

COMPLIANCE OF HEALTH-CARE STAFF TOWARD INFECTION CONTROL PRECAUTIONS IN HEMODIALYSIS UNITS – GAZA GOVERNORATES

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ABSTRACT

Objective: Health care associated infections are the most frequent adverse event in health-care delivery, which lead to significant mortality and financial burden for health systems. This study aimed to assess the health care providers' compliance with infection control practices in the hemodialysis (HD) units.

Methods: A cross-sectional, analytical design with census sample was used. The data were collected using interviewing questionnaire and observational checklist for the practice of health care providers. In total, 77 questionnaires were collected, 228 practice observational checklists and five physical environment observational checklists.

Results: The study findings revealed that hospital management does not practice its role efficiently in encouraging health care providers to be compliant with infection prevention and control (IPC) protocol. Findings of the study revealed that the majority of the study participants had not adequate training (79.2%) about the IPC protocol. The findings of the standard precaution showed that the compliance with hand hygiene score was 56.2%; personal protective equipment score was 87.5%; using waste management score was 39.6%; environmental infection control practices score was 54.3%, and aseptic technique score was 62.8%. However, additional precaution score was 56.5%. Moreover, the study revealed that 45.8% of the health care providers were exposed to an injury from used needles or sharp medical instruments. The study also found that 93.5% of the health care providers working in the HD unit received the recommended three doses of hepatitis B vaccine. Finally, the study showed that there are a statistical difference's between hospitals and all standard precaution domains ($p=0.000$), while part of standard precaution domains (personal protective equipment, waste management, and environmental infection control practices) had a statistical difference with occupational type, respectively (0.000, 0.008, and 0.031).

Conclusion: There is a need to develop a Palestinian IPC protocol special for HD unit. A continuous education and training programs for health-care staff and physical environmental fitness concerning IPC protocol should be implemented.

Keywords: Hospital-acquired, Hemodialysis units, Infection control, Compliance.

INTRODUCTION

Infection is the most common cause of hospitalization and the second most common cause of mortality among hemodialysis (HD) patients [1]. Health care associated infections (HAIs) are the most frequent adverse event in health-care delivery. Globally, hundreds of millions of patients are affected by HAIs each year, leading to significant mortality and financial loss for health systems [2].

Patients who undergo dialysis treatment have an increased risk of getting an infection [1]. The increased risk of HAIs among HD patients are mainly due to immune compromised status; frequent and prolonged blood exposure during HD treatments through the vascular access and extracorporeal circuit (with many ports and connections); close proximity to other patients during treatment in the HD facility; frequent contact with healthcare workers who frequently move between patients and between machines; frequent hospitalization and surgery; and most importantly and non-adherence or a break in implementation of recommended practices, including hand hygiene and use of personal protective equipment [3].

Health care providers (HCP's) are at risk of exposure to bloodborne pathogens, as HD patients can have a high prevalence of bloodborne diseases; however, infection prevention and control (IPC) is a practical, evidence-based approach preventing patients and healthcare workers from being harmed by avoidable infections. Effective IPC requires constant action at all levels of the health-care system including policymakers, facility managers, healthcare workers, and those who

access health-care services [4]. Education, monitoring, improved availability of resources and disciplinary measures for poor compliance are required to improve infection control practices in hospitals [5].

In the year 2004, the first Palestinian IPC protocols were developed with the technical and financial support of MARAM project. MARAM project aimed to protect the HCPs, clients, and the community initiative implemented only at the primary health care centers in the Palestinian territories. In the year 2012, the Jordanian Infection Control guideline is adopted by MoH for implementation at the governmental hospitals. The guideline focused on the main issues of IPC practices such as hand hygiene, the use of personal protective barriers, the use of antiseptic, safe environment, waste management, and using disinfectant. In addition, it presented in details the infection control practices in various hospital units, including HD unit.

The standards Precautions must be consistently performed to reduce the infection risk for HCP's and patients. This study aimed to assess the health care providers' compliance with infection control practices in the HD units to decrease mortality and morbidity among both patients and health care providers in the Gaza Governorates.

METHODS

Study design

Analytical, descriptive, and cross-sectional study was conducted. Interviewing questionnaires were performed with all health care providers working at HD units at Gaza Hospitals. Afterward, all

official physicians and nurses working at governmental HD units were observed through checklists. The study participants were 78 health care providers (58 nurses and 20 physicians). Any employee who was working <6 months was excluded. Ethical approval was obtained.

The questionnaire consists of two parts. The first part includes sociodemographic data. The second part includes the questions that assess practice toward IPC Protocol. The observation checklist included two parts: The first part was designed to assess the main five practices pillars recommended in the IPC protocol, which involve wearing uniform, hand washing, using gloves, using antiseptics and disposables, and proper sharps disposal practices. The second part was designed to assess physical environment suitability for the IPC protocol requirements.

Data analysis

Data were collected, revised, coded and entered into statistical software (Statistical Package for the Social Sciences) SPSS version 24. For the statistical analysis of our data, descriptive and inferential analysis is used. Descriptive statistics such as frequencies were used to describe the main features of the data and to assess the first-hand relationship between the variables, T-test and ANOVA models were used when dealing with manifest variables. 95% confidence intervals (CIs) were calculated, and a significant result means that the p-value for the ordinal level measure is <0.05 and the confidence interval (CIs) is 95%.

RESULTS AND DISCUSSION

Characteristic variables of the study participants

In the HD center, 24.7% of participants were physician while 75% were nurses, 86% of them were male, and 14% were female. The age of the health-care employees ranged from 23 to 60 years. The mean age was 38.5 ± 9 years. Those aged from 23 to <35 years constituted 41%, 31% were aged 36–48, and 18% more than 49 years. Those aged from 30 to <35 years were 10.5% (Table 1). Regarding the academic qualifications, about 58% of the study participants had a Bachelor degree (BSc), 7.8% had master's degree, and only 5.2% had Doctor of Philosophy degree (Ph.D.).

The results revealed that the highest number of employees (44%) were working in Al-Shifa hospital, this result because this hospital considered the biggest hospital provided HD services followed by Nasser hospital (19.5%) while Al - Aqsa hospital employees represented 13%, Al - Najjar and Al - Rantisi hospitals involved 11.7%, respectively. Of participants, 34% of healthcare workers had experienced <5 years, while half of them had experience between 5 and 15 years and 13% had experienced more than 15 years. However, the results revealed that more than half of them received salary <2000 NIS (around 500 \$), 27% received 2000–3000 NIS (around 500-800\$), and the rest (10%) received more than 4000 NIS (around 1000\$).

Infection protocol practice

As shown in Table 2, in the HD units there are inadequate educational training programs to improve IPC practice, only 20.8% of the study participants attended training courses (15.8% of physicians and 22.4% of nurses). Half of the participants confirmed that the hospital did not update knowledge of health care providers about the proper IPC procedures. This results in consistent with the study conducted in Nepal and revealed that 27% of HCWs received training on IC [6]. In two HD units in Egypt, 55.2% and 80.6% of nurses, attended training courses on IC [7] compared to none of the nurses who received training in IC in a dialysis unit in Alexandria/Egypt [8]. Lack of training programs, lack of knowledge, scarcity of supplies, increased workload, and lack accountability are barrier for recommended IPC compliance [9].

Hepatitis virus infections continue to be a major concern in the dialysis settings, and HCWs are at risk for exposure to serious and sometimes deadly diseases [1]. The study results revealed that around half (45.8%) of the study participants (36.8% of Physicians and 62.1% of Nurse) were exposed to an injury from used needle or sharp medical

Table 1: Distribution of respondents based on sociodemographic factors

Variable	n=77 (%)	Variable	n=77 (%)
Occupation		Hospital employees	
Physician	19 (24.7)	Al -Shifa	34 (44.2)
Nurse	58 (75.3)	Nasser	15 (19.5)
Gender		Al -Aqsa	10 (13)
Male	66 (85.7)	Al - Najjar	9 (11.7)
Female	11 (14.3)	Al - Rantisi	9 (11.7)
Age		Years of work experience in HD unit	
23–35 years	32 (41.6)	<5 years	26 (33.8)
36–48 years	24 (31.2)	5–15 years	39 (50.6)
49–60 years	14 (18.2)	>15 years	10 (13)
Missing	7 (9.1)	Missing	2 (2.6)
Qualification		Actual salary	
Diploma	22 (28.6)	<2000 NIS	40 (51.9)
BSc	45 (58.4)	2000–4000 NIS	21 (27.3)
MSc	6 (7.8)	>4000 NIS	8 (10.4)
PhD	4 (5.2)	Missing	8 (10.4)

Table 2: Respondents' practice toward IPC protocol

Variable (n=77)	Yes
Attending education session or training on IPC	16 (20.8)
The hospital provides information and updates to health care providers on IPC	38 (49.4)
Have you exposed to injury from the needle or sharp medical instrument	43 (45.8)
Have you received HB vaccine?	72 (93.5)
Did you examine Ab titter for HB vaccine?	14 (18.2)
Examine patients for HB and HIV before dialysis	36 (46.8)
Give hepatitis free patients three doses of HBV	68 (88.3)
Isolating patients with known bloodborn diseases	6 (7.8)

HBV: Hepatitis B vaccine, HIV: Human immunodeficiency virus, IPC: Infection prevention and control

instrument. In northwestern Tanzania, Chalya *et al.* (2015) studied the reasons for the incident of needlestick injuries among healthcare workers and concluded that needlestick injuries are common among healthcare workers [10]. 66.2% of HCW's experienced needlestick injury among healthcare workers in Gharbiya Governorate, Egypt [11]. Non-compliance with standard infection control precautions for safe disposal of clinical waste was the main contributory factor for 16.2% of the significant sharps injuries; however, all these sharps injuries resulting from noncompliance were fully preventable [12].

Healthcare workers whom directly in contact with patients or handle material that could spread infection should get appropriate vaccines to reduce the chance that they will get or spread vaccine-preventable diseases [1].

The results revealed that 93.5% of the study participants' (84.2% of Physicians and 96.6% of Nurses) received vaccination for hepatitis B (HB). Only 67.5% of the study participants (52.6% of Physicians and 72.4% of Nurses) received the recommended three doses that ensure highest protection level for health care provider from cross infection and only 18.2% of the study participants (21.1% of Physicians and 17.2% of Nurses) examined the antibodies titter for HB vaccine.

Regarding vaccination for HD patients, there was low-level practice for examining patients for HB and human immunodeficiency virus (HIV) before dialysis (45.5%). However, the results showed that 87% of HD patients were given three doses of HB vaccine for non-infected patients and only 8% of patients with Known Blood Borne Diseases were isolated. HBV and hepatitis C virus (HCV) infections among HD patients varie greatly from country to country; the study found that 14% of HD patients in Saudi Arabia are HB positive and 7% of HD patients

are hepatitis C positive. In other Arab countries, hepatitis C positive cases were 23.7% in Sudan, 71% in Kuwait, and 41% in Tunisia, and in Egypt, the prevalence of hepatitis C in HD patient ranges from 52.3% to 82% [13].

Persons found to have anti-HBs levels of <10 mIU/mL after the primary vaccine series should be revaccinated with a second HB vaccination series. Administration of three or four doses on an appropriate schedule followed by anti-HBs testing 1–2 months after the third dose is usually more practical than serologic testing after one or more doses of vaccine. Persons who do not have a protective concentration of anti-HBs after revaccination should be tested for HBsAg. If the HBsAg test result is positive, the person should receive appropriate management. As the results revealed, only 20% of healthcare workers examined for Ab titer for HB vaccine. 89.6% of patients on HD in the Prince Salman Center for Kidney Diseases at Riyadh capital have the level of HBs antibodies (HBsAb) more than 10 IU/L, while only 10.4% of patients have the level of HBsAb <10 IU/L [14]. Persons whose test was negative for HBsAg should be considered susceptible to HBV infection and should be counseled about precautions to prevent HBV infection and the need to obtain HB immune globulin post-exposure prophylaxis for any known or likely parenteral exposure to HBsAg positive blood [15]. More than 90% of patients with known bloodborne disease did not isolate in a separate room, which is in consistent with the study conducted in Saudi Arabia that revealed there is a dedicated machine for patients with bloodborn infections used in 69% of the observations [16].

Standard precautions practice

Infection control precautions must be integrated into the routine activities of the hospital [4]. The infection control committee should identify priorities, implement the plan and continuously monitor the situation for assuring quality and its continuous improvement. These precautions include hand hygiene, personal protective equipment, waste management, environmental infection control practices, and aseptic techniques [17].

The study revealed inadequate hand hygiene practice, and the overall adherence was 56.2%, and only 24% employees were washing hands for 30–60 seconds using water and soap. About 27% is removing jewelry, watch, and rings when washing hands and 10% of them washing hands before contact with patients while more than 90% washing hands after contacts with patients. Nearly, all of healthcare workers wash their hands after contact with blood, body fluids, secretions, and excretions and half of them wash their hands before disinfection, dressing, blood sampling, etc., also 60% wash their hands after contact with patients surrounding environment. To ensure hand hygiene effectively, there were many steps and criteria health care providers must follow. The first is to avoid wearing watches, rings, and jewelry and take care of nails by keeping them short. The second is to wash hand at least 15 s, but no longer than 3 min [18]. In Ain-Shams University hospitals (Egypt), 23.2% of the observations showed inappropriate hand washing (short contact time <30 s and improper drying) [8].

Personal protective equipment, commonly called as “PPE,” refers to a variety of barriers and respirators used alone or in combination to protect mucous membranes, airways, skin, and clothing from contact with infectious agents. The selection of suitable PPE is based on the nature of the patient interaction and/or the likely modes of transmission of disease; personal protective equipment includes gloves, isolation gowns, masks, goggles, face shields, and respiratory protection [19].

In HD unit, the study results confirmed inadequate using of personal protective equipment and the overall adherence was 87.5%. Nearly, all healthcare workers wear gloves when contact with blood, body fluids, secretion, and excretion and 90% of them wear sterile gloves for invasive procedures and when handling contaminated instrument also, 70% wearing uniform, and only 1.3% of visitors wear protective clothing before entering HD unit. The observation results confirmed low level of compliance in wearing uniform (86.6%) and low level

of compliance in wearing gloves (40.7%) [9]. In a dialysis unit in a university hospital in Alexandria/Egypt, none of the HCWs used plastic aprons or face protection, but all of them wore nonsterile gloves before or after the different activities that required wearing gloves [20].

In a study done in Saudi Arabia, all health care providers in HD wore gowns, masks, gloves, and protective eyewear while performing procedures and during initiation and termination of dialysis [21]. More than half (56.6%) and <3 quarters (73.1%) of the observations, respectively, gowns and gloves were used before performing any procedure in HD units in Egypt [22].

The risks of unsafe injection practices have been well documented for the three primary bloodborne pathogens HIV, HBV, and HCV.

The study results confirmed inadequate waste management practice in HD units, and the overall adherence was 49.5%. Nearly, all used needles and syringes are discarded into safety box and 55% of employees recap, break or bend the used needle before disposal, and 86% of them separate used needle from the syringe before disposal. Furthermore, 40% of healthcare workers separated according to hazardous waste to the color-coded bin.

Poor management of health-care waste potentially exposes health care workers, waste handlers, patients, and the community at large to infection, toxic effects and injuries, and risks polluting the environment. Segregation of medical waste materials is essential at the point of generation, appropriately treated, and disposed safely [23]. The segregation also needs to be performed between the liquid and solid waste products. Categorizing the medical waste with correct segregation to isolate and manage each waste in the proper way. For this purpose, the segregations done in colored waste containers, label coding, and plastic bags [24].

There was insufficient segregation, collection, transportation, storage, treatment and disposal of hospital medical waste. Only 17.7% of the study participants indicated that medical waste was segregated before disposal [23].

A study done in Saudi Arabia showed that all disposable items were placed in thick plastic bags to prevent leakage. Wastes generated from the center were routinely disposed of properly in an incinerator, according to the Saudi regulations governing medical waste disposal [21].

In HD units in Egypt, less than half of the observations, sharps were disposed in puncture-resistant containers, while in a high percent (87.6%) and more than half (62.1%) of the observations, soiled materials were discarded in double plastic bags and dialyzer tubing was discarded in waterproof containers, respectively [22].

In addition, HD patients have a unique vulnerability to health care associated infections [25]. This vulnerability to HAIs is due to several factors including the number of a human being in continuous contact, environmental conditions, and procedural factors related to the HD settings, in addition to a multitude of HD patients comorbidities. Establishing an IPC program, which includes a bundle of strategies and interventions that are consistently performed, will reduce the risk of HAIs for both the employees and the HD patients [25].

Observation results revealed inadequate environmental IC practices and the overall adherence practice was 54.3%. More than half (57%) using disinfectants in cleaning patient unit, 71% of them using disinfectant in cleaning walls weekly and only 36% using disinfectants in cleaning patient bed between patients.

Cleaning process is essential before attaining high-level disinfection. This step is considered essential because inorganic and organic materials that remain on the surfaces of instruments interfere with the effectiveness of this process [1].

In the health care setting, contamination of environmental surfaces with various pathogens and the persistence of these pathogens on surfaces can be an important and frequent source of transmission of infectious agents due to frequent hand touching of HCWs. Cultures collected from different surfaces showed that 98.7% of these surfaces grown positive bacterial culture with some interesting resistance profile [26].

A study done in Saudi Arabia found similar results and showed that cleaning and disinfection of environmental surfaces at each dialysis station were routinely performed. Environmental disinfection included cleaning the dialysis equipment, dialysis beds, chairs, tables, and countertops with detergent germicide solutions, with special attention given to frequently touched surfaces and those potentially contaminated with the patient's blood [21].

In Khartoum, the surfaces of HD machines and the chairs were cleaned and disinfected between patients in 23.1% of the observations, while items taken to a patient's dialysis station were cleaned and disinfected before using them for other patients [27]. Cleaning table and machine surfaces after each patient were observed in 58.3% and 55.6% of cases, respectively [16], compared to 47.4% and 55.2% of the cases in a study done in HD units in Egypt[7].

Aseptic technique is one of the practices designed to reduce the risk catheter-related bloodstream infection; it should be used to prevent contamination of the catheter system including the use of a surgical mask for staff and patient and clean gloves for all catheter system connect, disconnect, and dressing [25].

The results confirmed inadequate using of aseptic techniques in HD unit and the overall adherence was 77.5%. More than 90% of hospitals disinfect internal parts of HD machine according to company instruction, 80% disinfect all instrument after the end of HD and before using to another patient, however only 44% of them performed sterility procedures for instruments and in invasive procedures and nearly all participants' used a sterile set of equipment for each patient.

In the Netherlands, all dialysis centers disinfected the interior circuit of the dialysis monitor at the end of each day [28]. Sterile equipment for invasive procedures was used in 80% of HD units [9]. Items taken to a patient's dialysis station that cannot be disinfected (e.g., adhesive tape) were dedicated only for use for the same patient in 7.7% of the observations [27].

Relevant reduction of hospital-wide central line-associated bloodstream infections was held with a comprehensive, multidisciplinary, and multimodal quality improvement program including aspects of behavioral change and key principles of good implementation practice. This is one of the first multimodal, multidisciplinary, and hospital-wide training strategies successfully reducing central line-associated bloodstream infections [29,30].

Physical environment practice

HD units should be designed, constructed, equipped, and maintained to provide dialysis patients, staff, and the public a safe, functional, and comfortable treatment environment [31]. However, the study results confirmed inappropriate distance in between HD beds in 80% of hospitals, which are a major obstacle hindering the implementation of the IPC protocol in the HD units. This finding may be due to the fact that there was a consecutive increase in the number of HD patients in past few years, as a result of that, there was an increased number of HD machine installed in these units to meet this need, regardless the available space, and design of these units. In addition, the results revealed that absence of an isolation room for patients with bloodborne disease in 40% of hospitals as in Nasser medical complex and Al Najjar hospital. Nearly, half of the hospitals did not have nursing staff assign specifically to deal with the isolated patients inside these HD units. Moreover, there is no place or room to clean and disinfect reusable

Table 3: Standard precautions checklist

Hand hygiene n=228	Yes
I wash my hands for 30–60 s using water and soap	55 (24.1)
I remove jewelry, watch, and rings when washing my hands	61 (26.8)
I wash my hands before contact with patients	24 (10.5)
I wash my hands after any contact with patients	209 (91.7)
I wash my hands after any contact with blood, body fluids, secretions, and excretions	226 (99.1)
I wash my hands before disinfection for dressing, blood sampling, etc.	113 (49.6)
I wash my hands after contact the patients surrounding	136 (59.6)
PPE	
I wear gloves when contact with blood, body fluids, secretion, and excretion	224 (98.2)
I wear sterile gloves for invasive procedures	205 (89.9)
I wear gloves when handling contaminated instrument	206 (90.4)
Wearing uniform	163 (71.5)
Visitors wear protective clothing before entering HD unit	3 (1.3)
Waste management	
Used needles and syringes are discarded into safety box	224 (98.2)
I do not recap, break or bend the used needle before disposal	103 (45.2)
I do not separate used needle from syringe before disposal	31 (13.6)
Waste materials are separated according to bags color guide	91 (39.9)
Environmental IC practices	
Using disinfectants in cleaning patient unit	130 (57)
Using disinfectant in cleaning walls weekly	161 (70.6)
Using disinfectant in cleaning patient bed between patients	82 (36)
Aseptic techniques	
Disinfect internal parts of HD machine according to company instruction	219 (96.1)
Disinfect all instrument after the end of HD and before using to another patient	173 (75.9)
Sterility of instruments and invasive procedures	101 (44.3)
The use of a sterile set of equipment for each patient	224 (98.2)

HD: Hemodialysis

contaminated instruments before sending it to the sterilization section in 80% of hospitals. Three hospitals have no adequate space for the storage of clean and sterile materials inside the HD units. Furthermore, two hospitals did not have a specific place to store contaminated material. Finally, all HD units in the study settings have an appropriate area for water treatment units.

In Al Najjar hospital there was no isolation room, and all patients with bloodborne disease resident in Rafah Governorate were referred to Nasser medical complex. Moreover, at Nasser medical complex, only patients with HBV were separated from other patients (separate machine in a separate room), while patients with HCV were using the separate machine but not separated physically from other patients in another room.

HD facility should be implement and maintain a program to ensure that all equipment (including emergency equipment, dialysis machines and equipment, and the water treatment system) are maintained and operated in accordance with the manufacturer's recommendations[31]

Observation results confirmed inadequate availability of Alcohol hand rub. It was available only in two hospitals in a continuous manner, and the supplies required for hand wash were available in three hospitals.

Table 4: Observation checklist for physical environment

Assessment of HD units' infrastructure fitness n=5	Yes (%)
There is adequate distance between HD beds	20
Customize place to deal with contaminated instruments reusable	20
There is isolation room for patient with bloodborne disease	60
The allocation of nursing staff to treat isolated patients during HD	60
Provide adequate space for the storage of clean and sterile materials away from the patient's service area	40
Allocation separated area to store contaminated material	60
There is adequate distance between HD beds	60
Availability of IPC protocol resources in the HD units n=5	40
Availability of Rubbing Alcohol lotion in the unit	60
Availability of hand washing supplies in the unit	40
Availability of sufficient disposables and linen in the unit	100
Availability of sharps disposal containers in each room	80
Availability of non-sterile gloves in the unit	80
Availability of sterile gloves in the unit	40
Covering beds by clean linen in the unit	80
Providing necessary tools and materials in isolation room	100
HD unit cleanness level n=5	80
Patient units are clean	100
Doctor's room is clean	80
Nursing room is clean	100
General cleanness in HD unit (kitchen, bathroom, and toilette)	60
Accumulation of medical waste inside the HD unit	0

HD: Hemodialysis, IPC: Infection prevention and control

Moreover, the safety boxes were available in all HD units as stipulated by the IPC protocol. The sterile and non-sterile gloves were available in 80% of HD units; however, there is a shortage in the availability of clean linens necessary to cover HD beds. Furthermore, the results showed clearly that there were numbers of HD beds were not covered with clean linens in three hospitals. Finally, the researcher noticed that there was sufficient amount of tools, materials, and equipment necessary for the isolation area of the HD units in 80% of hospitals.

Finally, inadequate linen and alcohol rubbing might be due to two reasons: Current resources of both linen and alcohol rubbing are not sufficient to meet the needs; the health-care staff and the hospital management do not perform its assigned role in controlling the loss of linens.

The results confirmed the high level of compliance in maintaining nursing room and patient units' cleanness in all hospitals. Physicians' rooms were clean in four hospitals. In addition, there was no accumulation of medical wastes inside the HD units. The results revealed that there was an acceptable cleanness level in HD unit accessories at 60% of hospitals.

There was discontinuous a cleanness level in hospitals HD units. This problem might be attributed to several reasons included: Cleaning companies were not performing its assigned role correctly; the number of bathrooms in the HD units was not enough, no bathrooms dedicated for patients, health-care staff, and visitors.

The observational checklist assessment results showed that there was a variation in the overall score level among the study setting, the overall mean score of physical environment fitness score was 67%. The highest score level was reported at Al Aqsa hospital with a mean score of 90%, while the lowest score level was reported at Nasser hospital with a mean score of 45%.

Table 5: Differences between hospitals and occupations by standard precautions and physical environment

Dependent variables	Independent variables	n	Mean	F/t	p
Hospitals Hand hygiene	Al Shifa	96	4.0417	10.819	0.000
	Nasser	39	3.2564		
	Al Aqsa	33	3.5152		
	Al Najjar	33	4.2727		
	Al Rantisi	27	4.7037		
Personnel protective equipment	Al Shifa	96	3.6979	11.895	0.000
	Nasser	39	3.4103		
	Al Aqsa	33	3.2727		
	Al Najjar	33	3.0000		
	Al Rantisi	27	3.8148		
Waste management	Al Shifa	96	2.0208	21.388	0.000
	Nasser	39	1.4615		
	Al Aqsa	33	2.2121		
	Al Najjar	33	2.8182		
	Al Rantisi	27	1.2963		
Environmental IC practices	Al Shifa	96	0.9583	30.353	0.000
	Nasser	39	1.9231		
	Al Aqsa	33	2.7576		
	Al Najjar	33	2.0000		
	Al Rantisi	27	1.8148		
Aseptic techniques	Al Shifa	96	3.4688	20.017	0.000
	Nasser	39	2.5385		
	Al Aqsa	33	2.7879		
	Al Najjar	33	3.5152		
	Al Rantisi	27	2.8519		
Occupation Hand hygiene	Physician	57	4.0526	0.869	0.386
	Nurses	171	3.9064		
Personnel protective equipment	Physician	57	3.0702	6.261	0.000
	Nurses	171	3.6433		
Waste management	Physician	57	2.2456	2.656	0.008
	Nurses	171	1.8947		
Environmental IC practices	Physician	57	1.3684	2.169	0.031
	Nurses	171	1.7251		
Aseptic techniques	Physician	57	3.0702	0.845	0.399
	Nurses	171	3.1696		

IC: Infection control

The results showed that there were statistically significant differences between hospitals in related to hygiene practice, personal protective equipment, waste management practice, environmental infection control practice and using of aseptic techniques (p=0.000), according to *post hoc* test (Scheffee test).

Higher compliance practice was shown in Al-Rantisi hospital than the other hospitals in related to hand hygiene, Personal Protective Equipment, and aseptic techniques this may be attributed to a limited number of HD machines and low workload which provides services to fewer patients compared to other hospitals. However, compliance with health-care management practice was higher in Al Najjar hospital than other hospitals. These results may attribute to commitments of a private company that provides required resources as an assigned contraction with MoH (color-coded bag, trolley), storage, and transportation of generated waste. Compliance with using aseptic techniques practice was higher in Alaqsa hospitals than other hospitals. This is due to the

efforts of the infection control unit and their desire to reduce the spread of infection among service providers and patients.

Regarding statistical difference between occupation and standard precautions domain. The results showed statistical differences with occupational type and using of personal protective equipment, waste management, and environmental infection control practices, respectively (0.000, 0.008, and 0.031).

These results confirmed that nurses were have the highest compliance to use personal protective equipment in comparison to physicians. This result may be due to natural nursing duty in taking care of the patient; however, physician showed higher compliance than nurses with regard to waste management practice in contrast nurses showed more compliance toward environmental infection control practices.

CONCLUSION

Non-compliance with infection control practices poses a serious risk of transmission of infectious diseases to patients receiving chronic HD. Most hospitals did not have conducive adequate IPC training programs among the health care providers. Many health care providers were exposed to injuries from used needle or sharp instruments, and most of them received HB vaccine, but the majority of them did not examine Ab titer for HB vaccine while inadequate vaccination practice was practiced in HD patients for HB and HIV before dialysis.

The assessment has found that standard precautions practice in the hospitals are not applied adequately according to the infection control standards practice whereby hand hygiene was inadequate, while nearly there is proper practice for using personal protective equipment. There is inadequate practice for hazardous waste management except for sharp/needle disposable system. Environmental infection control, aseptic techniques practices are not appropriate, and there are physical environmental obstacles hinders the implementation of standard IPC protocol and wide variation in the level of physical environmental fitness among different HD units.

There is a need to develop Palestinian IPC protocol special for HD unit. Implementation a continuous education and training programs for health-care staff concerning IPC protocol and application of scientific infection control precaution for effective and efficient practices in HD unit according to international standard.

Implementation of interventional behavioral hand hygiene program is important for improving the compliance to hand hygiene guidelines and improves physical environmental fitness needed to satisfy and performs the standard IPC protocol.

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