ASSESSMENT OF THE KNOWLEDGE AND PRACTICES OF INFECTION CONTROL STANDARD AMONG HEALTH CARE WORKERS AT THE PRIMARY HEALTHCARE LEVEL IN MAKKAH CITY AT SAUDI ARABIA

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Abstract

Background

Health care associated infections (HCAI) are one of the most serious and complex worldwide health problems. Commitment to standard precautions (SPs) and infection control (IC) measures are important to all healthcare providers (HCP) to prevent occupational exposure to hazardous materials. Healthcare workers (HCWs) are particularly more prone to blood-borne pathogens through contact with infected blood and body fluids during their work. It is based on the presumption that every person is infected or colonized with an organism that could be transmitted in the healthcare setting and thus health care workers need to apply infection control practices during the delivery of health care.Health care worker at risk of health associated infection (HAIs) due to their exposure to the patients during carrying out their duties. Health care workers in primary health care centers are the first to detect and to prevent the spread of infection. Standard precautions are regarded as an effective means for protecting health care worker, patients and community.

Aim of the study: The study aimed to assess the level of Knowledge and practices of infection control standard among health care workers at the primary healthcare level in Makkah City.

Method: A cross sectional study enrolled HCWs (doctors, nurses, lab workers) from 10 primary healthcare (PHC) centers in in Makkah, during the April to June, 2021, Our total participants were (200)

.**Results**:the knowledge regarding standard precautions of infection control study results show the majority of participant had average information were(55.0%) while weak knowledge were(21.0%) the data ranged from(5-18) by mean ±SD(12.15±3.11), also the Nationality is a significant relation between knowledge and Practices increase in the non-Saudi healthcare workers were mean+ SD respectively (12.980±2.606, 6.603±1.510), compared to the Saudis had adequate level of knowledge Practices where (T=-5.33, T=-6.152) and P-value=<0.001.

Conclusion: There was a gap between the actual and desired Knowledge and practices of Healthcare providers regarding IC. Continuing education programs are needed to improve their Knowledge and practices scores towards SPs and IC measures in order to reduce HCAI, inadequate knowledge particularly concerning the disposal of sharp instruments and hand hygiene were also detected. The studies highlighted the necessity of the provision of a comprehensive training program to ensure compliance with infection control measures by HCWs.

Key words: assess, knowledge, practice, infection, control, standard health, care, workers, primary health care

INTRODUCTION

Background

Prevention of health care associated infections is the duty of allhealth care workers(1). Medical and paramedical staffs must know various measures for their own protection (2). Many SPs and IC measures are designed to reduce the risk of acquiring occupational infection from both known and unexpected sources in Health care settings (3). Most of these precautions are usually simple, of low-cost and utilization of these precautions depends largely on the human element that may increase or decrease the chances of catching Health care associated infections (4)

The Centers for Disease Control and Prevention defines standard precautions as a group of infection prevention practices that apply to all patients, regardless of suspected or confirmed infection status, in any setting in which healthcare is delivered. It is based on the presumption that every person is infected or colonized with an organism that could be transmitted in the healthcare setting and thus health care workers need to apply infection control practices during the delivery of health care. They are designed to protects HCWs from infection by applying the basic principles of infection prevention through hand hygiene, personal protective equipment, needle stick and sharps injury prevention, cleaning and disinfection, respiratory hygiene (cough etiquette), waste disposal and safe injection practices.[5]

Worldwide, there has been increased stress on standard precautions for medical professionals, and research into standard precautions has been carried out in many countries to discover defect areas and adherence pattern.[6, 7] Globally, the World Health Organization (WHO) estimated that billions of injections are administered every year within healthcare settings.[8] These injections according to the WHO are commonly used for curative purposes, most of which are unnecessary and avoidable. Inappropriate injections can lead to avoidable harm particularly in developing countries where safety resources and practices cannot always be guaranteed.[9]

The established precautions target both patients and medical personnel. Isolation measures include avoidance of direct contact with patients and air-borne particles, and require proper hand hygiene including sterilization, the use of self-protection equipment, and the safe disposal of sharp instruments to avoid health care associated infections (HCAIs).[10]

A recent estimate of the burden of blood-borne infections due to unsafe injection practices revealed that up to 46% of hepatitis B, 38% of hepatitis C and 12% of human immunodeficiency virus (HIV) infections are associated with unsafe injections.[11]Furthermore, unsafe injection practices can fuel the transmission of other emerging and reemerging infectious diseases such as the Ebola virus disease.[12] Modeling using the fraction of unsafe injection-associated blood borne viral infections estimated a burden of 9.18 million preventable disability-adjusted life years from 2000 to 2030.[13]

Health care associated infections can be defined as an infection occurring in a patient during the process of care in a hospital or other healthcare facility which was not present or incubating at the time of admission.[14]

The prevention of Health care associated infections perhaps requires a multi‑targeted approach. When properly conducted, it can also affect other aspects of medical practice. A study from Indonesia found a decrease of inappropriate use of antibiotics by about 22% after the implementation of a multifaceted infection control and antibiotic stewardship program.[15]

Literature Review

The most of systematic review has shown that there is generally low of the Knowledge and practices of infection control standard among health care workers at the primary healthcare level in Makkah City at Saudi Arabia, good knowledge and practice of injection safety are important particularly in developing sub-Saharan African countries where the pool of people living with blood-borne viruses is high.[16]

Nosocomial transmission of infections among healthcare givers and their patients usually results from breach in hospital infection control guidelines. To curtail this, there is need to educate healthcare givers on infection control measures, however, this The quarterly mandatory training embarked upon by the hospital infection control committee would likely explain the overall good knowledge and practice . A similar pattern has been previously reported in Nigeria.[17] In Nigeria, there were a lot of efforts to promote the safety of the injection recipient, the healthcare workers and the community.[18] An overwhelming majority of the current study population attended a formal training on injection safety as reported in a previous study.[19] Studies elsewhere also showed that training improves knowledge and compliance with standard precaution.[16,20,21] In another study among health workers in a Tertiary Hospital in North‑Eastern Nigeria, training on standard precautions was predictive of correct knowledge of standard precaution.[22]

The identified gaps in knowledge and practice of hand hygiene in this study despite regular training, is alarming. Ogoina et al.[17] reported the poor practice of hand hygiene despite good knowledge among HCW in two tertiary hospitals in Nigeria. Insufficient water supply among others has been shown to affect the practice of hand hygiene among HCW in Nigeria.[23] In Uganda, Sethi et al.[24] reported that up to 75% of HCW at Mulago general hospital disagreed with the fact that their hands, when unclean, can be a source of infections and less than half of the respondent reported having easy access to clean water in between patients. This knowledge and practice gap in hand hygiene needs to be bridged, as hand hygiene is the single most important means of preventing HCAI.[25]

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 [26]. In Al-Kharj, (27) 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, (28)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.

Rationale

The most of systematic review has shown that there is generally low of the Knowledge and practices of infection control standard among health care workers at the primary healthcare level in Makkah City at Saudi Arabia. There is a great risk to transmit infection from primary health care workers to the community and the burden of treatment in comparison to prevention, healthcare workers, particularly nurses are at a greater risk of acquiring and transmitting infections during the course of carrying out their daily usual duties in primary healthcare facilities. Effective knowledge about standard precautions of infection control and having favorable attitude towards them as well as practicing them properly is very critical in controlling the transmission infections among HCWs, SPs malpractice represents public health problem with wide variety of prevalence locally and internationally.

Aim of the study

The study aimed to assess the level of Knowledge and practices of infection control standard among health care workers at the primary healthcare level in Makkah City.

Objectives:

To assess the level of Knowledge and practices of infection control standard among health care workers at the primary healthcare level in Makkah City. To investigate their practice towards measures of infection control standard precautions

Methodology:

Study design

This study is descriptive type of cross-sectional study was conducted among 200 of the health care workers applying a convenience sampling technique

Study Area

The study will be carried out in PHC centers in the Makkah Al-Mokarramah. Makkah is the holiest spot on Earth. It is the birthplace of the Prophet Mohammad and the principal place of the pilgrims to perform Umrah and Hajj. It is located in the western area in Kingdom of Saudi Arabia and called the Holy Capital. Contains a population around 1.578 million. This study was conducted in Makkah in PHC centers , in the western region of Saudi Arabia. and it reflects a diversified demographic profile with a considerable portion of the population comes from rural descent, while others come from an urban one. This difference translates into biological, socioeconomic and lifestyle differences in the Makkah population.

Study population

PHC health care professionals (n=200) distributed as follows: physicians, nurses and laboratory technicians. during the April to June, 2021

Sample size

Sample size was calculated using openEpi online sample size calculator at 95% confidence level with bound on error of 5% regarding standard infection control precautions is 74% based on study conducted by Al Hammer L et al, 201725 max sample size required is 200 participants

Selection criteria:

Inclusion criteria

- Primary health care workers (doctors, nurses, laboratory technicians) in PHC center
- all ages
- agreed to participate in the research.
- All nationalities
- All male and female

Exclusion criteria :

- Pharmacists, dentists, dental assistant .
- Those who have Vacation,
- Disabled and absent during the data collection period.

Data collection tool and technique:

Data were collected by self-administrated questionnaire.

First part of the questionnaire includes questions about Demographic data of the physicians (gender, age, nationality, job title)

Second part about knowledge, and practice of standard precautions which including hand will be assessed covering hand hygiene obtained from WHO injection safety, and protective equipment utilization with barriers of adherence to standard infection control precaution.

Score was created for the participants` responses to knowledge questions and statements, Right 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 and well as the overall knowledge. Participants who scored at or above the mean score percentage for each subscale as well as for the overall were considered having “adequate knowledge” and those who scored below the mean score percentage were considered 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 (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 ≤0.05 was considered significant for all inferential analysis.

Ethical approval:

- The ethical approval was taken from the Regional Research Ethics committee. A permission letter was obtained from the regional director of the MOH before starting the data collection.
- A written Informed consent was obtained from each participant from commencing the data collection.
- The researcher preserved the confidentiality of the participants at all steps of the study for the data collection, analysis and result.

Budget: Self-funded Results

Table 1 Distribution of characteristics of the participant data(age, gender, nationality, specialty, doctors job title, Experience from graduation , worked in Quality System Application Centers, take an infection control course) in our study(n=200 HCWS

	N	%
Age (years)		
<35	76	38.0
35-50	88	44.0
>50	36	18.0
Range	22-65	
Mean±SD	37.285±8.155	
Gender		
Male	124	62.0
Female	76	38.0
Nationality		
Saudi	150	75.0
Non-Saudi	50	25.0
Specialty		
Nurse	105	52.5
Doctor	70	35.0
Administrative	25	12.5
Doctors job title (n=70)		
General practitioner	21	30.0
Resident	31	44.3
Specialist	14	20.0
Consultant	4	5.7
Nursing job title (n=105)		
Technical	70	66.7
specialist	35	33.3
Experience from graduation (years)		
<5	42	21.0
5-10.	84	42.0
10-20.	42	21.0
>20	32	16.0
Range	1-38.	
Mean±SD	19.55±10.554	
Have you ever worked in Quality System Application Centers?		
Yes	88	44.0
No	112	56.0
Did you take an infection control course?		

Yes	70	35.0
No	130	65.0

Table 1 shows that most of the participants (44.0%) were in the age group from (35-50) years follow by the (38.0%)were in the age <35years and the data ranged from(22-65) by mean ±SD(37.285±8.155),the majority of them were males (62.0%) while female(38.0%),also the Majority (75.0%) were Saudi nationals. Half of them were nurses were52.5% while 35.0% were doctor. Concerning qualification of physicians, 44.3% were residents while concerning qualification of nurses, 66.7% were technical. Their years of experience ranged the data ranged from (1-38) by mean ±SD(19.55±10.554) the majority of participants not worked in Quality System Application Centers were(56.0%) also 65.0%not take an infection course.

Table 2: Description of the knowledge and practice of infection control standard among health care workers at the primary healthcare level

	Yes		No	
	N	%	N	%
Using routinely an alcohol-based hand rub for hand hygiene	182	91	18	9
The main route of cross-transmission of potentially harmful germs between patients in a health-care facility (Health-care workers' hands when not clean)	176	88	24	12
Which of the following hand hygiene actions prevents transmission of germs by following the 5 moment for the hand hygiene?				
Before touching a patient	182	91	18	9
After touching a patient	178	89	22	11
Immediately after a risk of body fle were uid exposure	176	88	24	12
After exposure to the immediate surroundings of a patient	130	65	70	35
immediately before a clean/aseptic procedure	142	71	58	29
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	150	75	50	25
Hand rubbing is more effective against germs than hand washing	84	42	116	58
Hand washing are recommended after hand rubbing	88	44	112	56
Hand washing and hand rubbing are recommended to be performed in sequence	162	81	38	19
The minimal time needed for alcohol-based hand rub to kill most germs on your hands (20-30 seconds)	120	60	80	40
The minimal time needed for hand washing to kill most germs on your hands (40-60 seconds)	136	68	64	32
Which type of hand hygiene method is required in the following situations?				
Before touching patient (examination or injection) (Rubbing)	120	60	80	40
After removing examination gloves (Rubbing/ washing)	174	87	26	13
After visible exposure to blood (Washing)	150	75	50	25
Which of the following should be avoided, as associated with increased likelihood of colonization of hands with harmful germs?				
Wearing jewellery	150	75	50	25
Damaged skin	176	88	24	12
Artificial fingernails	152	76	48	24
Regular use of a hand cream	70	35	130	65

Practice of the healthcare workers regarding	Yes		No	
	N	%	N	%
Personal protective equipment element of standard precautions of infection control				
The component of PPE (Face Shields, Gloves, Mask, and Gowns)	160	80	40	20
Which of the following is the correct sequence for wearing PPE? (Gown-Mask-Goggles-Gloves)	110	55	90	45
Which of the following is the correct sequence for Removing PPE? (Gloves- Goggles- Gown- Mask	106	53	94	47
The gloves should be changed if contacting the different patient	190	95	10	5
Wearing gloves is important when handling patients, body fluids, cut skin and mucus membranes.	186	93	14	7
Disposal of sharp instruments element of standard precautions of infection control				
Disposition of needles should be in the sharp containers	194	97	6	3
Contaminated needles should not be bent or recapped after usage	182	91	18	9
The sharp box is only disposed of when it is full	120	60	80	40
Cough and sneeze etiquette element of standard precautions of infection control				
Following the standard precautions of infection control if you should cough or sneeze do you cover your palm of hand on your nose and mouth to protect the other ?	140	70	60	30
The best place to practice cough etiquette is upper arm ?	180	90	20	10

Table 2 shows that majority of the participants answer yes could recognize that using routinely an alcohol based hand rub is required for hand hygiene were(91%). Only (12)% 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 the hand hygiene were known by 71% of HCWS regarding immediately before a clean/aseptic procedure to 91.0% of them regarding before touching the patient. Most of the HCWS (75%) knew that hand rubbing is more rapid for hand cleansing than hand washing while 42.0% 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 (88%) and the lowest known was wearing jewellery (75%)

Table 3: Description of the Knowledge and practice of the healthcare workers regarding personal protective equipment element of standard precautions of infection control

Table 3 showsregarding the Knowledge statements/questions that majority of the participants answer yes Components of the PPEs were known by majority of the participants (80.0%). Vast majority of the respondents (93.0%) knew that wearing gloves is important when handling patients, body fluids, cut skin and mucus membranes while 95% knew that the gloves should be changed if contacting the different patient. The correct sequence for wearing or removing PPE was properly recognized by 40% and 43.0% of the respondents, respectively. Regarding the disposal of sharp instrumentsmajority of the respondents could recognize that disposition of needles should be in the sharp containers (97.0%) and contaminated needles should not be bent or recapped after usage (91.0%). However only 60% of them knew correctly that the sharp box is not only disposed of when it is full, regarding the cough and sneeze etiquette majority of the healthcare workers knew that the best place to practice cough etiquette is upper arm (90.0%). However, only (30.0%) of them could recognize that following the standard precautions of infection control if should cough or sneeze do they should not cover their palm of hand on their nose and mouth to protect the others

Table 4 Distribution of knowledge and practice regarding standard precautions of infection control

		Weak	**Average**	**High**	**Score**	
					Range	**Mean±SD**
Knowledge	**N**	42	110	48	5-18.	12.15±3.11
	%	21	55	24		
Practices	**N**	70	98	32	3-9.	6.88±2.481
	%	35	49	16		

Table 4 showsthe knowledge regarding standard precautions of infection control study results show the majority of participant had average information were(55.0%) while weak knowledge were(21.0%) the data ranged from(5-18) by mean ±SD(12.15±3.11), while regarding practice results show the majority of participant had average information were(49.0%) while weak knowledge were(35.0%) the data ranged from(3-9) by mean ±SD(6.88±2.481).

Figure (1) Distribution of knowledge and practice regarding standard precautions of infection control

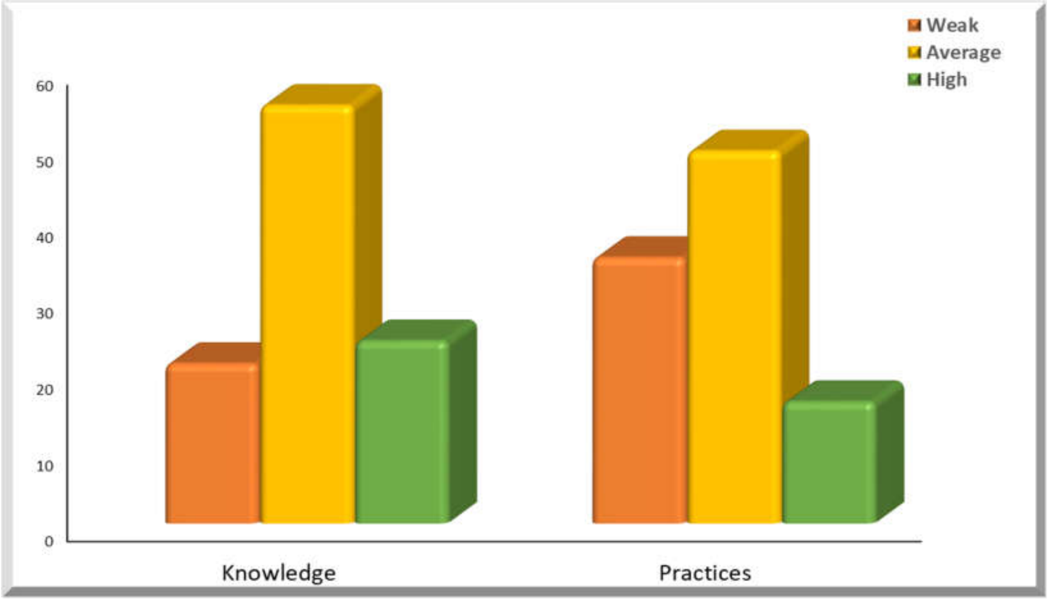

Figure (2) Correlation between Know
ledge and Practicesregarding standard precautions of infection control

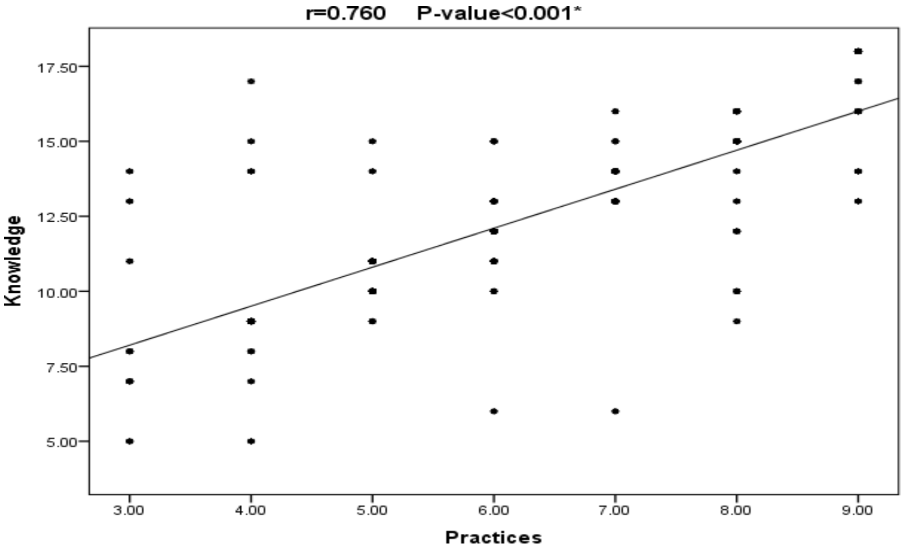

Table 5 Distribution of the Correlation between the Participants' Knowledge and Practices and the demographic data

Demographic data		Knowledge	ANOVA or T-test		Practices	ANOVA or T-test	
		Mean ± SD	F or T	P-value	Mean ± SD	F or T	P-value
Age	**<35**	14.118 ± 2.123	120.029^f	<0.001*	7.105 ± 1.372	63.547	<0.001*
	35-50	12.636 ± 1.919			6.318 ± 1.352		
	>50	8.139 ± 1.376			4.111 ± 1.090		
Gender	**Female**	14.611 ± 1.632	11.561^t	<0.001*	7.278 ± 1.324	7.557	<0.001*
	Male	11.141 ± 2.607			5.625 ± 1.567		
Nationality	**Saudi**	10.571 ± 2.791	-5.333^t	<0.001*	5.041 ± 1.645	-6.152	<0.001*
	Non-Saudi	12.980 ± 2.606			6.603 ± 1.510		
Specialty	**Nurse**	13.827 ± 1.647	80.110^f	<0.001*	6.827 ± 1.245	43.314	<0.001*
	Doctor	12.525 ± 2.549			6.374 ± 1.607		
	Administrative	7.731 ± 1.402			3.885 ± 0.952		
Experience	**<5**	9.500 ± 3.611	34.280^f	<0.001*	4.810 ± 2.003	18.620	<0.001*
	5-10.	13.202 ± 2.104			6.417 ± 1.424		
	10-20.	14.167 ± 1.513			7.167 ± 1.286		
	>20	11.719 ± 1.373			6.313 ± 1.091		
Have you ever worked in Quality System Application Centers?	**Yes**	13.830 ± 1.358	7.710^f	<0.001*	6.807 ± 1.202	4.592	<0.001*
	No	11.259 ± 3.179			5.759 ± 1.856		
Did you take an infection control course?	**Yes**	14.614 ± 1.804	10.976^f	<0.001*	7.329 ± 1.248	7.807	<0.001*
	No	11.192 ± 2.567			5.623 ± 1.581		

Table (5) and show that is a significant relation between knowledge and demographic data regarding age (increase in <35 follow by age 35-50) where F=120.029 and P-value=<0.001 by mean+ SD respectively (9.489±1.648, 7.795±1.246), also a significant relation between practices and age (increase in <35 follow by age 35-50) where T=63.547and P-value=<0.001 by mean+ SD respectively (7.105±1.372, 6.318±1.352), regarding gender In our study the majority of our participants were noticed female more than male in the Knowledge and practices with Mean± SD respectively (14.611±1.632, 7.278±1.324) were T=11.561,T= 7.557and P-value=0.001. Regarding the Nationality is a significant relation between knowledge and Practices increase in the non-Saudi healthcare workers were mean+ SD respectively (12.980±2.606, 6.603±1.510), compared to the Saudis had adequate level of knowledge Practices by mean+ SD respectively (10.571±2.791, 5.041±1.645) where (T=-5.33, T=-6.152) and P-value=<0.001 regarding Specialty In our study is a significant relation between knowledge and Practices increase, the majority of our participants were noticed Nurse more than doctor in the knowledge and practices with Mean± SD respectively (13.827±1.647, 12.525±2.549) were F=80.110, T= 43.314 and P-value=0.001. Regarding the Experience is a significant relation between knowledge and Practices increase in 10-20, were mean+ SD respectively (14.167±1.513, 7.167±1.286), where (F=34.280, T=18.620) and P-value=<0.001

There was a significant statistical association between ever worked in quality System Application Centers and standard infection control precautions and participants' knowledge/practice increased in Yes, Also significant statistical association was found between participants' take an infection control course and standard infection control precautions and participants' knowledge/practice increase in Yes

Discussion

Assessment of the Knowledge and practices of infection control standard among health care workers at the primary healthcare level is very important step in starting and implementing a good infection control program in any healthcare facility.[17]

Worldwide, many studies have shown that healthcare workers expressed variable levels of knowledge regarding standard precautions of infection control, with relatively limited studies have been carried out in the Kingdom of Saudi Arabia, Therefore, the present study was conducted to a assessment of the Knowledge and practices of infection control standard among health care workers at the primary healthcare level in Makkah City at Saudi Arabia.

(70%) of HCWs had ever participated in training program in infection control. In the present study, despite most of HCWs have 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 reconsiderations, we believe that adequate and well prepared training programs are essential in improving knowledge regarding standard precautions of infection control [29]. The same has been reported in Al-Kharj (KSA) by Alotaibi et al where 70% of the healthcare students had attended an infection control course.[30] In Hofuf,[31] the majority of medical students believed that the current teaching and training regarding standard precautions are insufficient in providing them with the required knowledge and skills. Contrary to that, in Ethiopia [31]

In the present study, the level of overall knowledge and practice regarding standard precautions of infection control was average information were(55.0%) while weak knowledge were(21.0%) the data ranged from(5-18) by mean ±SD(12.15±3.11), while regarding practice results show the majority of participant had average information were(49.0%) while weak knowledge were(35.0%) the data ranged from(3-9) by mean ±SD(6.88±2.481) particularly regarding disposal of sharp instruments and hand hygiene while the highest level of knowledge was observed concerning personal protective equipment's. The same had been reported previously in Al-Hassa (KSA)[32] where a deficiency in knowledge of components of SPs was demonstrated among primary healthcare physicians; particularly concerning hand hygiene, sharps disposal, management of sharps injuries and environmental cleaning. In Hofuf (2016),[29] approximately one-quarter of clinical years medical students (26.7%) scored ≥ 24 (out of 41points) which was considered as an acceptable level. The least knowledge score were in the areas of sharp injuries, personal protective equipment and health care of the providers. In Al-Qassim (2018)[28]

the knowledge regarding guidelines of Hand washing are recommended after hand rubbing was 44%. In Nigeria, 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.[17]In another Nigerian study,[33] 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,[19] Regarding compliance to SP practice, highest proportion of nurses had good practice compliance. In India,16 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 (2019),[34] Beyamo et al 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, none-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 primary healthcare were the significant predictors for having adequate SPs knowledge.[32] In Al-Kharj, [30] 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 SPs.[30] In Al-Qassim,[28] 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,[15] older age, previous training, and experience were positively correlated with higher scores of knowledge among HCWs. In Ethiopia (2018),[34] factors significantly associated with compliance to standard precaution practices among HCWs were experience of ≤5 years, training on standard precaution, having good hand hygiene and availability of (personal protective equipment's .

In a similar Saudi study, the commonest factors reported by HCWs for not implementing SPs during routine work were lack of resources and training opportunities, and excessive workload,[32] which are quite similar to those reported in the our study. 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.[17] In another study carried out also in Nigeria, non-availability of the materials was the main factor reported for non-adherence to SPs.[33]

CONCLUSION

Encourage the healthcare workers to adhere to the standard precaution. To use various educational materials about the importance of standard precautions to be distributed to the healthcare workers. A considerable proportion of healthcare workers working at primary healthcare settings in Makkah at Saudi Arabia expressed inadequate knowledge and practice regarding standard precautions of infection control; particularly concerning disposal of sharp instruments and hand hygiene. The knowledge level were for the following domains: hand hygiene, respiratory Hygiene/Cough Etiquette, and injection safety weak, majority of the HCWs thought that they should be involved in regular training session about standard infection control precaution.

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