

Level of adherence to COVID-19 protective measures among primary healthcare providers

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Abstract:

Background: Healthcare Providers should possess good knowledge and attitudes toward coronavirus to protect not only themselves but also their colleagues, families and the larger community.

Objectives of study: To assess the level of adherence to protection among Primary Healthcare providers against coronavirus in Iraq and to Find out if there was any association between the adherence of Primary Healthcare providers and certain demographic variables.

Method: This is a cross sectional that has been conducted at Baghdad /Al- Rusafa Health Directorate among 300 healthcare providers in Baghdad during one year. A questionnaire-based patient interview was employed as the data collection method. Chi-square test was used find out if there is any association between the study variables. P- value of <0.05 was considered statistically significant.

Results: Personal protective measures rating was significantly associated with age, occupation, receiving formal training in infection prevention and control practices, and being in direct contact with coronavirus patient. Workplace protective measures rating were significantly associated with occupation and providing direct care to coronavirus patient.

Conclusion:

1. Fair compliance to personal and workplace protective measures.
2. Although the overall adherence was poor; older age, being a physician, receiving formal infection prevention and control training, and being in direct contact with coronavirus patient were predictors of better adherence to personal protective measures; and thus, the younger age group should be the target of awareness campaigns emphasizing on the importance of self-protection from infectious diseases, such as coronavirus.
3. As for workplace protective measures, being a physician and in direct contact with coronavirus patient were also predictors of better adherence to workplace protective measures.

Keywords: Adherence, protective measures, Healthcare Providers.

Introduction

In December 2019, SARS-CoV-2, coronavirus that causes COVID-19, spread like a pandemic from Wuhan, China^[1]. With a 2% fatality rate, it creates an acute and devastating disease. However, in humans, this new coronavirus is frequently linked to moderate to severe respiratory illness^[2]. COVID-19 has become a worldwide health emergency because of its human-to-human transmission^[3]. Coronavirus is an enveloped virus that is not segmented and contains a single-stranded, positive-sense single-stranded RNA genome^[4]. The term "coronavirus" comes from the crown-shaped spikes that protrude from the surface of the virus^[5].

Transmission of the SARS-CoV-2 virus occurs through droplets and aerosols^[6]. Trials have demonstrated that SARS-CoV-2 may stay infectious in aerosols for 3 hours^[7]. Infection may also be spread from one individual to other^[8]. Spread from surfaces is currently believed to be less likely, though SARS-CoV-2 can persist contagious on steel materials for up to 48 hours and plastic materials for up to 72 hours^[8].

According to communicable diseases specialists, the closer people are to an individual who is infected with COVID-19, and the more time they spend together, the more probably the coronavirus may transfer from one individual to the other. A study of healthcare professionals found that failing to maintain a minimum distance of 1.8 meters away from patients with influenza increased their risk of infection^[9]. As a result, the Centers for Disease Control and Prevention (CDC) recommends a minimum distance of 1.8 meters (6 ft) from individuals with respiratory illnesses^[8]. Because virus-infected aerosols in inhaled air may travel up to 8 meters for example, while sneezing—the minimal distance of 1.8 m may not always be enough^[10].

In the case of SARS-CoV-2, it is expected that the peak of viral shedding and infectiousness will occur just before the onset of symptoms^[11]. Following the commencement of symptoms, there was a consistent decline in the amount of shed RNA up to the 38th day^[12].

Measures to minimize exposure risk and avoid transmission of COVID-19

Health care providers should be prepared with the necessary personal protective equipment (PPE). Patients with COVID-19 should be carefully and quickly isolated^[13].

In addition to hand sanitizers that contain 60–95% alcohol, hospitals should provide trash containers that may be utilized without touch. Physical barriers, such as Plexiglas or plastic, should be used to separate triage workers from patients who may be contagious. Patients and health care providers should be able to see each other at least 2 meters away in an examination room. Ventilation should be present in these areas as well^[13].

A health care provider (HCP) is at risk for getting COVID-19 if they have worked closely with a COVID-19 patient or have had close contact with a COVID-19 patient. Close contact is defined by the Centers for Disease Control and Prevention (CDC) as the following: being in the same room as an infected individual without keeping the 2-meter minimum distance and having direct touch with the infected person's secretions^[13].

Transferring from one healthcare provider to another is just as critical as transmission from patients. Creating groups of providers who work in hospitals and laboratories is one of the ways that will lower the possibility of transmission among HCP. By doing so, the social distance may be maintained while also lowering the danger of cross-infection. If a team member is infected with COVID-19, all close contacts should be quarantined^[14].

Proper hand hygiene has a 24-31% reduction in the spread of transmissible illness, making it a generally acknowledged principle in disease prevention⁽¹⁵⁾. Personal protective equipment (PPE) may help minimize the spread of disease, but it can't completely prevent it⁽¹⁶⁾.

It is possible that inadequate use of personal protective equipment (PPE) contributed to the nosocomial transmission of COVID-19^[17]. HCP should be taught when to use personal protective equipment (PPE), how to put it on, take it off, and replace it by themselves to avoid contamination, and how to properly dispose of and disinfect this equipment. Procedures and regulations should be in place at all health institutions to explain the right sequence of wearing and doffing this personal protective equipment (PPE) in a secure manner. After completing hand hygiene, the order in which personal protective equipment (PPE) should be put on is the gown, mask, goggles, face shield, and gloves; the order in which PPE should be removed is gloves, face shield, goggles, gown, and mask. The HCP should continue to wear the mask until after they have left the polluted location^[13].

It is possible that wearing a face mask, which is a kind of personal protective equipment, might be helpful in preventing the transmission of respiratory viruses and bacteria. Face masks are often used to prevent the spread of respiratory infections^[18]. Careful

placement of the mask on the face is required, and there should be no space between the mask and the face once it is in place^[19].

eye protection is an essential component of personal protective equipment (PPE) that should not be overlooked^[20]. When entering a patient's room, healthcare professionals are required to either use eye protection or a disposable face shield that protects both the front and sides of the face.^[13]

Gloves are required for hand protection for any medical operation since skin cleaning/disinfection alone does not eliminate all germs, particularly when contamination is significant. Nonsterile disposable gloves should be prioritized, and the European Centre for Disease Prevention and Control (ECDC) warns that there is no direct evidence that using gloves increases protection against COVID-19 when compared to adequate hand hygiene alone^[21].

Healthcare providers should wear a clean isolation gown before entering the patient's room or care area and should replace it as soon as it becomes contaminated. HCPs should remove their gowns before exiting these places and dispose them appropriately (red waste container). Gowns that are meant to be worn more than once should be cleaned thoroughly before use^[13].

Patients' medical equipment should never be taken out of their rooms or used on other patients, and it should not be shared. It is recommended that medical instruments such as stethoscopes and thermometers be sanitized after each use with ethyl alcohol or another disinfectant before being used on another patient.^[13]

The goal of social distancing is to keep contagious persons from coming into contact with others in the community since they haven't been recognized and thus can't be segregated^[22]. Closure of schools or office buildings as well as the suspension of public markets, and the postponement of meetings are all examples of social distance. In public marketplaces where maintaining social distance is challenging, reducing the number of people allowed in and promoting online purchases may lessen the amount of contact^[23].

Significant environmental pollution by patients leads nosocomial spread of the virus. Cleaning the surroundings and patient care equipment's using water and detergent, as well as applying disinfectants, have been found to be adequate and effective^[24].

Getting vaccinated is the most effective approach to protect people from getting SARS-CoV-2. The COVID-19 Treatment Guidelines Panel advises being vaccinated against COVID-19 as quickly as possible for everyone who meets the requirements established by the Advisory Committee on Immunization Practices of the CDC. The use of three different vaccinations to protect against COVID-19 has been authorized or licensed for use^[25].

Several Iraqi studies were conducted aiming to assess the adherence of Iraqi population to Covid-19 protection. Al-Qerem *et al.*, 2022 reported a high hesitancy towards COVID-19 booster dose acceptance among the Iraqi population.^[26] while Shareef *et al.* found that around half the population showed good adherence to COVID-19 vaccine.^[27]

Objectives of study:

1. To assess the level of adherence of protection among primary health care against COVID-19 in Al-Russafa and to find out if there is any association between the adherence of PHC providers and certain demographic variables.
2. To identify the sociodemographic, job, and clinical characteristics associated with poor adherence to personal and workplace protective measures, in order to set a plan for raising awareness regarding protection from COVID-19.

Subjects And Methods:

A cross sectional study with analytic element was conducted from 1st of Feb 2022 till 1st of Feb 2023. The study had been conducted at Baghdad /Al- Rusafa Health Directorate/ among three Healthcare sectors during one year. A convenient sampling has been chosen for this research as the population involved were Healthcare providers in the primary health care centers where the study took place. The total number of recruited participants was 345 patients, 300 of them completed the survey. All primary healthcare providers (physicians, dentists, pharmacists) who were willing to participate in the study were included.

The data were collected by a questionnaire adopted from the WHO checklist for COVID-19-

related health and safety measures. The questionnaire consisted of three parts:

- *Studied variables:*
 - Age, it was categorized into: 25-35 years, 36-45 years, and >45 years.
 - Gender: Male and female.
 - Occupation: Physician, dentist, and pharmacist.
 - Clinical history (history of COVID-19 infection): Yes or No.
 - Family history of COVID-19 infection: Yes or No.
 - History of death in the family due to COVID: Yes or No.
 - Formal training in IPC practices: Yes or No.
 - Whether the HCW provides direct care to covid-19 patient: Yes or No.
 - *Personal protective measures:* consist of 7 questions.
 - *Workplace preventive measures:* consist of 16 questions.

Scoring:

Each question had three possible answers that were scored as the following (*Always: 2, sometimes: 1, rarely: 0*), except for Question no. 5 of the personal protective measures and Question no. 10 of the workplace protective measures (that were scored inversely) as shown in table 1.

As for rating, Scores for each section were rated as *Good, Fair, or Poor* as illustrated in table (2):

Table 1: Possible answers for each section and their scoring with the minimum and maximum total scores illustrated.

Section	Possible answers	Scoring	Questions with inverse scoring	Maximum possible score
Personal protective measures	Always/ sometimes/ rarely	2/ 1/ 0	Q5	14
Workplace preventive measures	Always/ sometimes/ rarely	2/ 1/ 0	Q10	32

Table (2): The rating of the total score of each section.

Section	Poor score	Fair score	Good score
Personal protective measures	0-5	6-10	11-14
Workplace preventive measures	0-11	12-22	23-32

Ethical considerations:

1. An approval was taken from the scientific committee of the Scientific Council of Family Medicine – Iraqi Board for Health Specializations
2. Approval of Al- Rusafa Health directorate to facilitate the researcher mission
3. Approval of Al-Rusafa- Health sectors directed to affiliated primary health care centers to facilitate researcher mission
4. Informed consent was obtained from the participants before their involvement in the research

Data entry and analysis

Data entry was done by using Microsoft Excel 2019. Data was recorded into different quantitative and qualitative variables for the purpose

of analysis. Analysis was done using statistical package for social sciences (SPSS version 26). Data were summarized using measures of frequency, mean, dispersion (standard deviation), tables and graphs. A two-tailed P value of less than or equal to 0.05 was assigned as a criterion for declaring statistical significance.

Results:

A total number of 300 participants (physicians, dentists, and pharmacists) were included in the study sample. The age distribution of the studied sample ranged from 25-63 years with most of the studied sample (60.7%) being in the age group 25-35 years. Regarding gender distribution, it showed female predominance; as the male to female ratio was **1:1.5**. Concerning occupation, around three quarters of the participants (75.3%) were physicians; as shown in table (3).

Table (3): Sociodemographic characteristics of the studied sample.

Sociodemographic and job characteristics	Frequency	Percentage
Age		
25-35 years	182	60.7
36-45 years	90	30.0
>45 years	28	9.3
Total	300	100.0
Gender		
Male	118	39.3
Female	182	60.7
Total	300	100.0
Occupation		
Physician	226	75.3
Dentist	44	14.7
Pharmacist	30	10.0
Total	300	100.0

Table (4) illustrates covid-19 medical history. It can be seen that the majority of the studied sample had a positive history of covid-19 (90.7%),

positive family history (94.7%), and no history of family death due to Covid 19 (88.7%).

Table (4): Medical history of participants regarding covid-19.

Covid-19 medical history	Frequency	Percentage
History of covid-19 infection		
Yes	272	90.7
No	28	9.3
Total	300	100.0
Family history of covid-19		
Yes	284	94.7
No	16	5.3
Total	300	100.0
History of family death due to covid-19		
Yes	34	11.3
No	266	88.7
Total	300	100.0

Concerning infection prevention and control (IPC) training, most participants received none; as illustrated in figure (1).

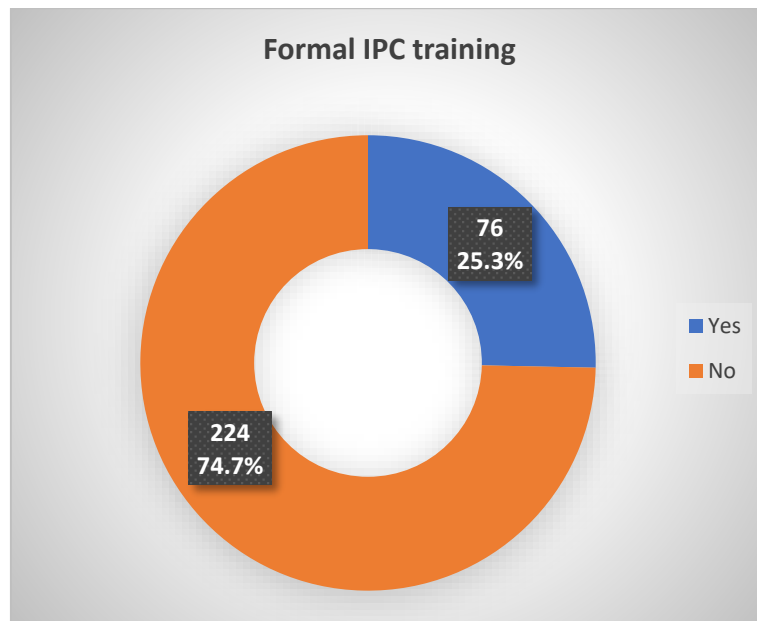


Figure (1): Formal training in IPC practices.

As for providing direct care to covid-19 patients, the majority (86.0%) were in direct contact with covid patients; as illustrated in figure(2).

Regarding personal protective measures, 66 (22.0%) participants showed good rating, 186 (62.0%) showed fair rating, and 48 (16.0%) showed poor rating; as illustrated in figure (3).

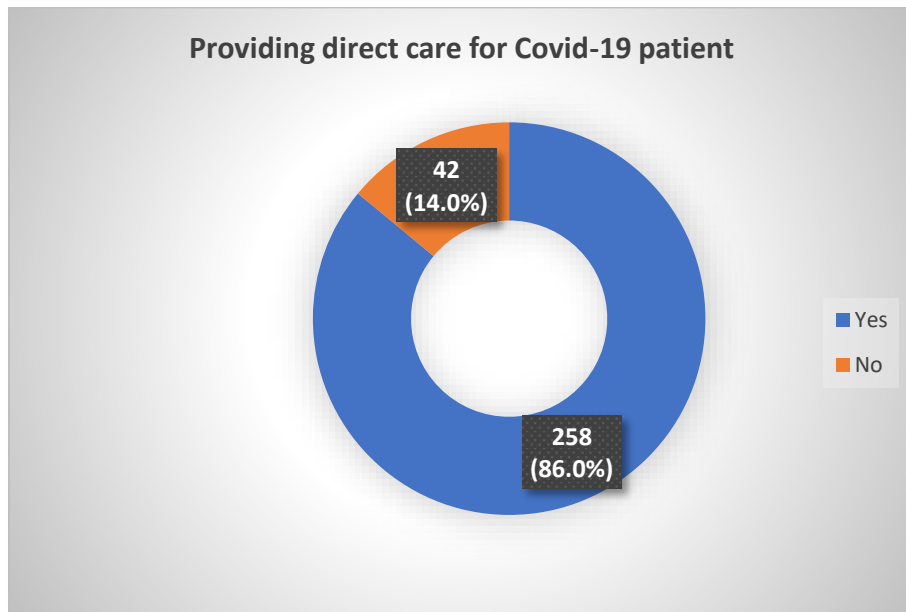


Figure (2): Participants direct contact with covid-19 patients.

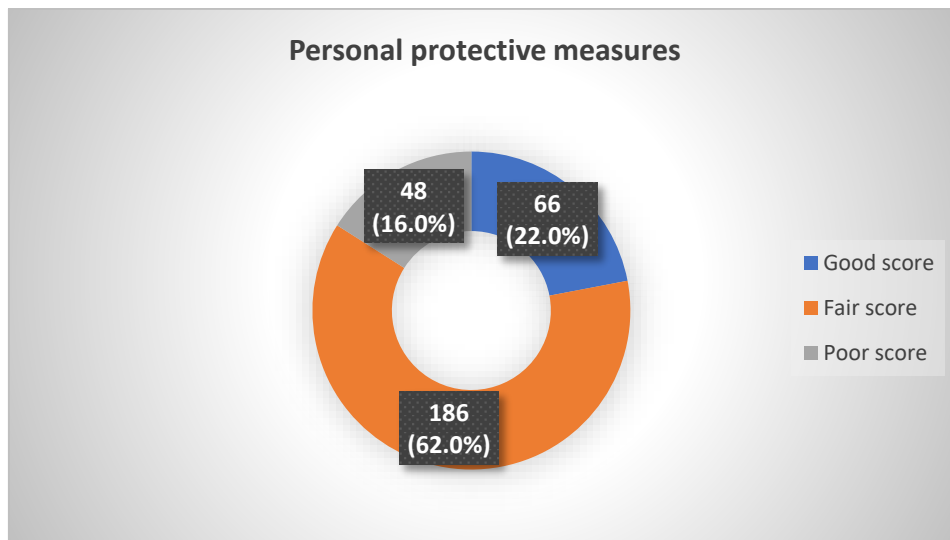


Figure (3): Personal protective measures.

Concerning workplace protective measures, 40 (13.3%) participants showed good rating, 234 (78.0%) showed fair rating, and 26 (8.7%) showed good rating; as illustrated in figure (4).

Answers to the questionnaire
Personal protective measures

Answers regarding personal protective measures are illustrated in table (5).

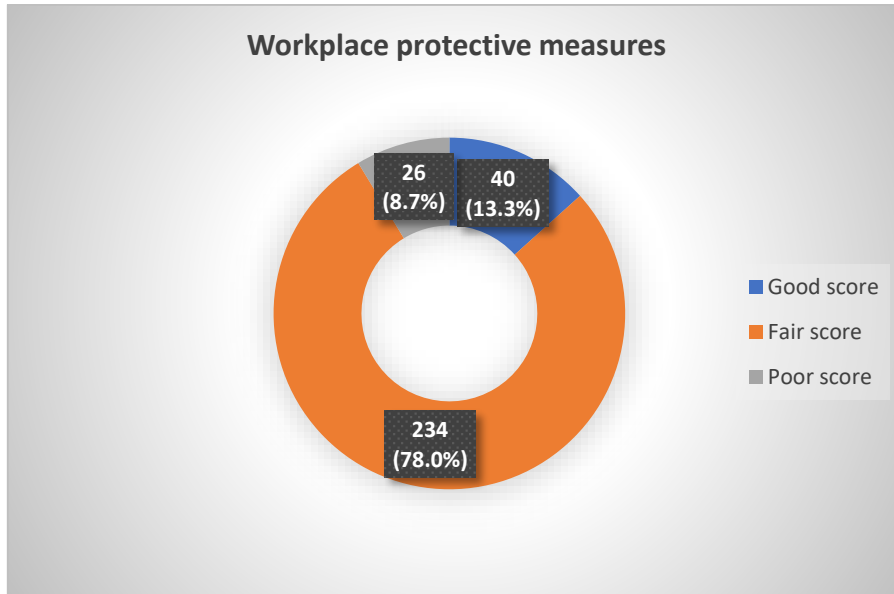


Figure (4): Workplace protective measures.

Table (5): Personal protective measures.

Question	Answer			Total (%)
	Rarely (%)	Sometimes (%)	Always (%)	
Q1) Wearing a face mask if in close proximity to others at work.	7.3	24.7	68.0	100.0
Q2) Wearing Gloves at work.	14.7	41.3	44.0	100.0
Q3) Using face shield or goggles or protective glasses in work.	27.3	50.0	22.7	100.0
Q4) Washing hand with soap thoroughly and frequently for at least 30 seconds.	3.3	59.3	37.3	100.0
Q5) Reusing mask.	10.7	54.7	34.7	100.0
Q6) Sneezing and cough into elbow or into a paper tissue	13.3	62.0	24.7	100.0
Q7) Wearing gown in work	29.3	50.7	20.0	100.0

Workplace protective measures

Answers regarding workplace protective measures are illustrated in table (6).

Table (7) illustrates the relationship between study variables and personal protective measures score. A statistically significant association was found between personal protective measures and each of age, occupation, receiving formal training

in IPC practices, and Direct contact with COVID-19 patient

Table (8) illustrates the relationship between study variables and workplace protective measures. A statistically significant association was found between workplace protective measures and each of occupation and Direct contact with COVID-19 patient.

Table (6): Answers regarding workplace protective measures.

Question	Answer			Total (%)
	Rarely (%)	Sometimes (%)	Always (%)	
Q1) Presence of complete prevention with using 70% alcohol concentration.	1.3	48.7	50.0	100.0
Q2) Avoidance of touching face and mouth and nose while touching contaminated things (beds, tables, doors).	6.0	62.7	31.3	100.0
Q3) Preference of n95 as highly protective measures.	38.7	37.3	24.0	100.0
Q4) Avoidance of touching surfaces in common areas in work.	13.3	64.0	22.7	100.0
Q5) Setting up an efficient and safe waste management system.	4.0	52.7	43.3	100.0
Q6) Allowing frequent aeration of the work premises to let in fresh air.	10.0	66.0	24.0	100.0
Q7) Using the disinfectant at the contact points of machines, especially if they are shared between workers.	6.0	60.7	33.3	100.0
Q8) Avoidance of unnecessary close contact and practice social distancing and keep at least 2 m distance from patients and other health care workers.	8.7	61.3	30.0	100.0
Q9) Receiving full vaccination (taking 2 doses of vaccine and booster dose).	1.3	50.0	48.7	100.0
Q10) Wearing my mask interfere with smoking habit.	16.0	31.3	52.7	100.0
Q11) preference of hand hygiene before and after any clean or aseptic procedure was performed.	4.7	59.3	36.0	100.0
Q12) Presence of sanitizers and alcohol on my desk.	5.3	48.0	46.7	100.0
Q13) Avoidance of gathering and overcrowding in the examination room.	4.7	47.3	48.0	100.0
Q14) In the waiting room, leave space between the seats.	11.3	65.3	23.3	100.0
Q15) Providing a separated room or isolated place for those infected or suspected with covid	8.0	56.0	36.0	100.0
Q16) Presence of tv models or support billboards for the awareness	24.7	43.3	32.0	100.0

Table (7): Relationship between study variables and personal protective measures score.

Study parameters	Personal protective measures score			P value
	Poor score (N=55)	Fair score (N=182)	Good score (N=63)	
Age				
25-35 years	32 (17.6%)	108 (59.3%)	42 (23.1%)	0.019*
36-45 years	14 (15.6%)	64 (71.1%)	12 (13.3%)	
>45 years	2 (7.1%)	14 (50.0%)	12 (42.9%)	
Total	48 (16.0%)	186 (62.0%)	66 (22.0%)	
Gender				
Male	22 (18.6%)	76 (64.4%)	20 (16.9%)	0.186
Female	26 (14.3%)	110 (60.4%)	46 (25.3%)	
Total	48 (16.0%)	186 (62.0%)	66 (22.0%)	
Occupation				
Physician	18 (8.0%)	150 (66.4%)	58 (25.7%)	<0.001*
Dentist	10 (22.7%)	26 (59.1%)	8 (18.2%)	
Pharmacist	20 (66.7%)	10 (33.3%)	0 (0.0%)	
Total	48 (16.0%)	186 (62.0%)	66 (22.0%)	
History of Covid 19 infection				
Yes	44 (16.2%)	172 (63.2%)	56 (20.6%)	0.215
No	4 (14.3%)	14 (50.0%)	10 (35.7%)	
Total	48 (16.0%)	186 (62.0%)	66 (22.0%)	
Family history of Covid 19				
Yes	46 (16.2%)	176 (62.0%)	62 (21.8%)	0.936
No	2 (12.5%)	10 (62.5%)	4 (25.0%)	
Total	48 (16.0%)	186 (62.0%)	66 (22.0%)	
History of family death due to covid-19				
Yes	8 (23.5%)	17 (50.0%)	9 (26.5%)	0.258
No	40 (15.0%)	169 (63.5%)	57 (21.4%)	
Total	48 (16.0%)	186 (62.0%)	66 (22.0%)	
Formal training in IPC practices				
Yes	2 (2.6%)	52 (68.4%)	22 (28.9%)	<0.001*
No	46 (20.5%)	134 (59.8%)	44 (19.6%)	
Total	48 (16.0%)	186 (62.0%)	66 (22.0%)	
Direct contact with COVID-19 patient				
Yes	36 (14.0%)	168 (65.1%)	54 (20.9%)	0.013*
No	12 (28.6%)	18 (42.9%)	12 (28.6%)	
Total	48 (16.0%)	186 (62.0%)	66 (22.0%)	

Table (8): Relationship between study variables and workplace protective measures score.

Study parameters	Workplace protective measures score			P value
	Poor score (N=26)	Fair score (N=234)	Good score (N=40)	
Age				
25-35 years	14 (7.7%)	136 (74.7%)	32 (17.6%)	0.094
36-45 years	10 (11.1%)	74 (82.2%)	6 (6.7%)	
>45 years	2 (7.1%)	24 (85.7%)	2 (7.1%)	
Total	26 (8.7%)	234 (78.0%)	40 (13.3%)	
Gender				
Male	12 (10.2%)	92 (78.0%)	14 (11.9%)	0.676
Female	14 (7.7%)	142 (78.0%)	26 (14.3%)	
Total	26 (8.7%)	234 (78.0%)	40 (13.3%)	
Occupation				
Physician	12 (5.3%)	180 (79.6%)	34 (15.0%)	<0.001*
Dentist	6 (13.6%)	38 (86.4%)	0 (0.0%)	
Pharmacist	8 (26.7%)	16 (53.3%)	6 (20.0%)	
Total	26 (8.7%)	234 (78.0%)	40 (13.3%)	
History of Covid 19 infection				
Yes	24 (8.8%)	214 (78.7%)	34 (12.5%)	0.394
No	2 (7.1%)	20 (71.4%)	6 (21.4%)	
Total	26 (8.7%)	234 (78.0%)	40 (13.3%)	
Family history of Covid 19				
Yes	26 (9.2%)	218 (76.8%)	40 (14.1%)	0.125
No	0 (0.0%)	16 (100.0%)	0 (0.0%)	
Total	26 (8.7%)	234 (78.0%)	40 (13.3%)	
History of family death due to covid-19				
Yes	4 (11.8%)	28 (82.4%)	2 (5.9%)	0.312
No	22 (8.3%)	206 (77.4%)	38 (14.3%)	
Total	26 (8.7%)	234 (78.0)	40 (13.3%)	
Formal training in IPC practices				
Yes	4 (5.3%)	56 (73.7%)	16 (21.1%)	0.057
No	22 (9.8%)	178 (79.5%)	24 (10.7%)	
Total	26 (8.7%)	234 (78.0%)	40 (13.3%)	
Direct contact with COVID-19 patient				
Yes	16 (6.2%)	204 (79.1%)	38 (14.7%)	0.001
No	10 (23.8%)	30 (71.4%)	2 (4.8%)	
Total	26 (8.7%)	234 (78.0%)	40 (13.3%)	

Discussion

During the COVID-19 pandemic, the reportedly high risk of HCWs' hospital-acquired infections intensified fears and concerns. Therefore, international and national health authorities recommended extra safety measures and protective guidelines to assure HCWs' safety^[28].

In the present study, most of the participants were <35 years, females, mostly physicians, with previous personal and familial exposure to Covid-19. Doctors constituted most of the studied sample, since they are the cornerstone of the healthcare system. The study by Binsaleh *et al.* in Saudi Arabia included 674 Healthcare providers who were mostly in the age group 28-37 years, males, and physicians^[29].

In the current study, it has been shown that most participants showed good and moderate rating regarding personal protective measures; and hence, can be considered to be compliant regarding personal protective measures; as the majority of HCWs showed a strong commitment to using personal protective equipment such gloves, masks, face shield, and gown, which is in concordance with the study by Shatnawi *et al.* who found that gloves were used by 92.9%, masks by 89.7%, gowns by 63.5%, and face shields by 51.4%.^[30] The Iraqi study by Hussein *et al.* also showed that around 75% of their sample were adherent to wearing masks.^[31] Darweesh *et al.* reported that 89.9% of Iraqi healthcare providers received injections of the COVID-19 vaccines.^[32]

The good commitment of HCWs regarding personal protective measures can be attributed to the nature of the HCW work, as wearing gloves and masks is routinely applied in hospitals and health care centers, as well as their genuine understanding about infectious diseases. Another reason might be the fear of carrying the virus home to immediate family members. For example, the study by Rabbani *et al.* showed that the majority (92%) of the participants thought about transmitting the virus to their families.^[33] This might also be the reason behind the frequent cleaning of hands by most of recruited HCWs in this study.

Concerning hand washing, around third of participants reported to always wash their hands. In UK, the study by Smith *et al.* reported that 67.8% of participants reported washing their hands the most recent time they were at work.^[34] In Oman, Abri *et al.* showed that the vast majority of participants in their study followed recommended hand hygiene practices, both before and after touching patients or after touching their surroundings and only <7.1% reported poor hand hygiene practices^[35]. In Wuhan, Ran *et al.* found that 3.1% of infected HCWs reported that suboptimal hand hygiene might have been the source of their COVID-19 infection^[36].

Regarding mask reuse, the majority of participants reported reusing masks. The study by

Check *et al.* concluded that Disposable N95 masks have significant failure rates following reuse in clinical practice and that healthcare personnel also performed poorly in assessing the integrity of the seal of their disposable respirators.^[37] Moreover, the United States Food and Drug Administration (FDA) no longer authorized the reuse of N95 masks.^[38]

Moreover, Abri *et al.* also showed that most participants used surgical facemasks.^[35] Given the highly contagious nature of the SARS-CoV-2 virus, and the lack of universal testing to detect asymptomatic individuals, respiratory precautions such as the use of facemasks are critical to protect HCWs from infection and to prevent further transmission to others.^[39]

The present study found compliant use of alcohol and sanitizers in most participants. This finding is in concordance with Aemro *et al.* in Ethiopia who found that alcohol-based hand sanitizers were used by 95.8% respondents to prevent spreading of COVID-19.^[40]

The present study has shown that age was significantly associated with personal protective measures; as older age (>45 years) was associated with better scores. This finding is in discordance with Aemro *et al.* who also found better adherence among the younger age group.^[40]

The current study found that physicians were significantly more likely to adhere to personal and workplace protective measures than dentists and pharmacists. This finding is in concordance with the study by Binsaleh *et al.* in Saudi Arabia who found that general physicians scored better in terms of wearing protective measures than technicians, nurses, pharmacists, and other Healthcare providers.^[29] A possible reason is that physicians have more contact to Covid-19 patients; and hence, need to take more care than pharmacists and dentists. This study found that providing direct care to a covid-19 patients was significantly associated with higher score of personal and workplace protective measures which is expected from centers that provide healthcare services to covid-19 patients. This finding is in concordance to other studies, such as that by Brooks *et al.*^[41] Smith *et al.* reported that participants with less patient contact were less likely to fully adhere to personal protective equipment.^[34]

Unfortunately, the present study has found that only 38 (25.3%) participants have received IPC training. While in the study by Abri *et al.*, 70.3% stated to have received proper training at least once.^[35] This finding reflects a gap in the Iraqi healthcare system; that when corrected, better outcomes regarding infection control can be achieved. According to the WHO, education and training regarding IPC protocols are one of the most important methods of monitoring preparedness and response during a pandemic. Such training should be mandatory for all HCWs regardless of level, role, or position, including in-depth training for new

employees as well as continuing education opportunities for existing staff.^[42] The Iraqi study by Lami *et al.* also emphasized on the importance of IPC training for healthcare workers.^[43] In Mosul, (Zakaria *et al.*) showed good adherence to IPC practices among the medical staff.^[44]

Moreover, personal protective measure in the present study were significantly associated with receiving IPC training, which reflects the efficacy of the training designed by the Iraqi Ministry of Health. Jeong *et al.* found that staff who sought information about the outbreak and infection control were more likely to comply with recommended behaviors, which is in concordance with the present study.^[45]

However; unlike the findings of the present study, Taghrir *et al.* found no significant association between protective behaviors and having received education,^[46] Nour *et al* found a non-significant increase in protective practices post-training,^[47] which is also against the current study. Evidence reviews by Brooks *et al.* suggested that staff felt their prior training and education were not useful in dealing with the rapidly changing nature of emerging infectious disease outbreaks. Participants themselves believed that inadequate training was a barrier to compliance and that infection control training with annual refresher courses would benefit them.^[41] The above studies suggested improving the quality of IPC sessions for them to reach their maximum benefit.

Conclusions:

From the findings of the present study, the following can be concluded:

- 1-The overall compliance of healthcare providers to personal protective measures was fair and the compliance to workplace protective measures was also fair.
- 2- Although the overall adherence was poor, older age, being a physician, receiving formal IPC training, and being in direct contact with covid-19 patient were predictors of better adherence to personal protective measures
- 3- As for workplace protective measures, being a physician and in direct contact with covid-19 patient were also predictors of better adherence to workplace protective measures.

Recommendations:

1. Establishment of an organizational culture of adhering to protective measures.
The Iraqi Ministry of Health infection prevention and control sessions were useful in increasing adherence to protective measures; and thus, they should be mandatory for all Healthcare providers, in order to protect them and their families.

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