

Assessment of the Knowledge and Practices of Infection Control Standard among Health Care Workers at the Primary Health care Level in Makkah City at Saudi Arabia 2022

Afrah Hamadi Al Shaikh¹, Mohammed Mana Almatari¹, Majed Moshabab Alahmari¹, Abdullah Ahmad Alharbi², Abdullah Ali Alharbi³, Iradah Abbas Al-Sabban¹, Shorog Awad Al-Moaabdi⁴, Ghada Mohammed Bukhari⁴, Samir Mohammed Alasmi⁵, Asmahan Ahmed Almuwalad⁵, Mohammad Awad Alshehri⁵, Raja Abdullah ALhemari⁶

¹Dentist, Primary Health Care Center in Khulais, Saudi Arabia.

²General Practitioner, Primary Health Care Center in Khulais, Saudi Arabia.

³X-Ray technician, Primary Health Care Center in Khulais, Saudi Arabia.

⁴Nursing Specialist, Primary Health Care Center in Khulais, Saudi Arabia.

⁵Nursing technician, Primary Health Care Center in Khulais, Saudi Arabia.

⁶Technical laboratory, Al-Dhabya and Al-Jama Health Center, Saudi Arabia.

Abstract

Background

Healthcare workers (HCWs)-associated infections lead to considerable morbidity, health-care workers infections contribute to increase of higher mortality and higher health-care costs. Prevention and control of infections among primary health-care workers is a critical public health concern. This study assessed the knowledge and practice (KP) of infection control standard among health care workers (HCWs) in the primary health care level in Makkah City at Saudi Arabia 2022. Healthcare workers have lost their lives in significant numbers in the discharge of their duties as a result of a breach in Infection Prevention and Control (IPC) procedures. The increasing incidence of emerging and re-emerging diseases complicates this burden.

Aim of study: To Assessment the knowledge and practices of infection control standard among health care workers at the primary health care level in Makkah City at Saudi Arabia 2022.

Methods: This cross sectional study included (200) health care professionals in Makkah City at Saudi Arabia 2022. (Doctors, nurses, lab workers) from primary healthcare (PHC) centers an self-administrated questionnaire was constructed by the researcher and was used for data collection. Divided in to 3 parts and contains 29 items i.e., socio-demographic characteristics, knowledge questions about infection control and statements about practice of health care providers regarding

infection control.

Results: there were 200 participants, and the majority age was(34.0%) in (30-40)years, the majority of them were males (65.0%), regarding the Nationality most of participants Saudi were(88.0%), regarding Position the majority of participant are nurse were(32.0%)also regarding the Qualification most of participants Bachelor were(38.0%) the Experience in PHC the majority of participant >10 years were (52.0%)

Conclusion:The demonstrated poor level of knowledge and . However, these conditions can be improved by training of the health care workers at the primary health care level about infection control standard. Knowledge of infection control standard among healthcare workers is of importance to enhance a healthy working environment. A few of these respondents had good knowledge of infection control standard and their age, professional cadre.

Keywords:knowledge, practices, infection control, standard,(HCWs) primary, health care, Makkah.

Introduction.

Background

Infection control is a combination of measures aimed at minimizing the risk of infection transmission within health care workers at the primary health care level.[1] Any breach in these infection control precautions facilitates and sustains the chain of transmission of infection from patients to health care workers, to other patients and visitors. [2] Poor knowledge and compliance could be associated with untold consequences among health care workers and patients. Such consequences include prolonged duration of hospitalization, increased severity of the primary illness, increased cost of care with unquantifiable impact on their quality of life and that of their families. [3] Healthcare workers are an indispensable component of the health system and they play cardinal roles in infection control precautions, which invariably contribute to the quality of patient care and management.[4] Poor knowledge and false practices of infection control standard claimed many lives health care workers at the primary health care level lives in KSA, although most infectious diseases can be treated or prevented. According to reports published by the MOH, brucellosis, chickenpox, and amoebic dysentery are the most chronic infections most easily transmitted among health care workers in KSA [5]. There are Infectious diseases control quality assurance departments that are established at a healthcare facility or institution with the task of implementing infection control programmes and guidelines.[6]infection control standard is a new but growing discipline in KSA, and at the national level, the Saudi MOH is responsible for establishing several centres for disease control and prevention. For instance, the Command and Control Centre (CCC) was set up with the aims of enhancing the prevention of infections and

establishing systems to track infections in KSA and worldwide.[7] Agencies such as the Centres for Medicare and Medicaid use hospital data to track hospital performance and primary health care on matters pertaining to Infectious diseases control quality [8]

The contaminated hands of health-care workers (HCWs) and health-care equipment have been identified as the primary sources of HAIs [9,10]. The pathogens of HAIs are commonly transmitted from one patient to another when HCWs do not perform hand hygiene properly following caring for one patient and contacting another patient [11]. The incidence of HAIs varies in different types of clinical departments. A study in Norway reported that the greatest infection rate is in the intensive care units followed by neonatal and burns units [12]. The occupational risk of acquiring respiratory infection to health care workers increases when the measures of infection control are not properly applied.[13-14] According to WHO, the prevalence of healthcare acquired infection in developed countries is 7.6% while in developing countries is about 10%.[15,16] The WHO has estimated that every year, about 3 million HCPs globally experience exposure to blood-borne Hepatitis C and B and HIV viruses while 2.5% of HIV cases and 40% of HBV and HCV cases among HCPs all over the world are caused by exposures to such infections.[17] The Centers for Disease Control and Prevention (CDC) recommended using standard precautions by both health care workers and patients.[18] Many studies conclude that adherence to standard precautions measures is fundamental to control

Literature review

Online searching for studies exploring the knowledge and practical towards standard infection control precautions among primary healthcare workers yielded relatively few studies as most studies conducted in this field were among healthcare workers in hospitals and future health care workers. In addition, relatively limited studies were carried out in Saudi Arabia .[19]

Faith, et al.(2019) study in Nigeria about good and fair knowledge among participants was reported as 50% and 44% respectively.[20] In Ethiopia, Yakob et al. showed that all participants had acceptable knowledge about contaminated needles and sharp materials that transmit disease causative agents, while 70.4% knew that gloves and gowns were required for any contact with patients.[21] In Brazil, Oliveria et al. identified a gap between knowledge of standard precautions and the practical applications among physicians.[22]

In Ethiopia (2019) Beyamo et al assessed the compliance of health care workers with standard precaution practices and identified its determinants in public health institutions. The study included 250 HCWs. Nearly two-thirds (65%) of them had complied with standard precaution practices. Factors significantly associated with compliance to standard precaution practices were experience

of ≤ 5 years, training on standard precaution, having good hand hygiene and availability of (personal protective equipment's)[23]

In Al-Kharj, Alotaibi et al assessed the knowledge of as well as compliance of health care students with standard precautions. Results revealed that among surveyed 353 students, 70% had previously attended an infection control course. The knowledge and compliance with SPs levels were high. The commonest source of information self-learning while the current curriculum was the least reported one. Female students were more knowledgeable and compliant with SPs compared to males. Student's specialty and academic level were significantly associated with knowledge and compliance regarding SPs .[19]

In Hofuf (2013), Amin et al (2013) evaluated in a cross-sectional study the knowledge of clinical years medical students about standard precautions of infection control' and explored their attitudes toward the current curriculum and training in providing them with effective knowledge and needed skills with this regard. The study included 251 students. Approximately one-quarter of them (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. The main sources of information were self-learning, and informal bed side practices. The majority of the participants believed that the current teaching and training regarding standard precautions are insufficient in providing them with the required knowledge and skills. These studies targeted future healthcare workers .[24]

In Al-Qassim (2018), Al Ra'awji et al evaluated in a multicenter cross-sectional study among 354 HCWs the knowledge, attitudes, and practices regarding guidelines of hand hygiene. The average knowledge score was 63%. Health-care workers aged over 30 years had higher scores than those younger than 30 years. Those at tertiary care hospitals had higher scores than those at secondary hospitals. Almost all had positive attitudes toward hand hygiene as well as adhering to the guidelines regularly. This study concentrated on only hand hygiene as a component of standard precautions .[25]

In Makkah, Alkot et al (2016) assessed the knowledge, attitude, and practice of health care workers toward Middle East respiratory syndrome coronavirus (MERS-CoV) among HCWs in primary health-care centers after an interventional education program. The level of satisfactory knowledge, positive attitude, and good practice of studied HCWs were significantly improved after exposure to the program, as it increased from 43.3%, 45%, and 57.4% before intervention to 67.9%, 63.8%, and 64.8% after intervention, respectively ($P < 0.001$). Older age, previous training, and experience were positively correlated with higher scores of knowledge.[26]

Rationale

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, The difficult challenge faced by the Saudi Ministry of Health is the healthcare services. services that are provided free of charge to all Saudi citizens, increasing awareness of health and disease .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. Up to our knowledge, no similar study has been conducted tacking this subject among HCWs in primary care settings in in Makkah City at Saudi Arabia 2022 .

Aim of the study

To Assessment the knowledge and practices of infection control standard among health care workers at the primary health are level in Makkah City at Saudi Arabia 2022

General objective:

The study aims toassessment the knowledge and practices of infection control standard among health care workers at the primary health are level in Makkah City at Saudi Arabia .

Materials and methods .

Study design:

This study is descriptive cross-sectional study

Study sitting:

The study has been carried out in the city of Makkah Al-Mokarramah Makkah PHC centers in in Makkah City at Saudi Arabia Region. There are 39 primary health care centers belonging to Ministry of health (MOH) distributed as North (20) and South (19)

Study population:

MOH PHC health care professionals (n=200) distributed as follows: 50 physicians,64 nurses and 22 laboratory technicians,Dental assistant 26 ,Dentist38

Study duration: August 20221st December 2022-

Sample size:

Sample size was calculated using open Epi online sample size calculator at 95% confidence level with bound on error of 5% regarding standard infection control precautions max sample size required is 200 participants.

Sample technique:

Sample technique was two stage.

At first stage: simple random sampling method will be used to select primary health care centers. At second stage: all the doctors, nurses and laboratory technicians within the selected PHCCs enrolled in the study. There are total primary health care centers . Expected numbers of HWs per each center are 10. So, we need 20 centers to collect the sample size.

Inclusion criteria:

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

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.

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 city of Makkah Al-Mokarramah Makkah 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.

Table 1 Socio-demographic characteristics of Personal characteristics of the participants (n=200)

	N	%
Age		
<30 years	50	25
30-40 years	68	34
40 -50years	44	22
<60	38	19
Gender		
Female	70	35
Male	130	65
Nationality		
Non-Saudi	24	12
Saudi	176	88
Position		
Physician	50	25
Dentist	38	19
Nurse	64	32

Lab technician	22	11
Dental assistant	26	13
Qualification		
PhD/MD/equivalent	16	8
Master	44	22
Bachelor	76	38
Diploma	64	32
Experience in PHC		
<5 years	30	15
5-10 years	66	33
>10 years	104	52

Table 1 shows there were 200 participants, and the majority age was(34.0%) in (30-40)years, while the age(<30)were(25.0%), the majority of them were males (65.0%) while female(35.0%), regarding the Nationality most of participants Saudiwere(88.0%), regarding Position the majority of participant are nurse were(32.0%)followed by Physician were(25.0%) followed by dentist were(19.0%), also regarding theQualification most of participants Bachelor were(38.0%) followed by diploma were(32.0%), Regarding the Experience in PHC the majority of participant >10 years were (52.0%) followed by 5-10 years were(33.0%)

Table 2: Knowledge of the healthcare workers regarding infection control element of standard precautions .

Statements statements/questions	TRUE		FALSE		Chi-Square	
	N	%	N	%	X ²	P-value
Dirty needle and sharp materials can transmit disease causing agents (TRUE)	190	95	10	5	162.000	0.000
Standard precautions should be practiced on all patients and laboratory specimen serology irrespective of diagnosis (TRUE)	132	66	68	34	20.480	0.000
Sharps should never be recapped (TRUE)	130	65	70	35	18.000	0.000

Needles should be bent or broken after use (FALSE)	64	32	136	68	25.920	0.000
When you have a patient who vomited in dressing room or clinic, the first step in infection control procedure is to isolate infected area (TRUE)	132	66	68	34	20.480	0.000
Sharp containers are utilized for used injection needles (TRUE)	170	85	30	15	98.000	0.000
Hepatitis B causing agent can be transmitted with dirty needles and sharps (TRUE)	190	95	10	5	162.000	0.000
Hepatitis C causing agent can be transmitted with dirty needles and sharps (TRUE)	150	75	50	25	50.000	0.000
HIV/AIDS causing agent can be transmitted with dirty needles and sharps (TRUE)	192	96	8	4	169.280	0.000
Tetanus (<i>Clostridium tetani</i>) causing agent can be transmitted with dirty needles and sharps (TRUE)	176	88	24	12	115.520	0.000
Malaria causing agent (<i>Plasmodium spp</i>) can be transmitted with dirty needles and sharps (FALSE)	150	75	50	25	50.000	0.000
Tuberculosis causing agent (<i>M. tuberculosis</i>) can be transmitted with dirty needles and sharps (FALSE)	142	71	58	29	35.280	0.000
Type of isolation with pulmonary tuberculosis is airborne precaution (TRUE)	136	68	64	32	25.920	0.000
There is treatment for MERS-CoV (coronavirus) (FALSE)	76	38	124	62	11.520	0.001
The best disinfecting material to clean exposed skin after contamination is soap (TRUE)	170	85	30	15	98.000	0.000
The appropriate immediate action after pricking finger by I.V. line needle is dressing wound and inform infection control supervisor(TRUE)	136	68	64	32	25.920	0.000

Table 2 shows the knowledge of the participants about infection control regarding (the Dirty needle and sharp materials can transmit disease causing agents, Standard precautions should be practiced on all patients and laboratory specimen serology irrespective of diagnosis, Sharps should never be recapped)the majority of participant have true information respectively (95.0%, 66.0%, 65.0%) while is a significant relation were P-value=0.000 X² respectively (162.000, 20.480, 18.000).

Regarding the When you have a patient who vomited in dressing room or clinic, the first step in infection control procedure is to isolate infected area, Sharp containers are utilized for used injection needles , Hepatitis B causing agent can be transmitted with dirty needles and sharps. Hepatitis C causing agent can be transmitted with dirty needles and sharps. HIV/AIDS causing agent can be transmitted with dirty needles and sharps. Tetanus (*Clostridium tetani*) causing agent can be transmitted with dirty needles and sharps the majority of participant have true information respectively (95.0%,75.0%,96.0%) while is a significant relation were P-value=0.000 X² respectively (162.000,50.000,169.280,115.520). Regarding the Type of isolation with pulmonary tuberculosis is airborne precaution ,The best disinfecting material to clean exposed skin after contamination is soap ,The appropriate immediate action after pricking finger by I.V. line needle is dressing wound and inform infection control supervisorthe majority of participant have true information respectively (68.0%,85.0%,68.0%) while is a significant relation were P-value=0.000 X² respectively (25.920, 98.000,169.280, 25.920).

Regarding the Needles should be bent or broken after use, The best disinfecting material to clean exposed skin after contamination is soap , Malaria causing agent (*Plasmodium spp*) can be transmitted with dirty needles and sharps, Tuberculosis causing agent (*M. tuberculosis*) can be transmitted with dirty needles and sharps the majority of participant have false information respectively (68.0%,75.0%,62.0%) while is a significant relation were P-value=0.000 X² respectively (25.920, 50.000,169.280, 11.520)

Table 3: Practice of the healthcare workers regarding infection control element of standard precautions.

practice statements/questions	Correct answer	
	Number	Percentage
Using routinely an alcohol-based hand rub for hand hygiene (Yes)	172	86
The main route of cross-transmission of potentially harmful germs between patients in a health-care facility (Health-care workers' hands when not clean)	132	66

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)	166	83
-After touching a patient (Yes)	174	87
-Immediately after a risk of body flew were uid exposure (Yes)	172	86
-After exposure to the immediate surroundings of a patient. (Yes)	152	76
-Immediately before a clean/aseptic procedure (Yes)	136	68
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)	158	79
-Hand rubbing is more effective against germs than hand washing (False)	130	65
-Hand washing is recommended after hand rubbing (False)	132	66
-Hand washing and hand rubbing are recommended to be performed in sequence (True)	156	78
The minimal time needed for alcohol-based hand rub to kill most germs on your hands (20-30 seconds)	138	69
The minimal time needed for hand washing to kill most germs on your hands (40-60 seconds)	140	70

Table 3 show regarding the Using routinely an alcohol-based hand rub for hand hygiene majority of the participants correct answer were(86.0%). While (66.0%) 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. Regarding Which of the following hand hygiene actions prevents transmission of germs by following the 5 moment for the hand hygiene. The majority of the participants after touching a patient correct answer were(87.0%), followed by iImmediately after a risk of body flew were uid exposure were(86.0%), While before touching a patient were(83.0%).

Regarding the following statements on alcohol-based hand rub and hand washing with soap and water are true. Most of the HCWS (79.0%) knew that hand rubbing is more rapid for hand cleansing, than hand washing while (65.0%) of them knew that hand rubbing is not more effective against germs than hand washing. Followed by Hand washing and hand rubbing are recommended to be performed in sequence were (78.0%) but The minimal time needed for hand washing to kill most germs on your hands (40-60 seconds)were(70.0%).

Table 4: Distribution of knowledge and practice of the healthcare workers about standard precautions of infection control .

				Score	
		N	%	Range	Mean±SD
Knowledge	Weak	21	10.5	4-16.	11.945±2.981
	Average	55	27.5		
	High	124	62.0		
Practice	Weak	51	25.5	1-13.	8.415±2.762
	Average	73	36.5		
	High	76	38.0		

This table 4 shows the majority of participant (62.0%) have high of the Knowledge about standard precautions of infection control, followed by (27.5%) of participant average while Range(4-16) and Mean ±SD(11.945±2.981), while regarding the practice the majority of participant (38.0%) have high of the practice about standard precautions of infection control, followed by (36.0%) of participant average while weak were(25.5)while Range(1-13) and Mean ±SD(8.415±2.762).

Figure (1):Distribution of knowledge the healthcare workers about standard precautions of infection control .

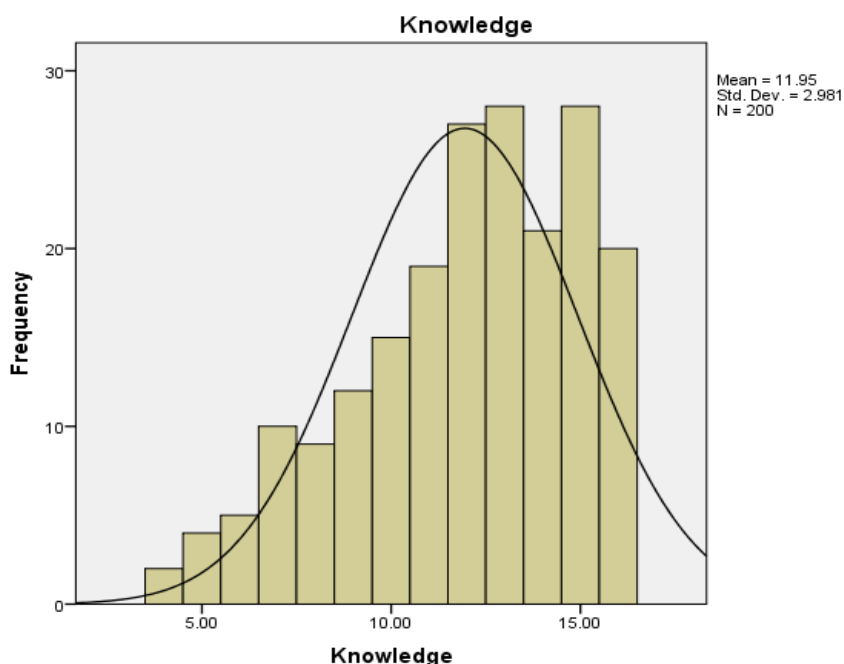


Figure (2):Distribution of practice the healthcare workers about standard precautions of infection control .

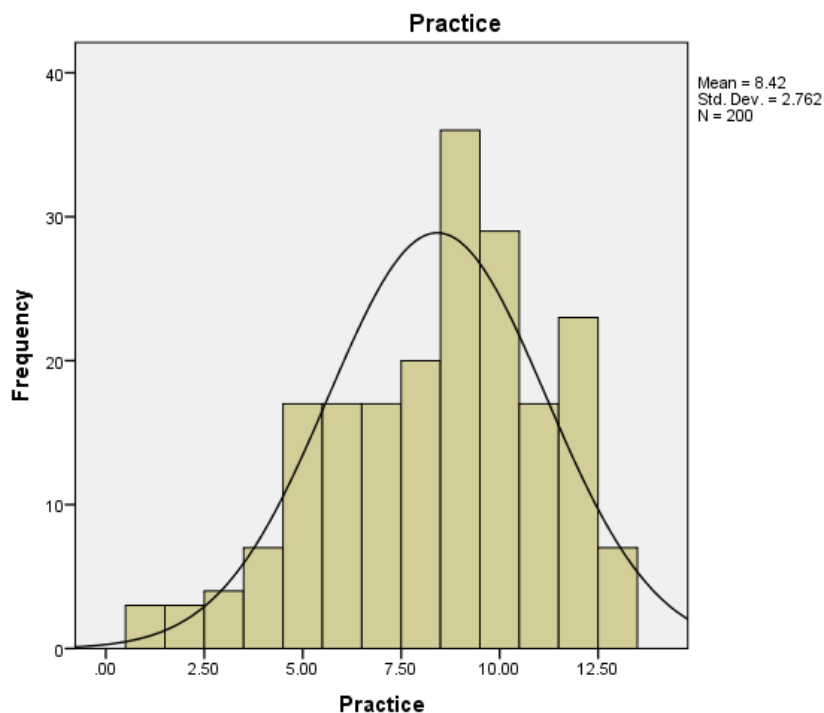


Figure (3):Distribution of knowledge and practice of the healthcare workers about standard precautions of infection control

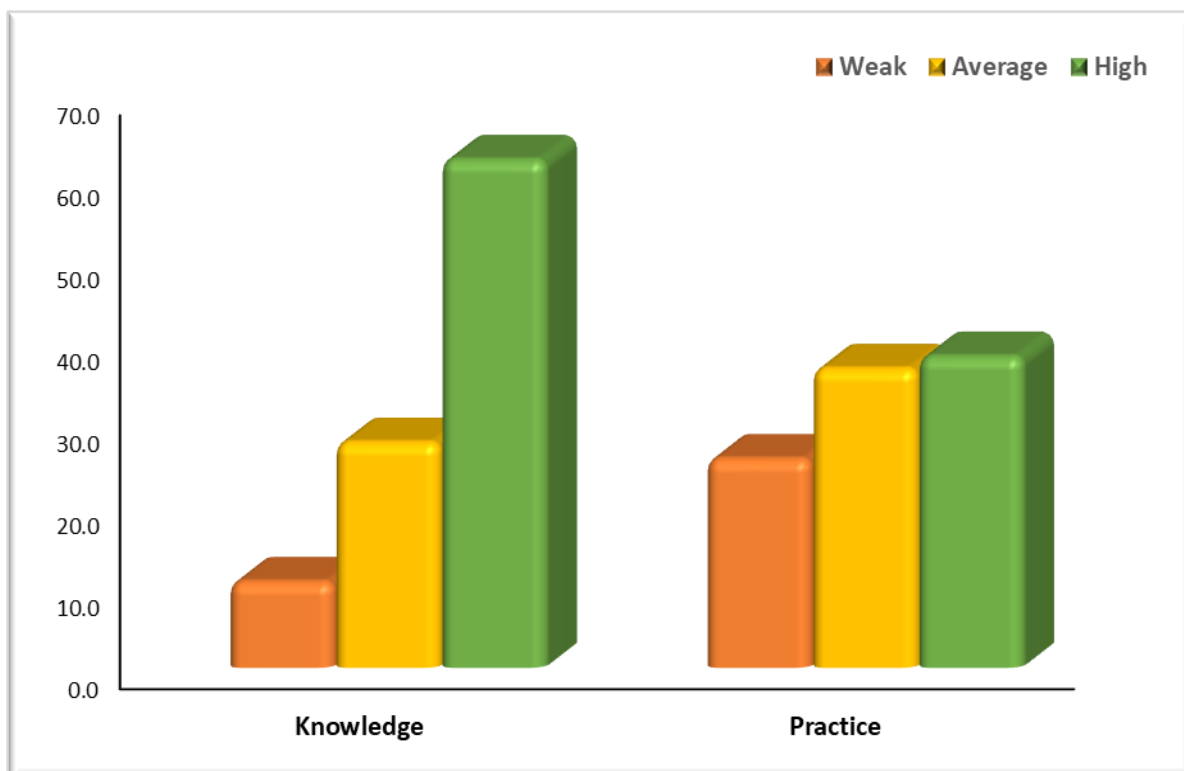


Table (5) Distribution of the relation of the Knowledge of the healthcare workers about standard precautions of infection control and the demographic data (age, gender, Nationality, Position, Qualification ,Experience in PHC)

		N	Knowledge	F or T	ANOVA or T-test	
			Mean ± SD		Test value	P-value
Age	<30 years	50	8.280 ± 2.532	F	138.423	<0.001 *
	30-40 years	68	11.632 ± 1.544			
	40 -50years	44	14.068 ± 1.189			
	<60	38	14.868 ± 0.935			
Gender	Female	70	13.557 ± 1.674	T	7.243	<0.001 *
	Male	130	11.077 ± 3.169			
Nationality	Non-Saudi	24	15.833 ± 0.381	T	19.769	<0.001 *
	Saudi	176	11.415 ± 2.780			
Position	Physician	50	14.640 ± 1.139	F	188.266	<0.001 *
	Dentist	38	14.211 ± 1.212			
	Nurse	64	11.609 ± 1.190			
	Lab technician	22	8.318 ± 2.191			
	Dental assistant	26	7.346 ± 1.495			
Qualification	PhD/MD/equivalent	16	15.438 ± 0.512	F	51.394	<0.001 *

	Master	44	14.22 7 ± 1.217			
	Bachelor	76	11.86 8 ± 2.625			
	Diploma	64	9.594 ± 2.537			
Experience in PHC	<5 years	30	10.53 3 ± 3.893	F	12.935	<0.001 *
	5-10 years	66	11.07 6 ± 3.130			
	>10 years	104	12.90 4 ± 2.175			

Table (5) show that is relation between the Knowledge and demographic data regarding age a significant relation (increase in <60 follow by 40 -50 years) were respectively Mean± SD (14.868±0.935 and 14.068 ±1.189%) and P-value=0.001 F 138.4237.059, regarding Gender a significant relation (increase in Female follow by male) were respectively Mean± SD (13.557± 1.674 and 11.077± 3.169%) and P-value=0.001 T 7.243, regarding Nationality a significant relation (increase in Non-Saudi) were Mean± SD (15.833 ± 0.381) and P-value=0.001 T 19.769, regarding Position a significant relation (increase in Physician follow by Dentist) were respectively Mean± SD (14.640±1.139 and 14.211 ± 1.212%) and P-value=0.001 F 188.266, regarding Qualification a significant relation (increase in PhD/MD/equivalent follow by Master) were respectively Mean± SD (15.438 ± 0.512 and 14.227±1.217%) and P-value=0.001 T 51.394, regarding Experience in PHC a significant relation (increase in >10 years follow by 5-10 years) were respectively Mean± SD (12.904± 2.175 and 11.076± 3.130%) and P-value=0.001 F 12.935

Table (6) Distribution of the relation of the Practice of the healthcare workers about standard precautions of infection control and the demographic data (age, gender, Nationality, Position, Qualification , Experience in PHC)

		N	Practice	F or T	ANOVA or T-test	
			Mean ± SD		Test value	P-value
Age	<30 years	50	6.760 ± 3.074	F	13.216	<0.001

	30-40 years	68	8.206 ± 2.531			*
	40 -50years	44	9.500 ± 2.308			
	<60	38	9.711 ± 1.958			
Gender	Female	70	9.457 ± 2.019	T	4.065	<0.001 *
	Male	130	7.854 ± 2.947			
Nationality	Non-Saudi	24	9.208 ± 2.797	T	1.505	0.134
	Saudi	176	8.307 ± 2.748			
Position	Physician	50	9.400 ± 2.286	F	10.492	<0.001 *
	Dentist	38	9.500 ± 1.928			
	Nurse	64	8.375 ± 2.498			
	Lab technician	22	7.182 ± 2.788			
	Dental assistant	26	6.077 ± 3.463			
Qualification	PhD/MD/equivalent	16	8.875 ± 2.802	F	5.157	0.002*
	Master	44	9.455 ± 1.958			
	Bachelor	76	8.526 ± 2.569			
	Diploma	64	7.453 ± 3.162			
Experience in PHC	<5 years	30	8.033 ± 3.045	F	0.912	0.403
	5-10 years	66	8.197 ± 3.004			
	>10 years	104	8.663 ± 2.511			

Table (6) show that is relation between the **Practice** and demographic data regarding age a significant relation (increase in <60 follow by 40-50 years) were respectively Mean± SD (9.711±1.958 and 9.500±2.308%) and P-value=0.001 F 13.216, regarding Gender a significant relation (increase in Female follow by male) were respectively Mean± SD (9.457 ±2.019 and 7.854 ± 2.947%) and P-value=0.001 T 4.065, regarding Nationality no significant relation (increase in Non-Saudi) were Mean± SD (9.208±2.797) and P-value=0.134 T 1.505, regarding Position a significant relation (increase in Dentist follow by Physician) were respectively Mean± SD (9.500±1.928 and 9.400 ± 2.286%) and P-value=0.001 F 10.492, regarding Qualification a significant relation (increase in Master follow by PhD/MD/equivalent) were respectively Mean± SD (9.455 ±1.958 and 8.875 ± 2.802%) and P-value=0.002 F 51.394, regarding Experience in PHC no significant relation (increase in >10 years follow by 5-10 years) were respectively Mean± SD (8.663±2.511 and 8.197±3.004) and P-value=0.403 F 0.912.

DISCUSSION

This study was conducted to Assessment of the knowledge and practices of infection control standard among health care workers at the primary health care level in Makkah City at Saudi Arabia 2022. The knowledge of standard precautions by healthcare workers is an essential step in starting and implementing a successful infection control program in any healthcare facility.[27]

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.[28] Therefore, the present study was conducted the present study. One of the most important characteristics of Makkah is its location, which is characterized by proximity to Makkah. In our study showed there were 200 participants, and the majority age was (34.0%) in (30-40) years, while the age (<30) were (25.0%), the majority of them were males (65.0%) while female (35.0%), regarding the Nationality most of participants Saudi were (88.0%), regarding Position the majority of participant are nurse were (32.0%) followed by Physician were (25.0%) followed by dentist were (19.0%), also regarding the Qualification most of participants Bachelor were (38.0%) followed by diploma were (32.0%), Regarding the Experience in PHC the majority of participant >10 years were (52.0%) followed by 5-10 years were (33.0%) (see Table 1)

Also showed that most of participants had high knowledge regarding infection control but the most of participant weak practices, In Makkah, the level of satisfactory knowledge and weak 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[29] (see Table 4) shows the majority of participant (62.0%) have high of the Knowledge about standard precautions of infection control, followed by (27.5%) of participant average while Range(4-16) and Mean \pm SD(11.945 \pm 2.981), while regarding the practice the majority of participant (38.0%) have high of the practice about standard precautions of infection control, followed by (36.0%) of participant average while weak were (25.5%) while Range(1-13) and Mean \pm SD(8.415 \pm 2.762)

There were a statistically significant differences regarding participants' knowledge according to their socio-demographic characteristics or their PHC center profile. Compared to previous study that was conducted among Nigerian Health care providers, the current knowledge status of participants was lower than that (92–97%).[26] In another study from Nigeria good and fair knowledge among participants was reported as 50% and 44% respectively.[23] In Ethiopia, Yakob et al. showed that all participants had acceptable knowledge about contaminated needles and sharp materials that transmit disease causative agents, while 70.4% knew that gloves and gowns were

required for any contact with patients.[30] In Brazil, Oliveria et al. identified a gap between knowledge of standard precautions and the practical applications among physicians.[22](see Table 5,6)

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.11 In Al-Kharj, 12 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. In Al-Qassim, 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.[25] In Makkah, older age, previous training, and experience were positively correlated with higher scores of knowledge among HCWs.[19] In Ethiopia (2018), 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. In another study carried out also in Nigeria, non-availability of the materials was the main factor reported for non-adherence to SPs.[23] In Nigerian, the most important factor influencing standard precautions 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.[31]

CONCLUSION

A considerable proportion of healthcare workers working at primary healthcare settings in Makkah , Saudi Arabia expressed inadequate knowledge and practice regarding standard precautions of infection control; particularly concerning disposal of sharp instruments and hand hygiene. Younger, none-Saudi healthcare workers and physicians; particularly consultants were more knowledgeable about SPs of infection control compared to their peers.

REFERENCES

1. Lai, T. H., Tang, E. W., Chau, S. K., Fung, K. S., & Li, K. K. (2020). Stepping up infection control measures in ophthalmology during the novel coronavirus outbreak: an experience from Hong Kong. *Graefe's Archive for Clinical and Experimental Ophthalmology*, 258(5),

1049-1055.

2. Ochie, C. N., Aniwada, E. C., Uchegbu, E. K., Asogwa, T. C., & Onwasoigwe, C. N. (2022). Infection prevention and control: knowledge, determinants and compliance among primary healthcare workers in enugu metropolis, south-east nigeria. *Infection Prevention in Practice*, 4(2), 100214.
3. Chigurupati, R., Panchal, N., Henry, A. M., Batal, H., Sethi, A., D'innocenzo, R., ... & Roser, S. M. (2020). Considerations for oral and maxillofacial surgeons in COVID-19 era: can we sustain the solutions to keep our patients and healthcare personnel safe?. *Journal of Oral and Maxillofacial Surgery*, 78(8), 1241-1256.
4. Curry, S. R., & Salgado, C. D. (2021). When hospitals harm: multimodal entry of SARS-CoV-2 into inpatient healthcare. *Clinical Infectious Diseases*, 72(4), 694-696..
5. Asdaq, S. M. B., Alshrari, A. S., Imran, M., Sreeharsha, N., & Sultana, R. (2021). Knowledge, attitude and practices of healthcare professionals of Riyadh, Saudi Arabia towards covid-19: A cross-sectional study. *Saudi Journal of Biological Sciences*, 28(9), 5275-5282.
6. Al-Ahmari, A. M., AlKhaldi, Y. M., & Al-Asmari, B. A. (2021). Knowledge, attitude and practice about infection control among primary care professionals in Abha City, Kingdom of Saudi Arabia. *Journal of Family Medicine and Primary Care*, 10(2), 662.
7. Alhumaid, S., Al Mutair, A., Al Alawi, Z., Alsuliman, M., Ahmed, G. Y., Rabaan, A. A., ... & Al-Omari, A. (2021). Knowledge of infection prevention and control among healthcare workers and factors influencing compliance: a systematic review. *Antimicrobial Resistance & Infection Control*, 10(1), 1-32.
8. Brooks, S. K., Greenberg, N., Wessely, S., & Rubin, G. J. (2021). Factors affecting healthcare workers' compliance with social and behavioural infection control measures during emerging infectious disease outbreaks: rapid evidence review. *BMJ open*, 11(8), e049857.
9. Iliyasu, G., Dayyab, F. M., Habib, Z. G., Tihamiyu, A. B., Abubakar, S., Mijinyawa, M. S., & Habib, A. G. (2016). Knowledge and practices of infection control among healthcare workers in a Tertiary Referral Center in North-Western Nigeria. *Annals of African medicine*, 15(1), 34.
10. Rowan, N. J., & Laffey, J. G. (2021). Unlocking the surge in demand for personal and protective equipment (PPE) and improvised face coverings arising from coronavirus disease (COVID-19) pandemic—implications for efficacy, re-use and sustainable waste management. *Science of the Total Environment*, 752, 142259.

11. Kaushal, P., Sangwan, G., Rana, K., Biswal, M., Kaur, M., & Lakshmi, P. V. M. (2021). Implementation status of national airborne infection control guidelines in the health care facilities of a North Indian State: A mixed method study. *Public Health in Practice*, 2, 100149
12. Koch, A. M., Nilsen, R. M., Eriksen, H. M., Cox, R. J., & Harthug, S. (2015). Mortality related to hospital-associated infections in a tertiary hospital; repeated cross-sectional studies between 2004-2011. *Antimicrobial resistance and infection control*, 4(1), 1-8.
13. Loef, B., Van Baarle, D., Van Der Beek, A. J., Sanders, E. A., Bruijning-Verhagen, P., & Proper, K. I. (2019). Shift work and respiratory infections in health-care workers. *American journal of epidemiology*, 188(3), 509-517.
14. Saraswathy, T., Nalliah, S., Rosliza, A. M., Ramasamy, S., Jalina, K., Shahar, H. K., & Amin-Nordin, S. (2021). Applying interprofessional simulation to improve knowledge, attitude and practice in hospital-acquired infection control among health professionals. *BMC medical education*, 21(1), 1-11.
15. World Health Organization. (2021). *Infection prevention and control during health care when coronavirus disease (COVID-19) is suspected or confirmed: interim guidance, 12 July 2021* (No. WHO/2019-nCoV/IPC/2021.1). World Health Organization.
16. Almasadi, M. M., Al-Qahtani, S. M., Alhelali, I., Alwadei, N., Aasiri, A., Alnabhan, M., ... & Alomar, K. (2020). Pattern and frequency of hospital acquired infections in pediatric intensive care unit at Abha maternity and children hospital, Saudi Arabia. *World Family Medicine Journal. Middle East Journal of Family Medicine*, 18(8).
17. Konlan, K. D., Aarah-Bapuah, M., Kombat, J. M., & Wuffele, G. M. (2017). The level of nurses' knowledge on occupational post exposure to hepatitis B infection in the Tamale metropolis, Ghana. *BMC health services research*, 17(1), 1-7.
18. Ge, Z. Y., Yang, L. M., Xia, J. J., Fu, X. H., & Zhang, Y. Z. (2020). Possible aerosol transmission of COVID-19 and special precautions in dentistry. *Journal of Zhejiang University-SCIENCE B*, 21(5), 361-368.
19. Alotaibi, M. M., Almasari, S. M., Alkadam, A. N., Alanazi, Y. A., & Al Gahtani, K. A. (2017). Knowledge and compliance with standard isolation precautions among healthcare students in Al-Kharj Governorate, Saudi Arabia. *J Health Spec*, 5(3), 162-70.
20. Faith, I., Harrison, E., Aigbiremolen Alphonsus, O., Ekundare, F. O., Rowland-Udoh Eloho, A., Ogeyemhe Charles, O., & Okudo Ifeanyi, O. A. B. (2019). Knowledge, attitude and infection prevention and control practices regarding Lassa fever among healthcare workers in Edo State, Nigeria. *Hospital*, 2, 2.

21. Faria, L. B. G. D., Santos, C. T. B. D., Faustino, A. M., Oliveira, L. M. D. A. C., & Cruz, K. C. T. D. (2019). Knowledge and adherence of the nurse to standard precautions in critical units. *Texto & Contexto-Enfermagem*, 28.
22. Oliveira, A. C., Marziale, M. H. P., Paiva, M. H. R. S., & Lopes, A. C. S. (2009). Knowledge and attitude regarding standard precautions in a Brazilian public emergency service: a cross-sectional study. *Revista da Escola de Enfermagem da USP*, 43, 313-319.
23. Beyamo, A., Dodicho, T., & Facha, W. (2019). Compliance with standard precaution practices and associated factors among health care workers in Dawuro Zone, South West Ethiopia, cross sectional study. *BMC health services research*, 19(1), 1-6.
24. Amin, T. T., Al Noaim, K. I., Saad, M. A. B., Al Malhm, T. A., Al Mulhim, A. A., & Al Awas, M. A. (2013). Standard precautions and infection control, medical students' knowledge and behavior at a Saudi university: the need for change. *Global journal of health science*, 5(4), 114.
25. Al Ra'awji, B. A., Almogbel, E. S., Alharbi, L. A., Alotaibi, A. K., Al-Qazlan, F. A., & Saquib, J. (2018). Knowledge, attitudes, and practices of health-care workers regarding hand hygiene guidelines in Al-Qassim, Saudi Arabia: A multicenter study. *International journal of health sciences*, 12(2), 3.
26. Alkot, M., Albouq, M. A., Shakuri, M. A., & Subahi, M. S. (2016). Knowledge, attitude, and practice toward MERS-CoV among primary health-care workers in Makkah Al-Mukarramah: an intervention study. *Int J Med Sci Public Health*, 5(5), 952-60.
27. Tan, C., Kallon, I. I., Colvin, C. J., & Grant, A. D. (2020). Barriers and facilitators of tuberculosis infection prevention and control in low-and middle-income countries from the perspective of healthcare workers: A systematic review. *PloS one*, 15(10), e0241039.
28. ALjohani, H. S., & Sulaiman, A. A. (2021). Assessment of Health Care Workers' Knowledge and Practice Toward Infection Standard Precautions in Primary Health Care setting, Buraidah, Saudi Arabia. *Middle East Journal of Family Medicine*, 7(10), 81.
29. Alzahrani, A. A. A., Rumbo, T. A., Alzahrany, N. A. A., & Tumayhi, Y. M. 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. *European Journal of Molecular & Clinical Medicine (EJMCM)*, 6(01), 2019.
30. Desta, M., Ayenew, T., Sitotaw, N., Tegegne, N., Dires, M., & Getie, M. (2018). Knowledge, practice and associated factors of infection prevention among healthcare workers in Debre Markos referral hospital, Northwest Ethiopia. *BMC health services*

research, 18(1), 1-10.

31. ElBadry, S., Ghaleb, M. A., & Abou Zeid, N. A. (2019). Healthcare Personnel Opinion and their Implementation Obstacles Regarding the Standard Precautions in Hemodialysis Unit. *Evidence-Based Nursing Research, 1(4), 13-13.*