

Assessment of Health Care Workers' Knowledge and Practice Toward Infection Standard Precautions in Primary Health Care setting, Buraidah, Saudi Arabia

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Received: June 2021; Accepted: July 2021; Published: August 1, 2021.

Citation: Hanein Saad ALjohani, Amel Abdalrahim Sulaiman. Assessment of Health Care Workers' Knowledge and Practice Toward Infection Standard Precautions in Primary Health Care setting, Buraidah, Saudi Arabia. World Family Medicine. 2021; 19(8): 81-90 DOI: 10.5742/MEWFM.2021.940103

Abstract

Background: This study aimed to assess knowledge of standard precautions (SPs) and infection control by healthcare workers (HCWs) at the primary healthcare level in Buraidah City, Qassim Region, Saudi Arabia.

Methods: A cross sectional study enrolled HCWs (doctors, nurses, lab workers) from 20 primary healthcare (PHC) centers in Buraidah. Two-hundred participants were selected randomly to participate in this study. Data was collected by a pretested, self-administered questionnaire, containing 29 items about basic knowledge of components of SPs and infection control including hand hygiene, personal protective equipment, sharps disposal, environmental sanitation and care of healthcare providers. Data was entered and analyzed using SPSS.

Results: The mean age of HCWs was 35.7 (SD±6.6) years. Females represented (51.5%) of the study participants. History of receiving formal training in standard infection control precaution in the last three years was mentioned by almost two-thirds (68.5%) of them. About 102 (51.0%) of the HCWs had adequate level of knowledge (>5 correct answers) regarding standard precautions (SPs) of infection control. The younger ($p=0.020$), non-Saudi healthcare workers ($p<0.001$), physicians ($p<0.001$); particularly consultants ($p=0.018$), were more knowledgeable than their counterparts. The barriers of improper use of PPEs reported by HCWs

were uncomfortable (61.5%), some patients feel stigmatized when PPEs are used (60.5%), shortage in items at PHCC (54%) and workload due to patients' over-crowding (49%).

Conclusion: Generally the study finding revealed adequate knowledge of SPs among the study participants. However, inadequate knowledge particularly concerning the disposal of sharp instruments and hand hygiene were also detected. These findings highlighted the necessity of the provision of a comprehensive training program to ensure compliance with infection control measures by HCWs.

Key words: knowledge, practice, infection standard precautions, primary health care

Introduction

Healthcare workers (HCWs) play an important role in providing prevention, diagnosis, treatment, and care to people in diverse healthcare settings. According to the World Health Organization (WHO), HCWs are all people who are involved in activities that aim at enhancing health, include those who provide health services such as doctors, nurses, laboratory technicians, and pharmacists (1, 2). Health workers are exposed to a number of occupational hazards in healthcare settings, including biological, chemical, ergonomic, physical, and stress/violence (1, 3).

Health care-associated infections are considered the major cause of morbidity and mortality. Health care associated infections occur worldwide and affect all countries, and more than 90% occur in low-income countries. So, health care-associated infections may have severe consequences in primary health care (PHC) centers and transmission from former clients and healthcare workers may also lead to outbreaks in the community (4, 5). Healthcare workers at PHC centers are the first point of contact of consumers with health care system especially during this COVID-19 pandemic.

In the Kingdom of Saudi Arabia (KSA), one of the mitigation plans for COVID-19 pandemic containments is establishment of Tatammen Clinics at PHC level where suspected COVID-19 are screened and managed. This may increase the stress on standard precautions for medical professionals (6).

Health care worker's awareness regarding standard precautions (SP) measures is vital, as researches reported that compliance with these safety measures in health institutions may be related to the knowledge of health care staff (7).

Adherence of medical professionals to standard precautions protects patients and medical workers besides controlling the occurrence of hospital infections (8).

The study aims to assess the knowledge, and practice of primary health care workers in Buraidah regarding standard infection control precautions.

Subjects and Methods

A descriptive cross-sectional study was conducted at 20 PHC centers in Buraidah, Qassim Region, Saudi Arabia during a period from December 2019 to March 2020. From a total of 469 HCWs at PHC centers in Buraidah, 200 HCWs (Physicians, nurses and lab workers) were randomly selected to be enrolled in this study. The representation of them was 1 lab worker, 4 doctors and 5 nurses from each PHC center. After reviewing the pervious literature review -WHO (4), a pretested and self administered questionnaire was designed to collect data about the participants' knowledge, and practice towards standard precautions and infection control measures which include

hand hygiene, injection safety and personal protective equipment (PPE) utilization with barriers of adherence to standard infection control precautions.

A score was created for the participants' responses to knowledge questions and statements; correct answers were given a score of 1 whereas wrong answers were given a score of 0. Total score and its percentage were computed. The mean of the score percentage was estimated for each of the subscales as well as the overall knowledge. Participants who scored at or above the mean score percentage for each subscale as well as for the overall score were considered as having "adequate knowledge" and those who scored below the mean score percentage were considered as having inadequate knowledge. For the overall knowledge score, the mean percentage score was 71.66%.

Data analysis:

Data were entered and analyzed using Statistical Package for Social Sciences (SPSS) software, version 26. Descriptive analysis was carried out as the mean and standard deviation (\pm SD) were calculated for quantitative variables; frequency and proportion were calculated for categorical variables. For comparisons, chi-square and t-test was used for categorical and quantitative variables respectively. P-value \leq 0.05 was considered significant for all inferential analysis.

Results

The study participants' personal characteristics are summarized in Table 1. The mean age was 35.7 (SD \pm 6.6) years. Females were 103 (51.5%). The majority of HCWs 163 (81.5%) were Saudi. Half of them were nurses 100 (50%), 80 (40%) were physicians and 20(10%) were lab workers. Their years of experience ranged between less than one years to 36 years with a mean of 9.8 (\pm SD 6.3) years. Almost two-thirds of the participants 137 (68.5%) received formal training in standard infection control precaution in the last three years.

Participants' Knowledge & practice about the standard precautions (SPs) of infection control

In this study, the overall level of the participants' knowledge and practice regarding SPs of infection control was adequate 117(58.5%) as shown in Figure 1. The Participants' knowledge was assessed by dividing the standard precautions of infection control into 4 sections (Hand Hygiene, PPE, Disposal of sharp instruments, Cough and Sneezing Etiquette). Detailed information about participants' knowledge & practice was presented in Table 2.

Hand hygiene

Slightly more than half of the participants (51%) had an adequate level of knowledge and practice regarding hand hygiene as seen in Figure 2.

The majority of the participants could recognize that routinely using an alcohol-based hand rub is required for hand hygiene. Only 43% knew correctly that the main

route of cross-transmission of potentially harmful germs between patients in a health-care facility is health-care workers' hands when not clean. The five moments for hand hygiene were known by 62% of HCWs regarding immediately before a clean/aseptic procedure to 90.5% of them regarding before touching the patient. Most of the HCWs (74%) knew that hand rubbing is more rapid for hand cleansing than hand washing while 52.5% of them knew that hand rubbing is not more effective against germs than hand washing.

Regarding the procedures that should be avoided to decrease likelihood of colonization of hands with harmful germs, the highest known was damaged skin (83%) and the lowest known was wearing Jewellery (72%) (Table 2). Personal protective equipments (PPEs)

The majority of the participants (61%) had an adequate level of knowledge and practice regarding PPE use as seen in Figure 2.

Components of the PPEs were known by the majority of the participants (84.5%). Wearing full PPE in case of a doctor who is working in Tetamman clinics either taking swab from suspected case of COVID-19 or treating a confirmed case could be recognized by 76% of the participants. The vast majority of the respondents (96.5%) knew that wearing gloves is important when handling patients, body fluids, cut skin and mucus membranes while 85% knew that the gloves should be changed if contacting a different patient. The correct sequence for wearing or removing PPE was properly recognized by 53% and 48.5% of the respondents, respectively (Table 2).

Reasons behind the low use of PPEs at PHC setting

In this study, respondents reported different reasons for the low use of the PPEs at the PHC level. The majority 172 (86%) were thought due to the lack of regular training in SPs, PPEs are uncomfortable 123(61.5%) and patient feels stigmatizes when PPEs used 121(60.5%). Facing shortage of equipment at PHC, workload due to patient overcrowding and beliefs like no infection can be acquired at PHCs were also mentioned by 108(54%), 98(49%) and 68(34%) of the participants, respectively (Figure 3).

The shortage in face masks (24%), and gloves (20%) were the commonest reported.

Disposal of sharp instruments

Less than half (43%) of the participants had an adequate level of knowledge and practice regarding disposal of sharp instruments as shown in Figure 2.

Most of the respondents (95.5%) recognized that disposal of needles should be in the sharp containers and contaminated needles should not be bent or recapped after usage (83.5%). However only 55% of them knew correctly that the sharp box is not only disposed of when it is full (Table 2).

Cough & Sneeze Etiquette

More than half of the participants (54%) had adequate level of knowledge and practice regarding cough and sneeze etiquette as seen in Figure 2.

The majority of the HCWs knew that the best place to practice cough etiquette is by using upper arm (92.5%). However, only 56.5% of them recognized that covering nose and mouth during coughing or sneezing by palm is against the SPs of infection control (Table 2).

Factors affecting the Participants' Knowledge and practice

The mean age of HCWs with adequate level of knowledge about standard precautions was significantly lower than those with inadequate level of knowledge [34.8(±6.4) versus 37.0(±6.8)], $P=0.020$. The majority of non-Saudi HCWs (86.5%) compared to Saudis (52.1%) had adequate level of knowledge, $p<0.001$. The majority of physicians (80%) compared to nurses (48%) and laboratory workers (25%) expressed adequate level of knowledge, $p<0.001$. Regarding doctors' qualifications, all consultants compared to general practitioners (53.8%) had adequate level of knowledge, $P=0.018$ (Table 3).

There was no significant statistical association between receiving formal training in standard infection control precautions and participants' knowledge/practice. Also no significant statistical association was found between participants' gender, years of experience and level of knowledge (Table 3).

Table 1: The Personal characteristics of the Study participants, (n=200).

Characteristics	Frequency (n)	Percentage (%)
Age Mean (\pm SD)	36 (\pm 6.6) years	
Gender		
Male	97	48.5
Female	103	51.5
Nationality		
Saudi	163	81.5
Non-Saudi	37	18.5
Specialty		
Nurse	100	50.0
Doctor	80	40.0
Lab worker	20	10.0
Doctors` qualification (n=80)		
General practitioner	13	16.2
Resident	40	50.0
Specialist	24	30.0
Consultant	3	3.8
Nurses` qualification (n=100)		
Nurse register	37	37.0
Nurse assistant	3	3.0
Nurse Diploma	60	60.0
Experience from graduation		
Range	<1-36 years	
Mean \pm SD	9.8(\pm 6.3) years	
History of training in SPs in the last three years		
Yes	137	68.5
No	63	31.3

Table 2: Knowledge & practice assessment about standard precautions of infection control among HCWs at PHC level, (n=200).

Knowledge statements/questions	Correct answer	
	Frequency (n)	Percentage (%)
Hand hygiene		
Using routinely an alcohol-based hand rub for hand hygiene (Yes)	197	98.5
The main route of cross-transmission of potentially harmful germs between patients in a health-care facility; (Health-care workers' hands when not clean)	86	43.0
Which of the following hand hygiene actions prevents transmission of germs by following the 5 moment for the hand hygiene? -Before touching a patient (Yes) -After touching a patient (Yes) -Immediately after a risk of body fluid exposure (Yes) -After exposure to the immediate surroundings of a patient. (Yes) -Immediately before a clean/aseptic procedure (Yes)	181 180 169 129 124	90.5 90.0 84.5 64.5 62.0
Which of the following statements on alcohol-based hand rub and hand washing with soap and water are true? -Hand rubbing is more rapid for hand cleansing than hand washing (True) -Hand rubbing is more effective against germs than hand washing (False) -Hand washing are recommended after hand rubbing (False) -Hand washing and hand rubbing are recommended to be performed in sequence (True)	148 105 113 140	74.0 52.5 56.5 70.0
The minimal time needed for alcohol-based hand rub to kill most germs on your hands (20-30 seconds)	118	59.0
The minimal time needed for hand washing to kill most germs on your hands (40-60 seconds)	124	62.0
Which type of hand hygiene method is/are required in the following situations? -Before touching patient (examination or injection) (Rubbing) -After removing examination gloves (Rubbing/washing) -After visible exposure to blood (Washing)	121 188 142	60.5 94.0 71.0
Which of the following should be avoided, as associated with increased likelihood of colonization of hands with harmful germs? - Wearing jewellery (Yes) - Damaged skin (Yes) - Artificial fingernails (Yes) - Regular use of a hand cream (No)	144 166 155 110	72.0 83.0 77.5 55.0
Personal Protective Equipments (PPE)		
The components of PPE (Face Shields, Gloves, Mask, and Gowns)	169	84.5
What are the situations require wearing full PPE? -A doctor who contacts to a case have fever or acute respiratory symptoms during pandemic Covid-19. -A doctor who is working in Tetamman either taking swab from suspected case of Covid-19 or treating a confirmed case.	93 152	46.5 76.0
Which of the following is the correct sequence for wearing PPE? (Gown-Mask-Goggles-Gloves)	106	53.0
Which of the following is the correct sequence for Removing PPE? (Gloves- Goggles- Gown- Mask)	97	48.5
The gloves should be changed if contacting the different patient. (Yes)	170	85.0
Wearing gloves is important when handling patients, body fluids, cut skin and mucus membranes. (Yes)	193	96.5
Disposal of Sharp Instruments		
Disposition of needles should be in the sharp containers. (Yes)	191	95.5
Contaminated needles should not be bent or recapped after usage. (Yes)	167	83.5
The sharp box is only disposed of when it is full. (No)	110	55.0
Cough & Sneeze Etiquette		
Following the SPs of infection control, during coughing or sneezing do you cover your nose and mouth by your palm of hand? (No)	113	56.5
The best tool to practice cough etiquette is upper arm? (Yes)	185	92.5

Table 3: Factors Affecting the HCWs Knowledge & Practice Towards the SPs of infection control, (n=200).

Characteristics	Overall knowledge/practice about standard precautions		P-value
	Inadequate (n=83) N (%)	Adequate (n=117) N (%)	
Age (years) Mean(\pm SD)	37.0 (\pm 6.8)	34.8 (\pm 6.4)	0.020*
Gender Male (n=97) Female (n=103)	45 (46.4) 38 (36.9)	52 (53.6) 65 (63.1)	0.173
Nationality Saudi (n=173) Non-Saudi (n=37)	78 (47.9) 5 (13.5)	85 (52.1) 32 (86.5)	0.001*
Specialty Nurse (n=100) Doctor (n=80) Lab worker (n=20)	52 (52.0) 16 (20.0) 15 (75.0)	48 (48.0) 64 (80.0) 5 (25.0)	0.001*
Doctors` qualification (n=80) General practitioner (n=13) Resident (n=40) Specialist (n=24) Consultant(n=3)	6 (46.2) 7 (17.5) 3 (12.5) 0 (0.0)	7 (53.8) 33 (82.5) 21 (87.5) 3 (100)	0.018*
Nurses` qualification (n=100) Nurse register (n=37) Nurse assistant (n=3) Nurse Diploma (n=60)	19 (51.4) 1 (33.3) 32 (53.3)	18 (48.6) 2 (66.7) 28 (46.7)	0.791
Experience from graduation (years) Mean (\pm SD)	10.3(\pm 6.1)	9.4(\pm 6.4)	0.299
Receiving training in SPs in the last three years No (n=63) Yes (n=137)	31 (49.2) 52 (38.0)	32 (50.8) 85 (62.0)	0.134

Figure 1: The overall level of the participants` knowledge and practice regarding SPs of infection control at PHC level.

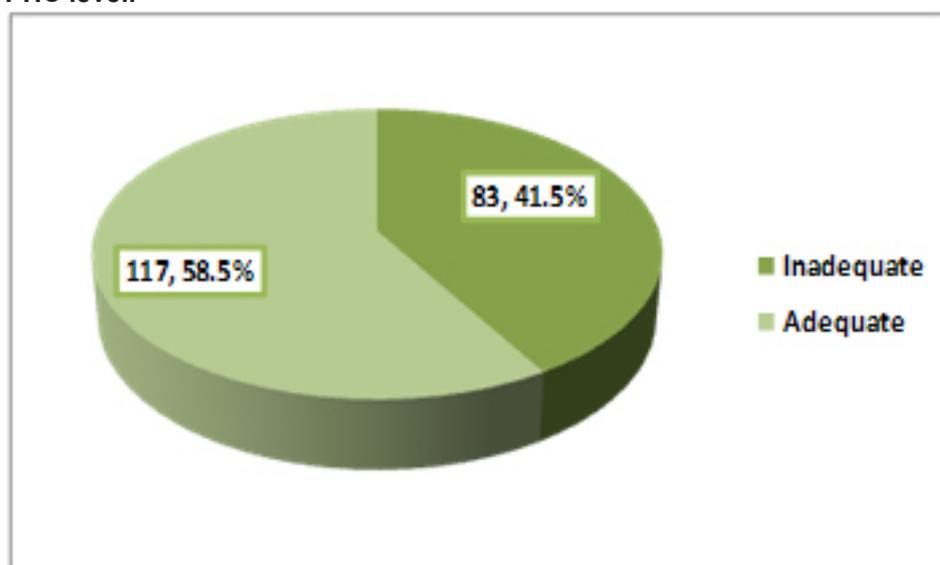


Figure 2: Level of the participants` knowledge and practice regarding elements of SPs of infection control at PHC level.

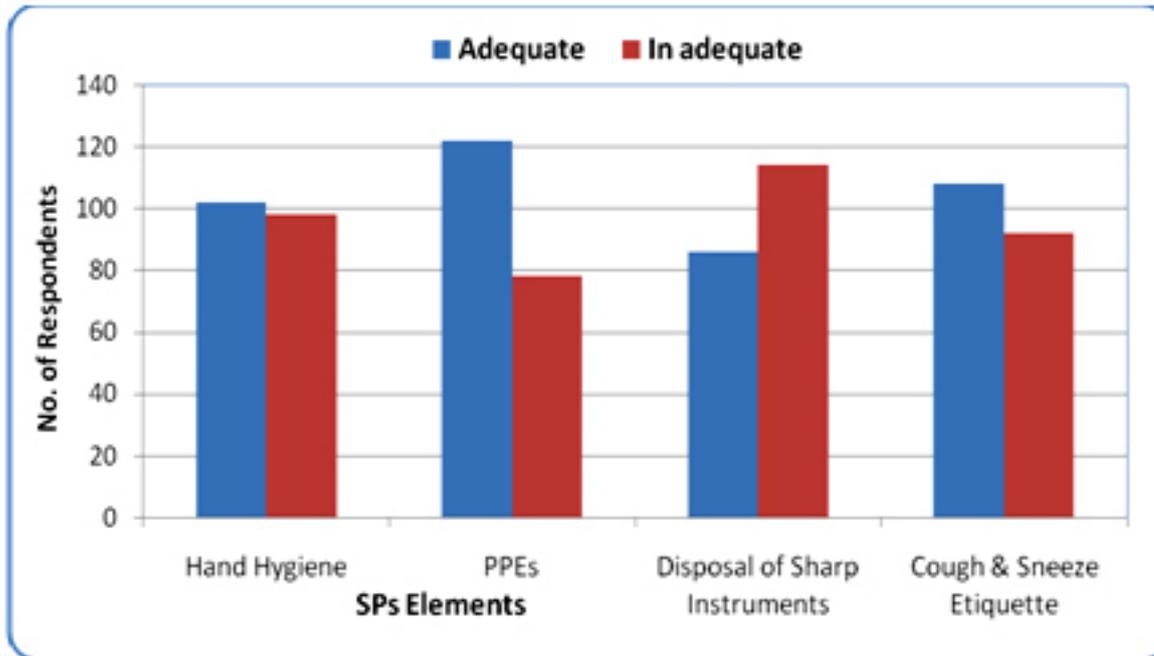


Figure 3: Reasons behind the low use of PPEs at PHC setting



Discussion

Evaluation of the knowledge and practice of standard precautions by HCWs is an essential step in starting and implementing a successful infection control program in any healthcare facility. Worldwide, many studies have shown that healthcare workers expressed variable levels of knowledge regarding SPs of infection control, with relatively limited studies having been carried out in the Kingdom of Saudi Arabia. Therefore, the present study was conducted to assess the knowledge, attitude and practice of primary health care workers in Buraidah regarding standard infection control precautions (9-15).

In the current study, receiving formal training in standard infection control precautions in the last three years was mentioned by almost two-thirds of the primary health care workers. The same has been reported in Al-Kharj (KSA) by Alotaibi et al (11), where 70% of the healthcare students had attended an infection control course. In Hofuf, (12) the majority of medical students believed that the current teaching and training regarding standard precautions is insufficient in providing them with the required knowledge and skills. Contrary to that, in Ethiopia, (13) 65.6% of HCWs had ever participated in training program in infection control. In the present study, despite most HCWs having attended training courses in infection control, this was not associated with having adequate knowledge regarding standard precautions of infection control, which raises a question regarding the quality and contents of such training occasions that may need reconsideration. In Makkah (14), the level of satisfactory knowledge, positive attitude, and good practice of studied HCWs toward MERS-CoV had improved after an interventional education program. So, we believe that adequate and well prepared training programs are essential in improving knowledge regarding standard precautions of infection control.

In the present survey, the level of overall knowledge and practice of SPs of infection control was adequate 58.5%, but only 41.5% of them expressed adequate level of knowledge; particularly regarding disposal of sharp instruments and hand hygiene while the highest level of knowledge was observed concerning PPEs. The same had been reported previously in Al-Hassa, KSA (11) where a deficiency in knowledge of components of SPs was demonstrated among PHC physicians; particularly concerning hand hygiene, sharps disposal, management of sharps injuries and environmental cleaning. In Hofuf (12) approximately one-quarter of clinical years medical students (26.7%) scored ≥ 24 (out of 41 points) which was considered as an acceptable level. The least knowledge score were in the areas of sharp injuries and PPEs. In Al-Qassim (15), the average knowledge regarding guidelines of hand hygiene among HCWs was 63%. In Nigeria, (16) the overall median knowledge and attitude scores toward SPs were above 90%, but median practice score was 50.8% among HCWs (physicians, nurses and laboratory workers) of two tertiary hospitals. The majority of the HCWs had poor knowledge of injection safety and complained of inadequate resources to practice SPs. In another Nigerian study, (17) only 16.6% of HCWs (physicians and nurses) had knowledge of the

basic concept of standard precautions and 42.2% knew potential sources of occupational exposure. Also in Nigeria, (18) almost half of HCWs (50.3%) had good knowledge regarding SPs. Physicians had the highest proportion with good knowledge, and porters the lowest, and 46.8% of them had good compliance to SPs. Regarding compliance to SPs practice, the highest proportion of nurses had good practice compliance. In India, (19), 79.9% of nurses had poor knowledge about standard precautions and 64.5% of them had inadequate knowledge about the transmission of blood-borne pathogens. In Ethiopia, Beyamo et al (20) revealed that 65% of HCWs had complied with standard precaution practices. Comparison between the aforementioned studies including the present one is not practical due to two main reasons; first, using different tools in assessing knowledge regarding SPs of infection control. Second, different characteristics of the participants in various studies as some of them were conducted among medical students, some among all HCWs and some others among specific HCWs.

The present study revealed that younger, non-Saudi healthcare workers and physicians; particularly consultants, were more knowledgeable about SPs of infection control compared to their peers. In another Saudi study, being female, holding a postgraduate degree and having more than 5 years of experience in PHC were the significant predictors for having adequate SPs knowledge (11). In Al-Kharj, (11) female medical students were more knowledgeable and compliant with SPs compared to males and also student's academic level was significantly associated with knowledge and compliance regarding SP. In Al-Qassim, (15) health-care workers aged over 30 years and those at tertiary care hospitals were more knowledgeable than younger physicians and those working in secondary care hospitals. In Makkah, (14) older age, previous training, and experience were positively correlated with higher scores of knowledge among HCWs. In Ethiopia, (20) factors significantly associated with compliance to SPs practices among HCWs were experience of ≤ 5 years, training on SPs, having good hand hygiene and availability of PPEs. In Italy, (21) HCWs in emergency departments with less practiced years, those who worked fewer hours per week and who had received information from educational courses and scientific journals were more knowledgeable about the risk of acquiring Hepatitis C and HIV from a patient. In addition, nurses, respondents who knew that HCWs' hands are vehicles for transmission of nosocomial pathogens, those obtaining information from educational courses and scientific journals, and needing information were associated with a higher perceived risk of acquiring a hospital-associated infection. Again, different characteristics of the participants in various studies could explain the variations in factors affecting knowledge.

In the present study, the majority of the HCWs thought that they should be involved in regular training sessions about standard infection control precaution. The commonest reported challenges against practice of SPs as reported by them were PPEs are uncomfortable, the patient feels stigmatized when PPEs are used, facing any shortage of

facilities/resources for the practice of standard precautions in primary healthcare and workload or patient overcrowding. In a similar Saudi study, the commonest factors reported by HCWs for not applying SPs during routine work were lack of resources and training opportunities, and excessive workload, (22) which are quite similar to those reported in the present survey. In another study carried out in Nigeria, house officers, laboratory scientists and junior nurses had lower knowledge and compliance with SPs than more experienced doctors and nurses (23). In another study carried out also in Brazil, non-availability of the materials was the main factor reported for non-adherence to SPs (24). The most important factor influencing SPs practice was the lack of provision of adequate protective equipment. Other factors included carelessness, lack of display of standard precautions guidelines, emergency nature of the procedure, insufficient water supply, patient's perceived to be at low risk of blood borne pathogens, pressure of time and standard precautions equipment interfering with technical skills (25).

Limitations of the study

Conduction of the study among PHC professionals working in MOH in one Saudi city could affect the generalizability of the study's findings over other healthcare settings. Also, the cross-sectional design of the study is considered one of the limitations as it proves only association and not causality between independent and dependent variables. Finally, the nature of the questionnaire used as self-administered and assessing knowledge, practice and attitude at the same time is subject to bias. However, it is based on WHO criteria for SPs of infection control. Despite those limitations, the study could have an ultimate importance for decision makers to overcome barriers to implement effective infection control programs at PHC settings.

Conclusion and Recommendations

Generally: the study finding revealed adequate knowledge of SPs among the study participants. However, inadequate knowledge particularly concerning the disposal of sharp instruments and hand hygiene were also detected. These findings highlighted the necessity of the provision of a comprehensive training program to ensure compliance with infection control measures by HCWs."

Abbreviations

HCWs: Health Care workers
 MOH: Ministry of Health
 PHC: Primary Health Care
 SPs: Standard persuasions
 WHO: World Health Organization

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