

# Factors Affecting Health Care Professionals' Adherence to COVID-19 Precautionary Measures

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**Objective:** COVID-19 is a public health emergency of international concern. There is still no definitive cure for this highly transmittable illness. Immunization and breaking the chain of infection is the only successful approach to mitigate its spread. Our study explored the adherence to COVID-19 preventive measures and its associating factors among Health Care Professionals (HCPs) working in Saudi Arabia.

**Methods:** For this cross-sectional study, an online survey was conducted from December 01, 2020, to March 31, 2021, among 978 HCPs in Saudi Arabia. The self-administered questionnaire consisted of demographic information, COVID-19 preventive behaviors, knowledge, attitude, fear, and risk. Mann–Whitney *U*-test, Kruskal–Wallis one-way analysis, Spearman correlation, and binary logistic regression tests were used in data analysis.

**Results:** Most of the HCPs were Saudi nationals (86.9%), females (63.1%), age group 20–29 years (42.3%), Middle Eastern ethnicity (82.5%), and working in the government sector (80.8%). A 52.2% of the participants were compliant with COVID-19 preventive behavior. The most and the least compliant preventive behaviors were “wearing masks” (88.8% compliance) and “keeping social distancing” (60.7% compliance). Preventive behavior was significantly higher in HCPs having a) more knowledge of COVID-19 ( $U=104849$ ;  $p < 0.001$ ); b) positive attitude ( $U=84402$ ;  $p < 0.001$ ); c) higher fear ( $U=103138$ ;  $p < 0.001$ ) and d) nursing profession ( $p < 0.01$ ). COVID-19 knowledge ( $p < 0.001$ ), attitude ( $p < 0.001$ ), and fear ( $p < 0.001$ ) contributed significantly to the prediction of preventive behavior compliance. A unit increase in COVID-19 knowledge, attitude, and fear scores raised the odds of being compliant with preventive behavior by factors of 2.34, 1.87, and 1.53 respectively.

**Conclusion:** About half of the study participants were compliant with COVID-19 preventive behavior. Preventive behavior is significantly higher among HCPs having more knowledge of COVID-19, more fear, a positive attitude, and the “nursing” profession. Having more knowledge, a positive attitude, and more fear of COVID-19 may increase the likelihood of being compliant with preventive behavior.

**Keywords:** health care professionals, health personnel, COVID-19, prevention, behavior

## Introduction

The continuous spread of SARS-CoV-2 made “COVID-19” a public health emergency of international concern.<sup>1</sup> The World Health Organization (WHO) declared COVID-19 a global “Pandemic” due to its exponential spread and proliferation in more than 210 countries. While vaccines against the virus were underway, preventive measures proved highly effective in reducing its transmission. Thus, governments started implementing preventive measures at various levels.

COVID-19 became an occupational health risk to health care professionals (HCPs).<sup>2</sup> The WHO issued guidelines for COVID-19 prevention among HCPs for example social distancing, use of face masks, frequent hand washing, etc.<sup>3</sup> Compliance of HCPs to these prevention measures was challenging as various factors (gender, education level, profession, availability of personal protective equipment, and knowledge level) could affect HCPs' adherence to preventive measures.<sup>4–7</sup>

Understanding these factors may enhance the chances of successful implementation of COVID-19 prevention and control measures among HCPs.<sup>8</sup>

An Israeli study reported that only 61% of physicians adhered to the guidelines issued by their ministry of health.<sup>9</sup> A Turkish study reported a significant correlation between COVID-19 precautionary measures and fear of COVID-19 among HCPs.<sup>10</sup> Research conducted in Korea identified the fear of COVID-19 and the knowledge/awareness about COVID-19 infection as significant factors affecting preventive behavior among nurses.<sup>11</sup> Research from Saudi Arabia reported adherence of 82% HCPs only to facial mask use.<sup>12</sup> Although 67,577,413 COVID-19 vaccine doses have been administered in Saudi Arabia so far,<sup>13</sup> there was no vaccine available when we conducted the current research. Preventive measures were the only means to prevent COVID-19 spread at that time. Hence, an assessment of the COVID-19 preventive behavior and its associating factors was duly needed. The current study assessed the compliance of HCPs with WHO and Ministry of Health (MOH) guidelines for COVID-19 prevention. We also explored the correlation between preventive behavior and sociodemographic data, knowledge, attitude, fear, and risk of COVID-19.

## Materials and Methods

The Institutional Review Board of Imam Abdulrahman Bin Faisal University (an officially authorized competent body for research ethics) granted ethical approval (IRB-UGS-2020-01-318). The sample size calculated by a sample size calculator (EpiInfo™ application version 5.5.2) was 770 participants (confidence interval 95%, a margin of error of 5%). Our inclusion criteria were HCPs (physicians, dentists, pharmacists, nurses, laboratory technicians/technologists, and allied health personnel), regardless of their nationality/ethnicity, employed in the public/private healthcare sectors of Saudi Arabia.

For this cross-sectional study, an online survey was conducted from December 01, 2020, to March 31, 2021, among 978 HCPs in Saudi Arabia. The sampling techniques used for the participants' enrollment were convenience sampling followed by snowball sampling. The researchers visited nearby medical and dental hospitals and shared the survey link with HCPs working in those hospitals. Respondents were requested to share the survey link within their professional circles.

## Data Collection

The informed consent was recorded electronically. The questionnaire consisted of the following sections:

1. Demographic variables: Age, gender, nationality, ethnicity, working sector, role in healthcare.
2. Preventive behavior against COVID-19: That scale consisted of 11 items answered as never, seldom, sometimes, frequently, always, and coded as 1, 2, 3, 4, 5 respectively.<sup>14</sup> The total score of these 11 items ranged from 11–55. For binary logistic regression, the preventive behavior scores (dependent variable) were dichotomized. Scores equal to or greater than median scores were categorized as “compliant” and scores less than the median scores were categorized as “non-compliant” with the preventive behavior.
3. Knowledge about COVID-19: Knowledge items were from a study by Limbu et al,<sup>14</sup> and scientific literature from the WHO, Center for Disease Control and Prevention (CDC), and MOH, KSA. These items asked about COVID-19 epidemiology, clinical features, modes of transmission, diagnosis, and management. A score of 1 was given for each correct answer and 0 for each incorrect or “I don't know” answer. The score ranged from 0 to 61. A total knowledge score below the median score was less knowledge, and the score  $\geq$  median score was more knowledge.
4. Attitude towards COVID-19: The attitude scale consisted of 6 items/questions.<sup>14</sup> Responses were scored using a 5-point Likert agreement scale. The total scores ranged from 6 to 30. Scores below the median score represented a negative attitude, and the scores  $\geq$  median score represented a positive attitude towards Covid-19.
5. Fear against COVID-19: Fear was evaluated by the “Fear of COVID-19 Scale (FCV-19S)”.<sup>15</sup> Responses were scored using a 5-point Likert agreement scale, and the total scores of 7 items ranged from 7 to 35. Scores below the median score represented less fear, and the scores  $\geq$  median score represented more fear.
6. COVID-19 risk scores were measured with the “objective risk stratification (ORS) tool”.<sup>16</sup> The risk level interpretation was as follows:

Low-risk level: score less than 3

Medium-risk level: score 3–5

High-risk level: score equal to or above 6

The study questionnaire is available as [Supplementary File 1](#).

A pilot study was conducted on 12 HCPs to check participants' understanding of the questionnaire. The face validity (initial preparation of items by the researchers from the scientific literature related to COVID-19 preventive behavior, knowledge, attitude, and fear) and the content validity (review and approval of the items by the experts/consultants in the field of infectious diseases) confirmed the validity of the questionnaire. The Cronbach's alpha (indicative of internal consistency) was 0.76, 0.85, 0.63, and 0.65 for preventive behavior, knowledge, attitude, and fear scales.

## Data Analysis

Responses were entered into SPSS version 26 (Statistical Package for the Social Sciences from IBM) for statistical analysis. The Shapiro–Wilk test revealed a non-normal distribution of data. Nonparametric tests (Mann–Whitney *U*-test for two groups and Kruskal–Wallis One-way Analysis test for more than two groups) were used for demography-based-subgroup comparisons of Preventive Behavior scores. When the Kruskal–Wallis test revealed significant differences among groups, Dunn's post hoc tests (with Bonferroni adjustments) were used on each pair of groups. The binary logistic regression test was used to find the probability of adherence to preventive behavior with sociodemographic variables, COVID-19 knowledge, attitude, fear, and risk scores. Preventive behavior was a dependent variable, and all other variables were independent variables. Spearman correlation found the correlation between quantitative variables. For all tests, a *p*-value less than 0.05 was significant.

## Results

The total number of HCPs who filled out the online survey was 978. 52.2% of the participants were compliant with COVID-19 preventive behavior. The least compliant preventive behaviors were social distancing (60.7% of the participants complied; mean scores: 4.13±1.20), followed by “wearing a complete set of personal protective equipment (PPE) consisting of gown, gloves, face shield/goggles, and an N95 mask while dealing with COVID-19 positive patients (71.1% participants complied; mean scores:4.55±0.82)”. (Table 1) The most compliant preventive behaviors were “wearing masks when in the clinical setting” followed by “wearing PPE whenever encountering a COVID-19 positive patient (88.8% and 88.7% compliance; mean scores: 4.35±1.35 and 4.85±0.47 respectively). The donning and doffing of PPE were practiced correctly by 80.4% and 77.8% HCPs respectively.

Most of the participants were females (63.1%), age group 20–29 years old (42.3%), Saudi nationals (86.9%), belonged to the Middle Eastern ethnicity (82.5%), and working in the government sector (80.8%) (Table 2). Mann–Whitney *U*-test revealed that the preventive behavior mean ranks were significantly higher in HCPs having a) more knowledge of COVID-19 than those having less knowledge ( $U=104849$ ;  $p=0.001$ ); and b) a positive attitude about COVID-19 than those having a negative attitude ( $U=84402$ ;  $p<0.001$ ); c) more fear of COVID-19 than those having less fear ( $U=103138$ ;  $p<0.001$ ). The Kruskal–Wallis test exhibited a significant difference between the mean ranks of at least one pair of groups in the variable “role in health care sector” (Chi-square ( $df=\chi^2(5)=14.668$ ;  $p=0.01$ ) (Table 2, also see [Detailed Table 2](#)). Dunn's pairwise tests were carried out and exhibited a significant difference between the Nurses and Physicians ( $p=0.04$ ) (adjusted using the Bonferroni correction). The remaining pairs did not show any significant difference.

Table 3 revealed a variation of 15% in preventive behavior (dependent variable) based on our model of various independent variables. COVID-19 knowledge ( $p<0.001$ ), attitude ( $p<0.001$ ) and fear ( $p<0.001$ ) contributed significantly to the model/prediction. Gender, age, nationality, ethnicity, working sector, and role in the healthcare sector did not add significantly to the model. A unit increase in COVID-19 knowledge, attitude, and fear scores raised the odds of having good preventive behavior by factors of 2.34, 1.87, and 1.53 respectively.

Table 4 revealed a weak but significant positive and direct relationship between preventive behavior scores and COVID-19 knowledge, attitude, and fear scores.

**Table 1** Study Participants' Preventive Behavior Frequency Distribution

Statement	Number (%)				
	Always	Frequently	Sometimes	Seldom	Never
1: I wear my mask when I am in the clinical setting	868 (88.8%)	80 (8.2%)	25 (2.6%)	5 (0.5%)	0 (0%)
2: I keep at least a 2-meter distance between me and others	594 (60.7%)	282 (28.8%)	91 (9.3%)	11 (1.1%)	0 (0%)
3: I wear my personal protective equipment (PPE) whenever I encounter a COVID-19 positive patient	867 (88.7%)	83 (8.5%)	20 (2%)	8 (0.8%)	0 (0%)
4: I wash my hands before and after encountering any patient	843 (86.2%)	107 (11%)	23 (2.3%)	5 (0.5%)	0 (0%)
5: I wash my hands for at least 20 seconds	778 (79.6%)	147 (15%)	45 (4.6%)	7 (0.7%)	1 (0.1%)
6: I am aware of and follow my healthcare center's infection control guidelines	807 (82.5%)	138 (14.1%)	31 (3.2%)	1 (0.1%)	1 (0.1%)
7: I intend to report any contact I may have had with any COVID-19 positive people, outside of my clinical practice	781 (79.9%)	138 (14.1%)	41 (4.2%)	12 (1.2%)	6 (0.6%)
8: I intend to report and abstain from attending my healthcare center if I experience any symptoms suggestive of COVID-19	758 (77.5%)	143 (14.6%)	38 (3.9%)	30 (3.1%)	9 (0.9%)
9: My PPE consists of a gown, gloves, face shield/goggles and a N95 mask, when I encounter a COVID-19 positive patient	695 (71.1%)	163 (16.7%)	81 (8.3%)	25 (2.5%)	14 (1.4%)
10: I follow these steps when donning my PPE: gather PPE, ensure hand hygiene, put on gown, put on mask, put on face shield/goggles, put on gloves, enter the room	786 (80.4%)	124 (12.7%)	55 (5.6%)	9 (0.9%)	4 (0.4%)
11: I follow these steps when removing my PPE: remove the gloves (without hand contamination), remove gown, exit the room, perform hand hygiene, remove face shield/goggles, remove face mask (without touching exterior), dispose in trash receptacle, perform hand hygiene again.	761 (77.8%)	144 (14.8%)	50 (5.1%)	14 (1.4%)	9 (0.9%)

## Discussion

This study aimed to assess compliance to COVID-19 preventive behavior among HCPs. Our results indicate that having more knowledge, a positive attitude, and more fear of COVID-19 increase the likelihood of practicing good preventive behavior. Previous studies conducted in Bangladesh,<sup>7</sup> Ethiopia,<sup>17,18</sup> Pakistan,<sup>19,20</sup> China,<sup>21</sup> and Vietnam,<sup>22</sup> also reported that knowledge of COVID-19 or any other infection could facilitate preventive actions against that infection. Alnasser et al,<sup>23</sup> reported a strong correlation between a positive attitude toward COVID-19 and preventive behavior. COVID-19 fear resulted in more adherence to preventive behavior because fear activates safety behaviors. In agreement with our results, nurses had higher preventive behavior than physicians/HCPs in studies conducted in Turkey<sup>24</sup> and Bangladesh.<sup>25</sup>

Li et al<sup>26</sup> found that subjects with a high level of risk perception had significantly stronger preventive behavior than those with a low level of risk perception. However, our study did not show that. Unlike Li's study that measured risk perception, we measured "risk scores" by gathering information about the presence/absence of risk factors of COVID-19. Our study participants might not be aware of these conditions as the risk factors for COVID-19.

Unlike a few previous studies that showed females having better preventive behavior,<sup>27,28</sup> we did not find any difference between males and females in this regard.

**Table 2** Comparison of Predictive Behavior Mean Ranks Among Participants' Subgroups

Demographic Factor		N (%)	Preventive Behavior Mean Ranks	P value
Gender	Female	617 (63.1%)	493.60	0.54
	Male	361 (36.9%)	482.49	
Age groups	20–29 years	414 (42.3%)	485.01	0.98
	30–39 years	316 (32.3%)	492.29	
	40–49 years	171 (17.5%)	490.40	
	50–59 years	59 (6%)	507.83	
	60–69 years	18 (1.8%)	475.14	
Nationality	Saudi	850 (86.9%)	482.71	0.05
	Non-Saudi	128 (13.1%)	534.59	
Ethnicity	Black African	13 (1.3%)	361.27	0.40
	Caucasian	22 (2.2%)	481.55	
	Indian Asian	136 (13.9%)	493.54	
	Middle Eastern	807 (82.5%)	491.10	
Working sector	Governmental	790 (80.8%)	492.44	0.49
	Private	188 (19.2%)	477.13	
Role in health care	Dentist	63 (6.4%)	434.56	0.01
	Technician/Technologist	214 (21.9%)	485.57	
	Allied Health Personnel <sup>a</sup>	143 (14.6%)	483.73	
	Nurse	191 (19.5%)	551.18	
	Pharmacist	61 (6.2%)	446.97	
	Physician	306 (31.3%)	476.24	
COVID-19 knowledge level	More	535 (54.7%)	515.02	0.001
	Less	443 (45.3%)	458.68	
COVID-19 attitude	Positive	527 (53.9%)	554.84	< 0.001
	Negative	451 (46.1%)	413.14	
Fear of COVID-19	High	532 (54.4%)	518.63	< 0.001
	Low	446 (45.6%)	454.75	
Risk Level of COVID-19	High	3 (0.3%)	524.17	0.53
	Medium	122 (12.5%)	515.00	
	Low	853 (87.2%)	485.73	

**Notes:** <sup>a</sup>Allied Health Personnel: Those who assist and facilitate the work of physicians in the health care system such as clinical nutritionist, physiotherapist, respiratory therapist etc.

**Table 3** Prediction of Preventive Behavior Based on Participants' Demographics, COVID-19 Knowledge, Attitude, Fear, and Risk Scores

Parameters	P value	Odds Ratios	95% Confidence Interval	
			Lower	Upper
Gender	0.266	0.812	0.562	1.172
Age	0.806	1.02	0.871	1.194
Nationality	0.059	0.597	0.377	0.947
Ethnicity	0.063	0.692	0.279	1.722
Working sector	0.857	0.968	0.676	1.385
Role in health care	0.186	0.838	0.574	1.225
COVID-19 knowledge	<0.001	2.34	0.914	0.968
Covid-19 attitude	<0.001	1.87	0.801	0.901
Covid-19 fear	<0.001	1.53	0.938	0.975
Covid-19 risk	0.074	0.811	0.645	1.021

**Table 4** Correlation of Preventive Behavior with Covid-19 Knowledge, Attitude, Fear, and Risk Scores

		Knowledge Score	Attitude Score	Fear Score	Risk Score
Preventive behavior score	Spearman correlation coefficient	0.151	0.293	0.125	0.001
	P value	0.000	0.000	0.000	0.986

There are some limitations of the present study. The study was self-reported. Hence, there is a chance of bias. The first three sections of the survey (preventive behavior, knowledge, and attitude) were assessed by a non-standard questionnaire because of the non-existent standardized questionnaires. The results of the study are limited to HCPs in KSA. We did not explore whether the institution provided timely and sufficient guidelines and prevention facilities such as social distancing stickers, facial masks, PPE, sanitizers, etc.

## Conclusion

Our study reports that among HCPs, mask-wearing is the most compliant preventive behavior, whereas social distancing is the least compliant one. Preventive behavior is significantly higher in HCPs having more knowledge, greater fear, and a positive attitude towards COVID-19 and those who are nurses by profession. Having more knowledge, a positive attitude and more fear of COVID-19 may increase the likelihood of practicing good preventive behavior.

## Acknowledgment

The authors acknowledge all study participants.

## Funding

The work was not supported or funded by any drug company.

## Disclosure

The authors report no conflicts of interest in this work.

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