

Personal Protective Equipment and Hand Hygiene Status in Health Care Workers during the Covid-19 Pandemic

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Abstract

Background: The COVID-19 pandemic presents a major risk to Health Care Workers (HCWs), which necessitates protective strategies. Personal Protective Equipment (PPE) and Hand Hygiene (HH) could prevent COVID-19 infections in healthcare facilities. Our study aimed to determine the level of PPE proper use among HCWs of Mashhad educational hospitals as well as their level of HH.

Methods: This cross-sectional study was conducted from January 1st, 2021 to January 1st, 2022 in three educational hospitals in Mashhad. A standard checklist was arranged based on the WHO guidelines and was filled out by the supervisors. Data were analyzed using SPSS v23.0.

Results: The total HCWs included in this study were 246, including 154 women. The majority of the participating staff were nurses 135 (54.9%). The most common PPE was the N95 mask (71.1%). One hundred and eighty-four people (46.3%) washed their hands through the standard method, and there was no significant difference between men and women. Also, the level of correct PPEs donning and doffing was 42.2% and 28.4%; respectively. PPE donning was not significantly different between men and women. However, we found a significant difference in doffing PPE.

Conclusion: It became evident that HCWs paid moderate attention to PPE and HH, demanding HCWs training to prevent infectious diseases such as the COVID-19.

Key Words: Covid-19, Hand Hygiene, Health care workers, Personal protection equipment.

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1- INTRODUCTION

COVID-19 has generated an unprecedented public health crisis. The World Health Organization (WHO) has reported that as of August 28, 2022, there have been approximately 600 million confirmed cases and approximately 6.5 million deaths from Covid-19 (1). Touching eyes, nose, or mouth with infected objects and aerosols constitute important routes of infection (2). Healthcare workers (HCWs), rather than the general population, frequently encounter COVID-19 cases, collect infectious samples, and perform aerosol-producing procedures, putting them in great danger. The overall infection rate among HCWs ranged from 3.9% to 11.0% with a mortality rate of 0.9%. (3). Infected HCWs can become infection sources. As a result, preserving HCWs is fundamental for protecting the whole society.

The recommended Personal Protective Equipment (PPE) for HCWs during COVID-19 include “surgical masks, particulate filter respirators (such as P2 or N95), gloves, goggles, face shields, gowns and aprons” (4). We discovered that certain studies on how HCWs utilize PPE appropriately and how much they concern about hand hygiene (HH) had previously been published (5–9).

Several researches demonstrated that PPE usage varies geographically. Previous research has primarily relied on questionnaires, resulting in self-administration biases. Our literature search revealed few studies which had a bias due to low answer rates among hard worker HCWs, who spend continuous hours working. This issue may lead to overrated proper self-reported PPE usage. Due to the nature of online surveys, we can't assure participants' identity validity. To our knowledge, no previous study has investigated PPE usage among Iranian HCWs.

In recent years, COVID-19 has claimed numerous lives and emerged as the leading global concern. Preserving HCWs and being aware of their proper way of using PPEs, greatly protects all people during the COVID-19 pandemic. Up to now, far too little emphasis has been placed on how proper HCWs use PPEs. This study aimed to assess how correct HCWs use PPEs and how much they are concerned about hygiene routines.

2- MATERIALS AND METHODS

2-1. Study design

This hospital-based cross-sectional study was conducted from January 1st, 2021 to January 1st, 2022 in wards of three educational, research, and treatment centers in Mashhad, Iran

2-2. Data collection

We designed a checklist according to WHO guidelines (10), polled by supervisors without healthcare workers' awareness. The checklist consisted of: 1) Socio-Demographic Factors (Age of respondent, sex, type of profession, and respondent working unit), 2) PPE utilization, and 3) Hand hygiene practice (good/intermediate/without compliance; as applicable).

2-3. Data Analysis

Categorical and continuous variables are presented as number (N), percentage (%), and mean \pm SD (Statistical deviation). Statistical analysis was performed using Chi-square test. The software used was a statistical package for social sciences, SPSS (Version 23.0. Armonk, NY). The level of statistical significance was defined as a p-value < 0.05 .

3- RESULTS

During the course of the monitoring process, 246 healthcare workers were observed by supervisors, involving 154 (62.6%) women. Participants in the study were aged on average 39.54 ± 11.80 years

old. As a profession, nurses (54.9%) accounted for the majority of the participants. This observation monitored reports of HCWs working in three shifts

(104 (42.3%) in the morning, 59 (24.0%) in the afternoon, and 83 (33.7%) at night) (**Table 1**).

Table-1: Demographic Characteristics of the participating Healthcare Workers

Demographic variable		Number (%) *
Sex - female		154 (62.6)
Working shift	Morning	104 (42.3)
	Evening	59 (24)
	Night	83 (33.7)
Types of profession	Nurse **	135 (54.9)
	Specialist ***	8 (3.2)
	Resident	16 (6.5)
	Intern	5 (2)
	Laboratory	6 (2.4)
	Other hcws ****	76 (30.8)

* Total number is 246;

** Including Screening nurse, Emergency nurse and Ward nurse.

*** Including specialist and super specialist.

**** Including nurse's assistants, and service staff.

N95 masks were the most commonly used protective equipment (71.1%), followed by gloves (62.6%). Although the apron had the least amount of use (5.2%).

As it is summarized in **Table 2**, which demonstrates the frequency of hand hygiene information, women valued handwashing with the standard method more than men (50.6% vs. 39.1%) (p=0.87). It was found that handwashing before touching a patient differed slightly between males and females (33.1% vs 31.5%), but post-contact handwashing was significantly more frequent in women (58.4% vs 45.7%) (p=0.063). Moreover, the percentage of alcohol-based hand washing was higher in women than in men (75.2% vs. 66.3%) (p=0.145).

There was no significant difference between men and women regarding the donning of personal protective equipment (47.4 vs 33.7) (p=0.108). However, when it came to doffing PPE, there was a significant difference between them (34.4

vs. 18.7). Among the women, 65.6 % used the mask correctly, while 60.9% of the men did (**Table 3**).

4- DISCUSSION

This is one of the first studies presenting a picture of the observed PPE usage among HCWs in Iran. Due to the high number of deaths during the COVID-19 pandemic, we regarded it as our duty to monitor the PPE usage conditions among our HCWs (11). The most noticeable finding to emerge from this study is that only 46% of HCWs washed their hands correctly, which is lower in comparison to Australia's performance (12).

In contrast with Australia and India, we found lower results in all five moments of hand hygiene assessed by WHO (12–14). We got a better result in the "after body fluid exposure risk" category compared to other moments.

Table-2: Comparison of hand hygiene measures in the study population regarding gender*

Hand hygiene	Sex				Shift			
	Male (n=92)	Female (n=154)	Total (n=246)	P-value	Morning (n=104)	Evening (n= 59)	Night (n=83)	P-value
Washing hands								
Before touching a patient	29 (31.5)	51 (33.1)	80 (32.5)	0.888	39 (37.5)	19 (32.2)	22 (26.5)	0.280
Before an aseptic procedure	35 (38.0)	57 (38.0)	92 (37.4)	>0.999	34 (34.0)	26 (44.1)	32 (38.6)	0.447
After body fluid exposure risk	60 (65.2)	109 (72.7)	169 (68.7)	0.249	60 (60.0)	51 (86.4)	58 (69.9)	0.002
After touching a patient	42 (45.7)	87 (58.4)	129 (52.4)	0.063	48 (48.5)	40 (67.8)	41 (49.4)	0.041
After touching a patient's surroundings	24 (26.1)	45 (29.2)	69 (28)	0.661	27 (26.0)	23 (39.0)	19 (22.9)	0.090
With water and washing liquids	59 (64.1)	111 (72.1)	170 (69.1)	0.202	53 (51.0)	50 (84.7)	67 (80.7)	<0.001
With alcohol-based hand rub	61 (66.3)	115 (75.2)	176 (71.5)	0.145	64 (62.1)	47 (79.7)	65 (78.3)	0.016
In standard way	36 (39.1)	78 (50.6)	114 (46.3)	0.870	36 (34.6)	28 (84.7)	50 (60.2)	0.002
Using gloves								
Instead of washing hands	48 (52.2)	86 (55.8)	134 (54.5)	0.599	55 (52.9)	26 (44.1)	53 (63.9)	0.060
Wearing whole time	28 (30.4)	44 (28.6)	72 (29.3)	0.774	45 (43.3)	13 (22.0)	14 (16.9)	<0.001

* Data are expressed as N (%).

Table-3: Comparison of PPE properties regarding gender *

Variable	Sex				Shift			
	Male (n=92)	Female (n=154)	Total (n=246)	P-value	Morning (n=104)	Evening (n= 59)	Night (n=83)	P-value
Performing high risk procedures								
Yes	56 (60.9)	99 (66.0)	155 (63.0)	0.109	58 (55.8)	45 (76.3)	52 (62.7)	0.127
Relatively	9 (9.8)	23 (15.3)	32 (13.0)		13 (12.5)	5 (8.5)	14 (16.9)	
No	27 (29.3)	32 (18.7)	59 (24.0)		33 (31.7)	9 (15.3)	17 (20.5)	
Coordination between the number of ppes and the type of activity								
Yes	59 (64.1)	105 (68.2)	164 (66.6)	0.788	68 (65.4)	43 (72.9)	53 (63.9)	0.682
Relatively	17 (18.5)	24 (15.6)	41 (16.6)		19 (18.3)	9 (15.3)	13 (15.7)	
No	16 (17.4)	25 (16.2)	41 (16.6)		17 (16.3)	7 (11.9)	17 (20.5)	
Coordination between the type of ppes and the type of activity								
Yes	64 (69.6)	109 (70.8)	173 (70.3)	0.297	73 (70.2)	40 (67.8)	60 (72.3)	0.713
Relatively	17 (18.5)	19 (12.3)	36 (14.6)		14 (13.5)	8 (13.6)	14 (16.9)	
No	11 (11.9)	26 (16.9)	37 (15.0)		17 (16.3)	11 (18.6)	9 (10.8)	
Ppes in sufficient quantity								
Yes	73 (79.3)	123 (79.9)	196 (79.6)	0.994	86 (82.7)	47 (79.7)	63 (75.9)	0.792
Relatively	13 (14.1)	21 (13.6)	34 (13.8)		12 (11.5)	9 (15.3)	13 (15.7)	
No	6 (6.6)	10 (6.5)	16 (6.5)		6 (5.8)	3 (5)	7 (8.4)	
Appropriate place for keeping ppes								
Yes	65 (70.7)	112 (72.7)	177 (71.9)	0.151	66 (63.5)	50 (84.7)	61 (73.5)	0.022
Relatively	23 (25.0)	27 (17.5)	50 (20.3)		28 (26.9)	4 (6.8)	18 (21.7)	
No	4 (4.3)	15 (9.8)	19 (7.7)		10 (9.6)	5 (8.5)	4 (4.8)	

Variable	Sex				Shift			P-value
	Male (n=92)	Female (n=154)	Total (n=246)		Morning (n=104)	Evening (n= 59)	Night (n=83)	
Quick access to ppes								<0.001
Yes	75 (81.5)	117 (76.0)	192 (78.0)	0.054	85 (81.7)	38 (64.4)	69 (83.1)	
Relatively	15 (16.3)	21 (13.6)	36 (14.6)		12 (11.5)	19 (32.2)	5 (6.0)	
No	2 (2.2)	16(10.4)	18 (7.3)		7 (6.8)	2 (3.4)	9 (10.9)	
Correct order of donning ppes								<0.001
Yes	31 (33.7)	73 (47.4)	104 (42.2)	0.108	34 (32.7)	22 (37.3)	48 (57.8)	
Relatively	24 (26.1)	31 (20.1)	55 (22.3)		22 (21.2)	24 (40.7)	9 (10.8)	
No	37 (40.2)	50 (32.5)	87 (35.3)		48 (46.1)	13 (22)	26 (31.4)	
Correct order of doffing ppes								<0.001
Yes	17 (18.7)	53 (34.4)	70 (28.4)	0.017	20 (19.4)	16 (27.1)	34 (41.0)	
Relatively	27 (29.7)	45 (29.2)	72 (29.2)		31 (30.1)	27 (45.8)	14 (16.9)	
No	48 (51.6)	56 (36.4)	104 (42.2)		53 (50.5)	16 (27.1)	35 (42.1)	
Correct use of mask								<0.001
Yes	56 (60.9)	101 (65.5)	157 (63.8)	0.457	67 (64.4)	23 (39.0)	67 (80.7)	
Relatively	22 (23.9)	28 (18.2)	50 (20.3)		19 (18.3)	26 (44.1)	5 (6.0)	
No	14 (15.2)	25 (16.3)	39 (15.8)		18 (17.3)	10 (16.9)	11 (13.3)	
Notify to use ppe properly								0.133
Yes	76 (82.6)	128 (83.1)	204 (82.9)	0.966	88 (84.6)	44 (74.6)	72 (86.7)	
Relatively	8 (8.7)	14 (9.1)	22 (8.9)		11 (10.6)	6 (10.2)	5 (6.0)	
No	8 (8.7)	12 (7.8)	20 (8.1)		5 (4.8)	9 (15.2)	6 (7.3)	

* Data are expressed as N (%).

However, there was no significant variance between sexes in hand hygiene, implying slight merit in women's performance. The observed Poor "hand washing before touching a patient" might be interpreted as HCWs primarily care about their own infection safety and considering patient protection as the second priority. A study in Wuhan showed that poor hand hygiene led to an increased risk of transmission from patients to health care workers after hand contamination (15). This neglect may be one of the reasons behind finding it difficult to control COVID-19.

Our study found that N95 respirators accounted for the majority of masks used (71.1%), while surgical (medical) masks accounted for the least number of masks (29.5%). In the absence of suspected or confirmed COVID-19 patients in the room, N95 is one of the best choices among different kinds of face masks (16). These results are so similar to those of the general population and of US health care workers (6).

Wearing a mask properly is necessary to get the best protection against SARS-CoV-2 (20). Our participants had a correct mask usage rate of 63.4% which is low even in comparison to regularly observed pedestrians in Iran (21).

Correct donning and doffing were the other notable factors for proper use of PPEs. We resulted in lower levels of paying attention to donning and doffing in the correct order in comparison to what Canada and Nigeria presented (18,19). In our study, HCWs showed more care to correct the donning process in comparison to the doffing process similar to Canadian results. It might have been due to the lack of adequate training in these procedures at the national level, particularly in the doffing process.

The level of glove consumption during the COVID-19 observed in this investigation is far below those observed in an Ethiopian

study (17). Moreover, our overall level of gown use was found to be 41.5%, lower than that of the previously reported level in the mentioned study.

Perhaps these differences are due to adverse effects and disabilities following long-term use of PPE in health care facilities Such as Extreme exhaustion, Inability to use the bathroom, Headaches, skin injuries, chest discomfort, dyspnea, and thirst. Regarding these experiences, HCWs' decisions can be malformed (7, 22). As compared to studies based on surveys, observation can provide more valid data due to reliance on self-reporting. This can lead to more realistic results and somehow explains why our HH and PPE usage results were lower in comparison to other studies.

4-1. Strengths and limitations of the study

Most of the limitations in our analyses were related to the cross-sectional nature of this research, which restricts its generalizability. We chose three educational hospitals as the sampling frame which may have caused selection bias. Also, the sample size wasn't high enough to capture the real HH and PPE usage in Iran. Additionally, due to the absence of multiple comparisons, corrections or adjustments for confounding factors, these results should be interpreted cautiously. Moreover, we were unable to evaluate HCWs' statistics efficiently because our checklist was limited in items. The higher number of women observed in our study population may have biased our comparison accuracy between genders. Nevertheless, in comparison to questionnaires and self-reports, observation can prevent social desirability bias.

5- CONCLUSION

Despite the fact that HCWs need to protect themselves as well as the patients, they often do not do so. In order to

improve the quality and accuracy, future research should be conducted with a great increase in sample size. It is recommended to do a follow-up after giving warnings, necessary training to HCWs, and conducting a cohort study on the participants' antibody level determination. In future general strategies of the government, frequent educational and training programs are necessary for HCWs to achieve the standards of care.

5-1. Ethical considerations

Mashhad University of Medical Sciences Ethics committee approved this study by the ethics code of IR.MUMS.MEDICAL.REC1399.187.

6- CONFLICTS OF INTEREST

None.

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