
	Mean ± SD		Mean ± SD	
<b>Age categories:</b>				
21-25	15.0±2.82		4.33±3.21	
26-30	12.11±2.97		3.31±3.70	
31-35	13.43±3.64		10.80±2.86	
36-40	14.0±1.73		----	
41-45	17.0±0.0		13.0±0	
>46	----		13.0±1.0	
<b>Test of sig.</b>	F=1.42		K=13.13	
<b>P Value</b>	0.26	NS	0.01	S
<b>Gender:</b>				
Male	14.0±2.58		----	
Female	13.48±3.25		6.48±5.11	
<b>Test of sig.</b>	t=0.30		NA	
<b>P Value</b>	0.76	NS	NA	
<b>Qualification:</b>				
Diploma	12.38±3.07		5.87±4.86	
Bachelor	14.83±2.72		13.50±0.70	
<b>Test of sig.</b>	t=2.10		U=2.32	
<b>P Value</b>	0.04	S	0.007	S
<b>Experiences years:</b>				
Less than 5 years	15.0±2.82		4.33±3.21	
More than 5 years	13.29±3.14		6.77±5.30	
<b>Test of sig.</b>	t=1.01		U=0.80	
<b>P Value</b>	0.32	NS	0.44	NS

**Table (7):** This table illustrates the comparison between both setting relating to the relationship between hand hygiene opportunities & socio-demographic data, it documented that, there was statistically significant difference regarding to application of hand hygiene opportunities and some of socio-demographic characteristics as age categories only in setting (2) and nurses' qualification in both setting.

**Table (8):** Correlation between Total Score of knowledge and Total Score of hand hygiene technique among the study groups:

Variable	Total score of knowledge for setting I University hosp.		Total score of knowledge for setting II Teaching hosp.	
	R	P value	r	P value
<b>Hand hygiene technique</b>	0.67	≤ 0.001 HS	0.52	0.007 S

**Table (8):** This table revealed that, positive correlation between total score of knowledge about hand hygiene and total score of proper hand hygiene technique among both the setting.

#### IV. Discussion

Hemodialysis patients are high risk for infection. Currently, hand hygiene is considered the mainly significant component of infection control measures. Performance of proper hand hygiene is an easy and very important technique in reducing of infection spread among hemodialysis patients. Application of hand hygiene for five opportunities /moments allow to control of infection all the times and maintaining patient safety. If the hemodialysis nurses had good level of knowledge about hand hygiene technique and its opportunities, that allow them good practices. The current study aimed to assess nurses' knowledge and practice regarding to hand hygiene technique and its opportunities application in hemodialysis units to maintain patients' safety units. Comparing between both setting regarding to nurses' knowledge about hand hygiene & its opportunities: The



present study documented that, more than half of nurses in setting (I) had good level of knowledge; while sixty percentage from nurses in setting (II) had poor level of knowledge about hand hygiene and its opportunities application, this result agreed with Mohamed, & Youssef, (2017)<sup>[26]</sup>, they said that in the developing countries the most predisposing factors of infection prevalence in Hemodialysis unities is the knowledge deficit about infection control measures and its application. Furthermore, this result supported b Ontario y 2012<sup>[27]</sup>; who said that, nurses should have adequate level of knowledge about hand hygiene and its opportunities; these knowledge enable them good practices of hand hygiene and its opportunities. The researcher explained that, nurses had Bachelor degree in nursing were twelve nurse in setting (I) and two nurse in setting (II), Bachelor degree nurses had more good information about infection control measures as hand hygiene and its opportunities by advancement of the faculty curriculum, these knowledge needed for application of proper hand hygiene and its opportunities as the main technique among other infection control measures.

#### **Comparing between both setting relations to application of hand hygiene opportunities:**

The present study showed that, the majority from nurses in setting (I) applied hand hygiene opportunities through five moments by good level of practice; this result in line with **HICPAC & WHO**<sup>[23&24]</sup> they recommended that, the nurses should be applied five moments for hand hygiene opportunities in hemodialysis to control of health care associated infections, while nurses in setting (II) contrast with **HICPAC&WHO**<sup>[23&24]</sup>, most of nurses in setting (II) had unsatisfactory level of hand hygiene opportunities application, which increased risk of infections incidence. The researcher explained that nurses had Bachelor degree in nursing had excellent information enabling them to improved their practice .

#### **Comparing between both settings regarding to hand hygiene technique:**

The present study reported that, most of nurses in setting (I) performed proper technique of hand hygiene during all its steps even duration, this result agreed with **Taylor, et al., (2015)**<sup>[25]</sup>, they stated 15 steps for proper hand hygiene technique, started by removed jewelry, maintain short nails, clean under nails, enough amount of soap with warm water, after that, rubbing hands together forcefully for at least 15 seconds, maintain one direction as follows, start palm to palm, palm to dorsal for both, fingers tips, thumb, palms, rinse hands under running water, finally dry hands, between fingers by tissue paper or disposal towel, while the opposite happened in setting (II) applied improper hand hygiene, which increasing the possibility of infections. The researcher explained that, level of nurses' practices of hand hygiene in setting (II) reflect their level of education was diploma nursing science, and lead to improper skills as result from inadequate knowledge.

#### **Comparing between both setting regarding to the relationship between socio-demographic characteristics of nurses and their knowledge as following:**

##### **Nurses qualification and their knowledge**

The current study approved that presence of a significant statistical difference between level of nurses education and their knowledge just only in setting (I); this result supported by **Matthew & Eileen (2011)**<sup>[28]</sup>; who stated that Bachelor degree of nursing science (BSN) superior than diploma nurses regarding to enough knowledge and professional practices.

##### **Nurses' age, experience years and their knowledge**

The present study documented that, nurses younger than 30 years old and nurse had less than 5 years of experience had more mean of knowledge in both setting than older nurses and more than 10 years of experience, this result supported by **Forsman, et al., (2010)**<sup>[29]</sup>, they stated that, recently graduated nurses had greatest knowledge than older, which enable them to provide high quality of nursing care with safety. Otherwise this result contrast with **El-Sol & Badawy (2017)**<sup>[30]</sup>, who wrote that, nurses aged more than 34 years old and more than 10 years experienced, had higher mean knowledge score, than younger. The researcher explained that, advancement in nursing faculty curriculum and methods of teaching, emphasized on preparing graduated nurses with all required knowledge, additional, encouraging student nurses during teaching years to gain knowledge by self learning and interprofessionally education, which creates positive improvement in information, this appear in recently graduated nurses during first 5 years after graduation, who were educated how gained knowledge by new technology and use of computer.

#### **Comparing between both setting according to the relationship among socio-demographic characteristics of nurses and practice of hand hygiene technique and its opportunities:**

The present study documented that, there was no relationship among practice of hand hygiene technique and its opportunities application and experience years, gender and age in setting (I), this result supported by **Fashafsheh, et al., (2015)**<sup>[31]</sup>, they stated that no correlation between practice regarding infection control measures and age, gender and experience years, while presence of positive relationship between

bachelor degree in nursing and practice of hand hygiene technique and its opportunities application, this result in line with **Joshi, et al., (2015)** <sup>[13]</sup>, they documented that, nurses had bachelor degree in nursing, more professional in practice related to prevention of nosocomial infection as hand hygiene technique and its opportunities application than diploma nurses.

### **Comparing between both setting regarding to correlation between total score of knowledge and total score of hand hygiene technique**

The current study reported that, **presence of positive correlation between** total knowledge score and total score of hand hygiene practice in both setting, this result supported by **Fashafsheh, et al., (2015)** <sup>[31]</sup>, they found that, presence of positive correlations between mean knowledge scores and mean practice scores about infection control measures.

## **V. Conclusion**

A proper Hand hygiene technique provides a hospital safety atmosphere for patients and health care staff. Hemodialysis nurses should have good knowledge and practices about hand hygiene technique and its opportunities.

## **VI. Recommendation**

Hemodialysis (HD) nurses need to establishment of hand care program for staff should be a key component of improving effective and safe hand hygiene practices to protect staff and clients/patients/visitors from infections.

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