





# Awareness and Practice of COVID-19 Precautionary Measures Among Healthcare Professionals in Saudi Arabia

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**Objective:** Healthcare workers (HCWs) are the backbone of the healthcare system and a skilled and healthy workforce is vital during a health crisis, such as the present coronavirus disease 2019 (COVID-19) pandemic. Healthcare workers are at higher risk of exposure to and transmission of the severe acute respiratory coronavirus-2 (SARS-CoV-2). Hence, HCWs should possess good knowledge and attitudes toward COVID-19 to protect not only themselves but also their colleagues, families and the larger community. Thus, the current study aims to assess the knowledge and practice of protective measures by HCWs in Saudi Arabia during the first wave of the COVID-19 pandemic to identify awareness of the disease, potential trends and associated predictors.

**Methods:** A cross-sectional, web-based study was conducted among HCWs about knowledge related to COVID-19 and practice of protective measures, such as social distancing and use of personal protective equipment (PPE) during the pandemic. A Fisher exact test and one-way analysis of variance (ANOVA) were used to investigate the level of association among variables.

**Results:** A total of 674 HCWs were recruited in the study (51.8% male, 42.7% aged 28–37 years old and 52% specialists). The Saudi Ministry of Health (MoH) was the main source of knowledge for most of the HCWs (89%) followed by the WHO (44.5%) and social media (42.3%). Washing hands before touching the face was the most selected choice (97.9%) as a precautionary method to limit SARS-CoV2 transmission. Most of the HCWs (74.6%) scored low for staying at home while the majority (71.2%) showed a high practice of personal protective methods, with pharmacists and general physicians scoring the highest.

**Conclusion:** Saudi HCWs showed high knowledge and practice of protective measures for COVID-19. Good knowledge correlates with adoption of appropriate practices to prevent spread of infection. The current findings highlight the importance of interventions such as tailored education and training courses for those with low scores to improve overall knowledge and practice.

**Keywords:** COVID-19, healthcare workers, knowledge, practice, precautionary measures

## Introduction

A novel  $\beta$ -coronavirus designated as severe acute respiratory syndrome coronavirus –2 (SARS-CoV2) was identified as the causative agent of coronavirus disease 2019 (COVID-19). The first COVID-19 outbreak was reported in December 2019 in Wuhan, China. The rapid spread of the virus led the World Health Organization (WHO) to declare a Public Health Emergency of International Concern in January 2020 and a pandemic in March 2020.<sup>1</sup> Symptoms range from mild to

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severe pathological manifestations of the disease in the infected population with comorbidities, which are often linked to acute respiratory distress syndrome.<sup>2,3</sup> The 21st century has seen three new coronaviruses evolve to pose a global challenge to public health. The newly identified SARS-CoV-2 shares similarities with the previously identified severe acute respiratory syndrome coronavirus (SARS) and Middle East respiratory syndrome (MERS), such as animal reservoirs, unpredictable emergence, rapid spread and serious infectious outcomes in humans.<sup>1</sup> The various modes of transmission of COVID-19 from human-to-human include contact via aerosols and droplets from infected individuals through coughing, sneezing or talking as well as fomites or contaminated surfaces.<sup>4</sup> The risk of community transmission from asymptomatic carriers also contributes to the burden of disease.<sup>5</sup> Although multiple vaccines are now available, their long-term efficacy is unknown, they may not be effective against mutant strains and are experiencing a high degree of hesitancy. Thus, the application of precautionary measures remains important to minimize pandemic spread and reduce mortality rate.<sup>6-8</sup> There are a variety of practices that play an important role in controlling infection such as washing hands, wearing face masks,<sup>9</sup> use of mouthwash,<sup>10</sup> social distancing (stay at home)<sup>11</sup> and isolating confirmed cases.<sup>8</sup> These measures are important for all members of the community.

Healthcare workers are the backbone of the healthcare system, and globally formed the first line of defense, critical for treating and managing patients in the first wave of the pandemic. These frontline workers in patient-facing roles are regularly exposed to infected cases and have high potential of transmission. A skilled and healthy workforce is a vital ongoing need to ensure safe and effective health services to the community, which is paramount in a health crisis such as the current one.<sup>12</sup> In addition, HCWs should hold good knowledge and attitudes toward COVID-19 to protect themselves, their colleagues, families and the larger community.<sup>13</sup> In light of the emergence of a new highly infectious disease the WHO and Centers for Disease Control and Prevention (CDC) published recommendations for precautionary measures and control of COVID-19 for wider dissemination among HCWs.<sup>14,15</sup> In Saudi Arabia, the government implemented several measures in response to increasing numbers of cases. Many levels of precautions, starting from a complete lockdown in some cities at different times, to self-isolation or self-quarantine for positive

cases, social distancing, home isolation (stay at home) etc. were enforced and advised.<sup>7,11,16</sup>

Knowledge affects attitudes in the workplace, which in turn also affects adherence to control measures.<sup>8,12</sup> This study aims to assess the knowledge and practice of protective measures by HCWs in Saudi Arabia during the beginning of the COVID-19 pandemic and to identify potential trends and predictors.

## Methods

### Study Design

A self-administered online survey was conducted between March 25 and April 17, 2020 to evaluate knowledge and adherence of HCWs to precautionary measures, such as washing hands, social distancing and use of personal protective equipment. To ensure wide dissemination of the online survey to HCWs in different regions of the kingdom, the survey (in Arabic) was distributed through different social media platforms (Twitter, WhatsApp and Snapchat). HCWs recruited in this study include pharmacists, medical physicians, nurses, technicians, specialists, and other healthcare professionals.

### Survey Instrument

A validated questionnaire, which was created based on the Saudi Ministry of Health and WHO guidelines, was used<sup>9,11</sup> ([Supplement 1](#)). The questionnaire consists of 23 questions and was divided into four sections: (1) Demographic characteristics of the HCW (age, gender, monthly income, marital status, profession and geographic region of residence); (2) The second part of questionnaire (multiple-choice questions) was designed to investigate the main source of knowledge about COVID-19 and most effective method to control the spread of the COVID-19 pandemic. Furthermore, HCWs were asked about their beliefs and perceptions related to the likelihood of SARS-CoV2 transmission through contaminated surfaces, via asymptomatic carriers, the correct method (five steps) of hand washing and who amongst them requested to stay home during the COVID-19 pandemic. The third section of the survey was made up of five questions to measure the practice of social distancing during the pandemic. The last section contains six questions evaluating the implementation of personal protective measures when leaving the home, including avoiding shaking hands, and wearing gloves and facial masks. The estimated time taken to complete the questionnaire was approximately 10 minutes.

## Scoring System

Practice of HCWs was scored out of 5 (range 0–5) and 6 (range 0–6) for social distancing and personal protective measures, respectively. One point was given to the most appropriate answer, while the least appropriate responses and those with no practice were scored zero. Additionally, a gradient scoring system was followed for questions measuring the frequency of application, in which responses with the word always, often or sometimes were scored as one (1), half (0.5) or a quarter (0.25) of a point, respectively. We used a cut-off of 75%.<sup>17</sup> Participants who scored  $\geq 75\%$  were considered good practitioners while those with  $< 75\%$  were considered low practitioners of COVID-19 precautionary measures.

## Statistical Analysis

Descriptive statistical analysis was used to determine the number of participants, percentages, the mean, standard deviation (SD) and the median in relation to variables describing knowledge and practices. Questions measuring HCWs' knowledge were assessed using Fisher's exact test to demonstrate any correlation between knowledge and demographic characteristics. Total practice scores were analysed based on demographic characteristics using one-way analysis of variance (ANOVA) and pairwise independent sample *t*-test. All statistical analyses were performed using SPSS software version 25.0.

## Ethical Approval

Ethical approval for the study protocol, questions and consent statement was granted by the Ethics Committee at the University of Ha'il with the reference number H-2020-87. Data were maintained in accordance with the Declaration of Helsinki.

## Results

### Demographic Characteristics

A total of 674 healthcare workers participated in the study. The percentage of male (51.8%) respondents was slightly higher and the predominant age group ranged between 28–37 years old (42.7%). Married individuals represented more than half of the participants (52.1%) and 25.8% of the participants earned less than 3000 SR per month. Most of the contributors were from the western region of the Kingdom and the majority of them were specialists (52%), followed by technicians (23%) (Table 1).

**Table 1** Sociodemographic Characteristics of HCW Participating in This Study

Sociodemographic Characteristics		Number of Participants (% of Participants)
Gender	Male	349 (51.8)
	Female	325 (48.2)
Age group	18–27 years old	233 (34.6)
	28–37 years old	288 (42.7)
	38–47 years old	109 (16.2)
	Above 47 years	44 (6.5)
Marital status	Single	300 (44.5)
	Married	351 (52.1)
	Divorced	23 (3.4)
Monthly income	Less than 3000 SR	174 (25.8)
	Between 3000–5999 SR	86 (12.8)
	Between 6000–10,999 SR	111 (16.5)
	Between 11,000–15,999 SR	151 (22.4)
	Between 16,000–20,000 SR	71 (10.5)
	Above 20,000 SR	81 (12)
Geographic regions	West	311 (46.1)
	Middle	144 (21.4)
	East	25 (3.7)
	North	133 (19.7)
	South	61 (9.1)
Healthcare profession	General physician (GP)	48 (7.1)
	Specialist	353 (52.4)
	Technician	155 (23)
	Nurse	61 (9.1)
	Pharmacist	39 (5.8)
	Other	18 (2.7)

**Notes:** SR stands for Saudi Riyals (1 SR = 0.27 United States Dollars).

### Knowledge of HCWs About COVID-19

The Saudi MoH was the main source of information and knowledge for most of the participants (89%) followed by the WHO (44.5%). Washing hands before touching the eyes, nose, and mouth was the most commonly selected choice as a precautionary method to limit virus transmission among healthcare workers (97.9%), followed by taking vitamins to boost immunity (Table 2). A majority of recruited HCWs were knowledgeable about COVID-19 transmission routes and hand hygiene (more than 90% of HCWs answered 4 questions correctly) (Table 3). General physicians and

**Table 2** Responses of Healthcare Workers (HCWs) to Questions About the Main Source of Information About COVID-19 and the Effective Ways to Prevent/Control the Spread of SARS-CoV2

Question	Choices	Total Number of Responses (%*)
Main source of information about COVID-19	Ministry of Health World Health Organization Social media Television Friends and relatives Other	600 (89) 300 (44.5) 285 (42.3) 155 (23) 78 (11.6) 60 (8.9)
Which of the following can be defined as an effective way to prevent infection with SARS-CoV2?	Wash hands before touching eyes, nose, and mouth Taking vitamins to boost immunity Using a mouthwash Influenza vaccine Avoiding contact with those with chronic diseases	660 (73.5) 151 (22.4) 35 (5.2) 28 (4.2) 10 (1.5)

**Notes:** \*Participants were permitted to select more than one option for this question.

specialists were significantly ( $p < 0.05$ ) more aware about asymptomatic carriers compared with technicians.

## Practice of Precautionary Measures by HCWs

Although differences in practice scores between healthcare workers were low (insignificant), the results highlight the lowest and the highest score groups. The highest average score for staying home was among those

working in healthcare professions that were not listed (other) (2.78/5), followed by pharmacists and specialists (2.76/5). The majority of general physicians, specialists, technicians, nurses, and pharmacists scored below 50% (<2.5/5). Most of the recruited HCWs exhibited a high practice of personal protective methods (scored  $\geq 75\%$ ). The average total score for wearing protective equipment was highest among pharmacists (4.81/6), followed by general physicians (4.76/6) (Table 4).

**Table 3** Responses of Healthcare Workers (HCWs) to Questions Assessing Knowledge

	Number of HCWs Who Answered Correctly (%)			
	Do You Think That People Can Be Infected with SARS-CoV2 without Symptoms?	Who Do You Think Should Stay at Home?	Do You Think That SARS-CoV2 Can Be Transmitted Through Contact with Contaminated Surfaces?	Do You Know the Correct Way of Hand Washing?
General physician (GP)	48 (100)*	45 (93.8)	48 (100)	47 (97.9)
Specialist	344 (97.5)*	337 (95.5)	348 (98.6)	344 (97.5)
Technician	132 (85.2)	143 (92.3)	147 (94.8)	150 (96.8)
Nurse	55 (90.2)	56 (91.8)	58 (95.1)	58 (95.1)
Pharmacist	37 (94.9)	37 (94.9)	39 (100)	38 (97.4)
Other	14 (77.8)	18 (100)	18 (100)	17 (94.4)
Average	93.5%	94.4%	97.6%	97%

**Notes:** \*Significant change compared with technicians ( $p < 0.05$ ).

**Table 4** Scores of Healthcare Workers (HCWs) for Questions in Relation to Staying at Home, Hand Hygiene and Wearing Gloves/ Masks During the COVID-19 Pandemic

	Total Score of Staying at Home (Out of 5)			Total Score of Wearing Protective Measures (Out of 6)		
	Mean Score	HCWs with Low Score (%)*	HCWs with High Score (%)*	Mean Score	HCWs with Low Score (%)*	HCWs with High Score (%)*
General physician (GP)	2.64	37 (77)	11 (23)> 0.05	4.76	14 (29.2)	34 (70.8)
Specialist	2.76	253 (71.7)	100 (28.3)	4.69	102 (28.7)	251(71.3)
Technician	2.57	121 (78)	34 (22)	4.70	43 (27.7)	112 (72.3)
Nurse	2.34	50 (82)	11 (18)	4.67	18 (29.6)	43 (70.4)
Pharmacist	2.76	29 (74.3)	10 (25.7)	4.81	13 (33.4)	26 (66.6)
Other	2.78	13 (58.3)	5 (41.7)	5.41	4 (22.2)	14 (77.8)
Total		503 (74.6)	171 (25.4)		194 (28.8)	480 (71.2)

**Notes:** \*Participants scoring < 75% considered low practice while those who scored ≥75% are considered high practice.

## Discussion

As of now, the COVID-19 pandemic is still treated as an emergency outbreak and due to the nature of the work of frontline healthcare staff, they are considered to be individuals at a higher risk of contracting this viral infection.<sup>18</sup> Currently, there are limited investigations in Saudi Arabia where the knowledge and practice of protective methods amongst HCWs during the COVID-19 were evaluated. Hence, assessing the extent of knowledge about the disease amongst HCWs is necessary, especially to understand shortcomings and to spread further awareness.<sup>16</sup>

A few recent studies in Saudi Arabia revealed certain similarities to the overall findings of the current study, where good knowledge and practices of protective measures amongst HCWs were also documented.<sup>12,16,19</sup> However, home isolation (staying at home) of healthcare workers was not investigated in these studies. Despite the fact that nurses have shown the lowest mean score in home isolation in this study, there are no significant differences between all categories of HCWs. A study by Zhang et al. in China disclosed that nurses had less knowledge than doctors.<sup>13</sup> Another study in the US, comparing COVID-19 related knowledge, perceptions and information sources between healthcare workers and non-healthcare workers found that physicians, nurse practitioners or physician assistants showed higher overall knowledge than non-clinical health workers.<sup>18</sup> Nevertheless, no data for home isolation (home-stay) of participants were provided in

these studies. It was reported that the practice of staying at home by the Saudi public was deemed to be satisfactory (3.13/5).<sup>11</sup> However, Saudi HCWs scored less than the general public in practicing home-stay as they were exempt from staying at home (or working from home) during duty hours due to the increased demand in hospitals. Applying such protocols during off-duty hours or to medical personnel without frontline roles may significantly reduce unnecessary exposure of HCWs as well as their immediate families in addition to reducing the fear of contagion.<sup>20</sup>

Taking vitamins to boost the immunity and using mouthwash were selected by the minority of HCW as the most appropriate steps to fight the spread of COVID-19. This survey was during the early stages of the pandemic when the lack of an effective vaccine built a high burden upon HCW as they are only left with the implementation of precaution measures as well as maintaining a competent immune system to reduce the chance of developing this illness.<sup>21</sup> Although there is insufficient evidence that taking vitamins can protect users from COVID-19, a systematic review has suggested a possible correlation between taking vitamins and prevention of COVID-19.<sup>22</sup> Similarly, mouthwash has shown an *in vitro* activity towards multiple respiratory pathogens,<sup>23</sup> and has been advised by dentists for patients with confirmed COVID-19 before examination.<sup>24</sup> Our findings concur with a similar study



where about a third of dentists were aware of the benefit of mouthwash as protective actions from contracting COVID-19.<sup>10</sup>

The majority of HCWs in the current study showed high levels of commitment to personal protective measures, such as wearing gloves and masks. This finding may be attributed to the nature of their work, as wearing gloves and masks is routinely applied in hospitals, as well as their genuine understanding about infectious diseases. Also, this study was conducted during the national lockdown in Saudi Arabia. Hence, due to sustained information campaigns by the Saudi Ministry of Health, the entire population, including healthcare workers were aware that good hand hygiene as well as the practice of wearing masks and gloves when leaving the house were all important steps to control the spread of COVID-19 in addition to other infectious diseases.<sup>9,12,16</sup> This may explain our finding, where despite differences in the demographic characteristics, all HCW groups in our study showed high scores for hand hygiene, with the mean scores close to each other. A similar study conducted by Rabbani and AlSaigul on Saudi HCWs indicated that fear of carrying the virus home to immediate family members was reported by the majority (92%) of the participants.<sup>12</sup> This might also be the reason behind the frequent cleaning of hands by 87% of recruited HCWs in this study.<sup>12</sup>

Multiple information sources and tools were implemented by the Saudi MoH to provide healthcare related information to the public through social media as well as via digital platforms.<sup>20</sup> The current investigation illustrated that the Saudi MoH was acknowledged by recruited HCWs as their main source of information during this pandemic followed by the WHO and social media. However, the study conducted by Surva (2021) in the US found that HCWs' knowledge was highly associated with government websites as the main source of information and low knowledge was associated with the HCW who were using social media as a source.<sup>25</sup> These is opposed with this study where Saudi's HCW were using social media as the second source of information. This is because of the implantation of MoH guidelines and the efforts they have done to simplify and increase the knowledge of all citizens about COVID-19 precautionary methods including the HCWs through the MOH's social media.<sup>26</sup>

The current findings indicate a good knowledge of HCWs regarding the beneficial application of home-stay, as well as their awareness of the route of transmission of SARS-CoV-2 among themselves and others during the

COVID-19 pandemic.<sup>12,16,27</sup> It is unsurprising that general physicians and specialists were more knowledgeable about the possibility of asymptomatic COVID-19 carriers compared with technicians. This may be attributed to specialist training and continued professional development. Similarly, recent reports observed significant differences between medical doctors and other HCW groups (nurses, pharmacists, dentists, lab technicians and medical students) in relation to answering a question concerning whether the symptoms of COVID-19 appear in 2–14 days; where 15.6% from 453 HCWs answered in the negative.<sup>19</sup>

Mitigation and control of the spread of SARS-CoV-2 is strongly linked to the adoption and practice of precautionary measures depending on an individual's knowledge and attitude.<sup>27</sup> Information pertaining to incubation period and symptoms of SARS-CoV-2 must be provided to HCWs. Specially designed training programs and workshops need to be conducted for HCWs during the course of this pandemic to continuously remind them of essential preventative measures such as the importance of correct use and disposal of surgical face masks and hand hygiene etc., in addition to keeping them abreast of new updates. Evidence shows that educating HCWs about COVID-19 via a series of online courses has successfully raised HCW knowledge and practice in this respect.<sup>27</sup> Additionally, home-stay for non-essential HCWs may help in checking the spread of infection. Thus, the Saudi MoH should establish training courses, meetings or workshops mainly to raise awareness of HCWs about COVID-19 and its protective measures. Also, integration and dissemination of WHO recommendations, guidelines and Covid-19 related updates by the Saudi MoH to HCWs through social media would encourage better compliance. This suggestion is based on the current results where the MOH was chosen as the main source of information and social media was the second and the WHO the third choice. Nevertheless, low practice of personal protective measures may be attributed to discomfort associated with wearing masks. A recent study has shown that the majority of HCW reported headache, breathing difficulty and stress after wearing of N95 masks for a long time.<sup>28</sup> Thus offering appropriate masks can enhance practice of HCW in protective measures.

## Limitations

Due to the prevalent restrictions on outside activities in the duration of data collection for this study, including a national lockdown, probability sampling was not available and snowball sampling was preferred. Hence,

inherent limitations include the non-generalizable nature of the results due to lack of prevalence calculations.

## Conclusion

The current study offers useful insights into the knowledge of HCWs about COVID-19 and their practices of protective measures. Although Saudi HCWs are knowledgeable about virus transmission routes and hand-washing techniques, they exhibited low practice of social distancing (staying at home), which can be attributed to their long working hours during this pandemic. The majority of HCWs showed a high practice of personal protective methods, with pharmacists and general physicians scoring the highest. Further education and training, particularly amongst those with low scores for understanding virus transmission routes and precautionary measures is necessary to promote better practice in the workplace and to reduce chances of infection. With the threat of new SARS-CoV-2 variants ongoing, the awareness and preparedness of the HCWs is essential for a sustained response to mitigate the spread of COVID-19. Furthermore, since this study was conducted during the early stages of the pandemic, follow-up studies of HCW's knowledge may find the changes over the year.

## Data Sharing Statement

All data generated in this study are included in this published article and its supplement.

## Author Contributions

All authors made substantial contributions to study conception and design, acquisition and analysis of data; took part in drafting the article or revising it critically for important intellectual content; agreed on the journal to which the article will be submitted; provided their final approval of the version to be published; and agreed to be accountable for all aspects of the work.

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## Disclosure

The authors declare that there is no conflict of interest in this work.

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