

COVID-19 vaccine acceptance among healthcare workers in the United Arab Emirates



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ABSTRACT

Background: COVID-19 vaccine hesitancy among healthcare workers (HCWs) is a threat to any healthcare system. Vaccine hesitancy can increase infection risk among HCWs and patients, while also impacting the patients' decision to accept the vaccine. Our study assessed COVID-19 vaccine acceptance among HCWs in United Arab Emirates (UAE).

Methods: Using purposive sampling, UAE HCWs registered in the Abu Dhabi Department of Health (DOH) email database were invited to complete an online questionnaire, between November 2020 and February 2021, to understand COVID-19 vaccine acceptance and hesitancy, and trust in sources of information. Simple logistic regression was used to assess the associations between demographic factors with COVID-19 vaccine acceptance.

Results: Of the 2832 HCWs who participated in the study, 1963 (69.9%) were aged between 25 and 44 years and 1748 (61.7%) were females. Overall, 2525 (89.2%) of the HCW population said they would accept a COVID-19 vaccine. HCWs who were 55+ years of age, male, and physicians/surgeons were more likely to accept a COVID-19 vaccine (OR 3.1, 95% CI 1.5–6.2, $p = 0.002$; OR 1.8, 95% CI 1.3–2.4, $p < 0.001$; and OR 1.8, 95% CI 1.1–2.9; $p = 0.01$, respectively). The most reliable sources for COVID-19 vaccine information were the UAE government (91.6%), healthcare providers (86.8%), health officials (86.3%), and the World Health Organization (WHO; 81.1%).

Conclusions: COVID-19 vaccine acceptance was high among the UAE HCW population. Several factors were identified as significant determinants of vaccine acceptance. UAE healthcare authorities can utilize these findings to develop public health messaging campaigns for HCWs to best address COVID-19 vaccine concerns — particularly when the government is vaccinating its general population.

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Introduction

The timeline for development and mass rollout of the COVID-19 vaccination has been unprecedented. The World Health Organization (WHO) declared the pandemic on March 11, 2020, and the results of phase-one clinical trials for vaccine development were published in the summer of 2020, which was followed by the emergency use of the vaccine across several countries (NECADMA, 2021; CTA, 2020; OWID, 2021b). The impact of the COVID-19 vaccination on mitigating and controlling the pandemic is to be further assessed in the months to come.

More than 700 000 COVID-19 cases had been reported in the United Arab Emirates (UAE) by August 2021. Nevertheless, the UAE had one of the lowest reported death rates (0.29%) in the world (Al Hosany et al., 2021; Al Nuaimi et al., 2020). Abu Dhabi, the capital and the second-most populous city in the UAE, began deploying its vaccination program for the public after making the COVID-19 vaccine available to frontline HCWs and essential government officials in September 2020 (OWID, 2021a). Globally, the UAE was among the leading countries in starting the vaccination program, with more than 10 million doses administered by May 2021 (NECADMA, 2021; Al-Hosani et al., 2021).

HCWs are at the frontline during the COVID-19 pandemic, and are therefore at high risk of infection and mortality (Bandyopadhyay et al., 2020a). COVID-19 infections and deaths among HCWs follow those of the general population around the world. The WHO Eastern Mediterranean region had the highest case fatality rate (5.7 per 100 infections) as compared with other regions, such as Europe, which reported the lowest fatality rate (0.6 per 100 infections) (Bandyopadhyay et al., 2020b).

Most COVID-19 cases and deaths among HCWs worldwide were reported in the 50–59 age range, while HCWs aged over 70 years had the highest case fatality rate (Bandyopadhyay et al., 2020b). HCW shortages due to illness, with COVID-19 infections adding to the burden of healthcare systems, can jeopardize any country's efforts in controlling the COVID-19 pandemic (NIP, 2021). Protection of HCWs is a priority, but it adds extra burden due to the high demand for personal protective equipment (PPE) and the need for occupational health programs to screen and manage COVID-19 resources.

Therefore, vaccination represents the most cost-effective measure in protecting and maintaining the sustainability and safety of this important sub-population. Healthcare professionals' acceptance of the COVID-19 vaccine will determine whether this important goal of protecting the health of this population is achieved. An understanding of the risk factors that influence HCWs' decision to be vaccinated is needed to guide a successful vaccination program. Additionally, HCWs are considered a trusted source of information in the UAE population, which can contribute heavily to the public acceptance of vaccination campaigns (Alremeithi H et al., 2021). Our study aimed to assess the acceptability of COVID-19 vaccination among HCWs in the UAE, only a few months after its rollout.

Methods

Our study was conducted in Abu Dhabi, which is the largest of the seven Emirates in the UAE. Abu Dhabi has the region's largest network of ambulatory healthcare centers, including government and private hospitals. All networks are governed by the Abu Dhabi Department of Health (DOH). HCWs are required by the government to register in the central DOH licensure system to practice within the Emirate. This database of emails was used to invite HCWs to participate in the study. In addition, all healthcare facilities' leaderships were requested to distribute the survey internally.

Using purposive sampling, UAE HCWs registered in the Abu Dhabi DOH email database were invited to complete an electronic questionnaire (Supplementary Material) via Qualtrics® (Qualtrics, Provo, UT, USA) between November 2020 and February 2021. Participants were eligible if they were 18 years of age or older, were an HCW, could

read English, and had access to the internet via computer and/or smartphone. The target population comprised physicians, nurses, allied healthworkers, and administrators licensed to work in the Emirate of Abu Dhabi, both in the government and private sectors. While some institutions were academic, they all provided patient-care services. The range of practices included prevention centers, primary healthcare services, hospital-based medical services, and complex patient care, such as oncology and interventional surgical specialties. Assuming the UAE HCW population to be 77 022 (UAE, 2021), with a vaccine acceptance of 50% and margin of error of 4% (95% CI 46–54%), a sample size of 596 individuals was calculated.

The survey, which was adapted from a previous published report, was kept in English, and contained 30 questions (Supplementary Materials) (Malik et al., 2020). Basic demographic information was collected, as well as the country of origin, city of residence, and religious affiliation. Additionally, participants were asked the following question: 'If a vaccine for COVID-19 becomes available in your country, and is recommended for you, will you take it?'; this variable was dichotomized to COVID-19 vaccine acceptance (0 = No/Don't know; 1 = Yes). Participants who responded 'No' or 'Don't know' were then asked for the main reason for not accepting a COVID-19 vaccine, using the following choices: 1) religion; 2) fear of potential side-effects; 3) lack of trust in those creating and distributing the vaccine; 4) do not believe vaccines work; and 5) lack of reliable data. Finally, participants were asked about their confidence in media sources and the reliability of these sources regarding the COVID-19 pandemic; these variables were dichotomized (0 = Very little/Little/Some/Don't know; 1 = Much/Very much).

The Abu Dhabi COVID-19 Human Research Ethics Committee and Yale University Institutional Review Board (IRB protocol number: 2000029237) approved this study. Participants provided e-consent prior to data collection.

Statistical analysis

Survey results were summarized, graphed, analyzed, and reported using Microsoft Excel® (Microsoft, Redmond, WA, USA) and STATA® (STATA, Version 16.1, College Station, TX, USA). Descriptive statistics were used to define the sample demographic characteristics. Additionally, the frequencies and percentages of responses to questions pertaining to COVID-19 vaccine acceptance, reasons for not accepting a COVID-19 vaccine, and confidence in organizations and reliability of media sources regarding COVID-19 were calculated.

Lastly, simple logistic regression, with univariable and multivariable analyses, was used to assess the associations between demographic factors and COVID-19 vaccine acceptance. The multivariable model was adjusted for potential confounders, including age, gender, country of origin, religion, and education. The results were reported as odd ratios (ORs) with 95 confidence intervals (95% CI). Two-sided *p*-values < 0.05 were considered as statistically significant.

Results

Among the 2832 HCWs who participated in the survey, 1963 (69.9%) were between 25 and 44 years of age, 1748 (61.7%) were females, and 2786 (98.4%) had a college-level education or higher. The sample was mostly represented by HCWs from the government (*n* = 1338; 47.3%) and private (*n* = 1156; 40.8%) sectors. Almost half of the participants were nurses (*n* = 1402; 49.9%), while there were 569 (20.2%) physicians/surgeons, 135 (4.8%) pharmacists, and 90 (3.2%) dentists. Regarding the nationality of the participants, 216 (7.6%) were from the Gulf Cooperation Council (GCC — Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the UAE), 761 (26.9%) were Southeast Asian (Malaysia and Philippines), and 1033 (36.5%) were South Asian (India and Pakistan). Additionally, 1048 (37.0%) of the HCWs were Muslim, while 1409 (49.7%) were Christian. Lastly, 428 (15.1%) participants had a

Table 1
Demographic characteristics among HCWs in UAE (N = 2832)

	n (%)
Age (years):	
18–24	16 (0.6)
25–34	976 (34.5)
35–44	987 (34.8)
45–54	637 (22.5)
55+	216 (7.6)
Gender:	
Male	1084 (38.3)
Female	1748 (61.7)
Education:	
Less than high school	6 (0.2)
High school	40 (1.4)
Some college	50 (1.8)
College	1573 (55.5)
Postgraduate/professional	1163 (41.1)
Religion:	
Christianity	1409 (49.7)
Islam	1048 (37.0)
None	31 (1.1)
Other	344 (12.2)
Healthcare sector:	
Private	1338 (47.3)
Government	1156 (40.8)
Semi-government	332 (11.7)
Self-employed	6 (0.2)
HCW category:	
Physician/surgeon	569 (20.2)
Dentist	90 (3.2)
Nurse	1402 (49.9)
Pharmacist	135 (4.8)
Other HCW	617 (21.9)
Nationality:	
Gulf Cooperation Council	216 (7.6)
Other Arab countries	433 (15.3)
South Asian	1033 (36.5)
Southeast Asian	761 (26.9)
European	95 (3.3)
US	29 (1)
Other	265 (9.4)
Chronic illness:	
Yes	428 (15.1)
No	2404 (84.9)
Contracted COVID-19:	
Yes	285 (10.1)
No	2547 (89.9)
Social network sick with COVID-19:	
Yes	1364 (48.2)
No	1468 (51.8)
Will you take the COVID-19 vaccine?	
Yes	2525 (89.2)
No	307 (10.8)
Recommend COVID-19 vaccine to a family member?	
Yes	2512 (88.7)
No	320 (11.3)

chronic illness. Table 1 shows the characteristics of the survey participants.

COVID-19 vaccine acceptance

The majority of the HCWs (n = 2525; 89.2%) stated that they would take the COVID-19 vaccine, while 2512 (88%) reported recommending the vaccine to their family members. Factors associated with greater acceptance of the COVID-19 vaccine among study participants were being aged 45–54 (OR 2.0, 95% CI 1.4–2.9; p < 0.001) or 55+ (OR 3.1, 95% CI 1.5–6.2; p = 0.002), and being male (OR 1.8, 95% CI 1.3–2.4; p < 0.001). Physicians/surgeons were also more likely to accept the vaccine (OR 1.8, 95% CI 1.1–2.9; p = 0.01). With regard to nationality, HCWs who were from the GCC (OR 0.4, 95% CI 0.2–0.7; p = 0.001), other Arab countries (OR 0.4, 95% CI 0.2–0.7; p < 0.001), Southeast Asia (OR 0.5, 95% CI 0.3–0.7; p < 0.001), and Europe (OR 0.2, 95% CI 0.1–0.3; p

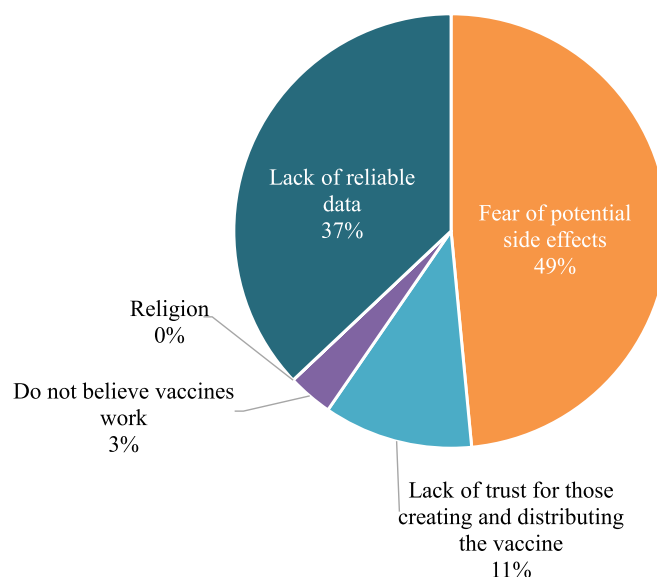


Figure 1. Main reason for COVID-19 vaccine refusal among UAE HCWs (N = 297)

< 0.001) were less likely to accept a COVID-19 vaccine compared with South Asian HCWs (Table 2). Educational level was not a determining factor for COVID-19 vaccine acceptance.

Regarding the different types of COVID-19 vaccine, 2192 (80.3%) of the participants preferred the inactivated vaccine type, 708 (31.1%) preferred the protein-based vaccine type, 570 (25.2%) preferred the virus vector vaccine type, and 538 (23.9%) preferred the genetic vaccine type (Table 3). The majority of respondents (2328; 82.2%) felt comfortable taking the vaccine as part of the UAE’s emergency authorization of a COVID-19 inactivated vaccine for frontline workers (Table 4).

Reasons for refusal to accept COVID-19 vaccine

When asked about the main reason for not getting the COVID-19 vaccine, of those who said they would not accept a vaccine (n = 307; 10.8%), 144 (48.5%) reported a fear of potential side-effects, 110 (37%) reported lack of reliable data regarding the vaccine, 33 (11.1%) reported a lack of trust in those creating and distributing the vaccine, and 10 (3.4%) responded that they did not believe the vaccine would work (Figure 1).

Reliability of media sources and confidence in organizations

The highest-reported reliable sources of COVID-19 information were healthcare providers (n = 2458; 86.8%), health officials (n = 2445; 86.3%), and WHO (n = 2297; 81.1%) (Figure 2). With regard to organizations as information sources on the COVID-19 vaccine, the highest levels of confidence were in the UAE government (n = 2593; 91.6%), healthcare providers (n = 2581; 91.1%), the health ministry (n = 2563; 90.5%), and WHO (n = 2337; 82.5); religious scholars accounted for the least confidence (n = 1427; 50.4%) (Figure 3).

Discussion

The high acceptance rate for the COVID-19 vaccine among HCWs in the UAE is reassuring. Approximately nine out of 10 respondents were willing to be vaccinated. In comparison, studies conducted early in the COVID-19 pandemic — during the vaccine development phases — showed a much lower acceptance rate. For example, in the USA, 64% of HCWs were willing to be vaccinated within 30 days, 10% were willing to be vaccinated after 6 months, and 26% reported being unwilling to

Table 2
Multi-variable ordinal logistic regression for COVID-19 vaccine acceptance across demographic characteristics

	Total = 2832n (%)	Accept COVID-19 vaccine (%)	Unadjusted OR; p-value; 95% CI	Adjusted OR; p-value; 95% CI
Age (years):				
18–24	16 (0.6)	12 (75)	0.4; 0.1; 0.1–1.3	0.4; 0.2; 0.1–1.4
25–34	976 (34.5)	847 (86.8)	0.9; 0.3; 0.7–1.1	0.8; 0.5; 0.6–1.0
35–44	987 (34.8)	871 (88.3)	Ref.	Ref.
45–54	637 (22.5)	590 (92.6)	1.7; 0.005; 1.2–2.4	2.0; < 0.001; 1.4–2.9
55+	216 (7.6)	205 (94.9)	2.5; 0.005; 1.3–4.7	3.1; 0.002; 1.5–6.2
Gender:				
Male	1084 (38.3)	1007 (92.9)	2.0; < 0.001; 1.5–2.6	1.8; < 0.001; 1.3–2.4
Female	1748 (61.7)	1518 (86.8)	Ref.	Ref.
Education:				
Less than high school	6 (0.2)	6 (100)	N/A	N/A
High School	40 (1.4)	37 (92.5)	1.4; 0.5; 0.4–4.7	1.7; 0.5; 0.4–7.6
Some college	50 (1.8)	44 (88)	0.9; 0.7; 0.4–2.0	0.7; 0.5; 0.3–2.0
College	1573 (55.5)	1408 (89.5)	Ref.	Ref.
Postgraduate/professional	1163 (41.1)	1030 (88.6)	0.9; 0.4; 0.7–1.2	0.8; 0.1; 0.6–1.1
Religion:				
Christianity	1409 (49.7)	1258 (89.3)	Ref.	Ref.
Islam	1048 (37.0)	906 (86.5)	0.8; 0.03; 0.6–1.0	0.8; 0.2; 0.5–1.1
None	31 (1.1)	27 (87.1)	0.8; 0.7; 0.3–2.3	0.9; 0.8; 0.3–2.7
Other	344 (12.2)	334 (97.1)	4.0; < 0.001; 2.1–7.7	2.4; 0.02; 1.2–5.0
Healthcare sector:				
Government	1338 (47.3)	1183 (88.4)	Ref.	Ref.
Private	1156 (40.8)	1059 (91.6)	1.4; 0.01; 1.1–1.9	1.3; 0.1; 0.9–1.7
Semi-government	332 (11.7)	277 (83.4)	0.7; 0.02; 0.5–0.9	0.8; 0.2; 0.6–1.1
Self-employed	6 (0.2)	6 (100)	N/A	N/A
HCW category:				
Physician/surgeon	569 (20.2)	528 (92.8)	1.6; 0.01; 1.2–2.4	1.8; 0.01; 1.1–2.9
Dentist	90 (3.2)	77 (85.6)	0.8; 0.4; 0.4–1.4	0.8; 0.5; 0.4–1.6
Nurse	1402 (49.9)	1243 (88.7)	Ref.	Ref.
Pharmacist	135 (4.8)	117 (86.7)	0.8; 0.5; 0.5–1.4	1.1; 0.9; 0.6–1.9
Other HCW	617 (21.9)	546 (88.5)	1.0; 0.9; 0.7–1.3	1.0; 0.9; 0.7–1.4
Nationality:				
Gulf Cooperation Council	216 (7.6)	176 (81.5)	0.2; < 0.001; 0.2–0.4	0.4; 0.001; 0.2–0.7
Other Arab countries	433 (15.3)	379 (87.5)	0.4; < 0.001; 0.3–0.6	0.4; < 0.001; 0.2–0.7
South Asian	1033 (36.5)	979 (94.8)	Ref.	Ref.
Southeast Asian	761 (26.9)	667 (87.7)	0.4; < 0.001; 0.3–0.6	0.5; < 0.001; 0.3–0.7
European	95 (3.3)	78 (82.1)	0.3; < 0.001; 0.1–0.5	0.2; < 0.001; 0.1–0.3
US	29 (1)	26 (89.7)	0.5; 0.2; 0.1–1.6	0.4; 0.1; 0.1–1.3
Other	265 (9.4)	220 (83)	0.3; < 0.001; 0.2–0.4	0.3; < 0.001; 0.2–0.4
Chronic illness:				
Yes	428 (15.1)	382 (89.3)	1.0; 0.9; 0.7–1.4	0.9; 0.4; 0.6–1.2
No	2404 (84.9)	2143 (89.1)	Ref.	Ref.
Contracted COVID-19:				
Yes	285 (10.1)	261 (91.6)	1.4; 0.2; 0.9–2.1	1.5; 0.1; 0.9–2.4
No	2547 (89.9)	2264 (88.9)	Ref.	Ref.
Social network sick with COVID-19:				
Yes	1364 (48.2)	1202 (88.1)	0.8; 0.1; 0.6–1.0	0.8; 0.2; 0.7–1.1
No	1468 (51.8)	1323 (90.1)	Ref.	Ref.

Note: Outcome = COVID-19 vaccine acceptance

Table 3
Acceptance of different types of COVID-19 vaccine

COVID-19 vaccine type	Number yes/total (%)
Inactivated vaccine	2192/2731 (80.3)
Genetic vaccine	538/2250 (23.9)
Viral vector vaccine	570/2260 (25.2)
Protein-based vaccine	708/2276 (31.1)

be vaccinated against COVID-19, even after 6 months of the initial roll-out (Ciardi et al., 2021). Nevertheless, rates of hesitancy towards the COVID-19 vaccine can reduce over time, and therefore it is essential to continue with such studies. A recent study has confirmed this trend, with a reported drop in vaccine hesitancy among the general US population, including a reduction of more than 20% in some racial/ethnic groups (Daly et al., 2021). In the UAE, this rate may have increased further due

Table 4
Emergency authorization of a COVID-19 inactivated vaccine in the UAE

	n (%)
Given the UAE’s recent emergency authorization of a COVID-19 inactivated vaccine for frontline workers, do you feel comfortable taking it? Total, N = 2832	
Yes	2328 (82.2)
No	504 (17.8)
Main reason why you would not get the inactivated vaccine. Total, N = 499	
Religion	1 (0.2)
Fear of potential side-effects	251 (50.3)
Lack of trust in those creating and distributing the vaccine	40 (8)
Do not believe vaccines work	12 (2.4)
Lack of reliable data	195 (39.1)

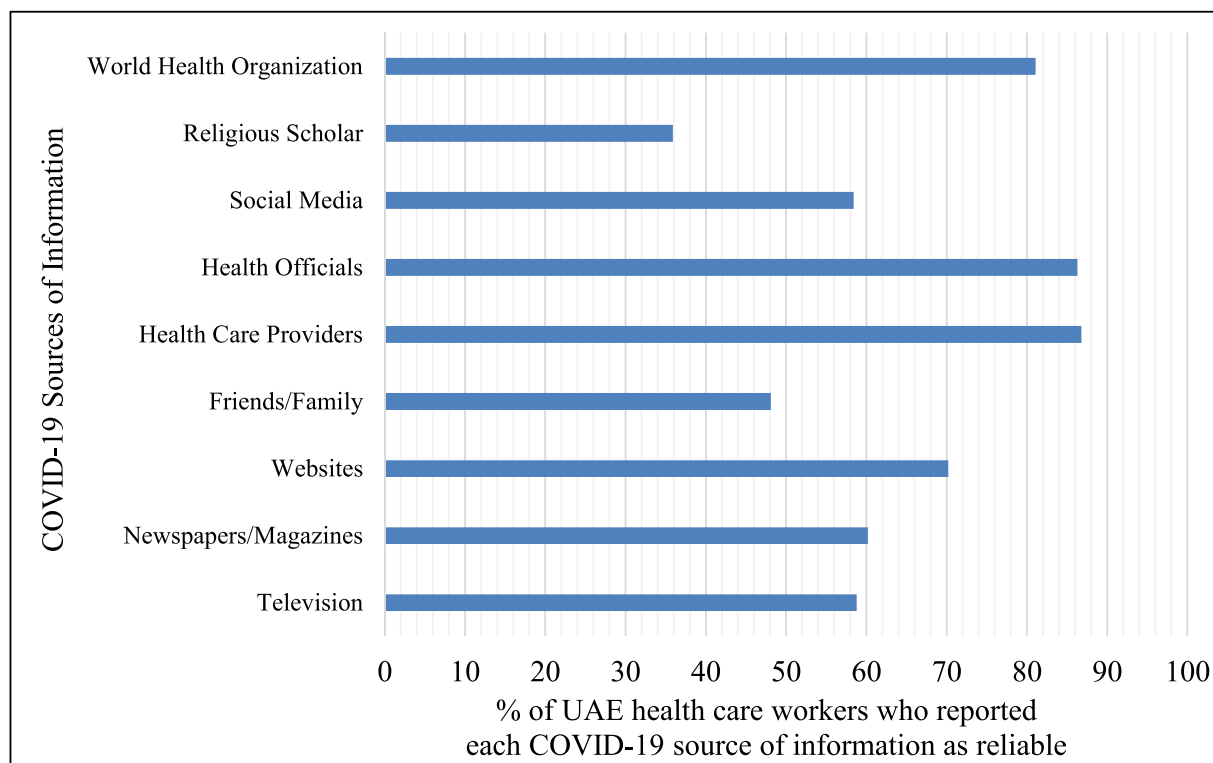


Figure 2. Reliability of COVID-19 information sources according to UAE HCWs

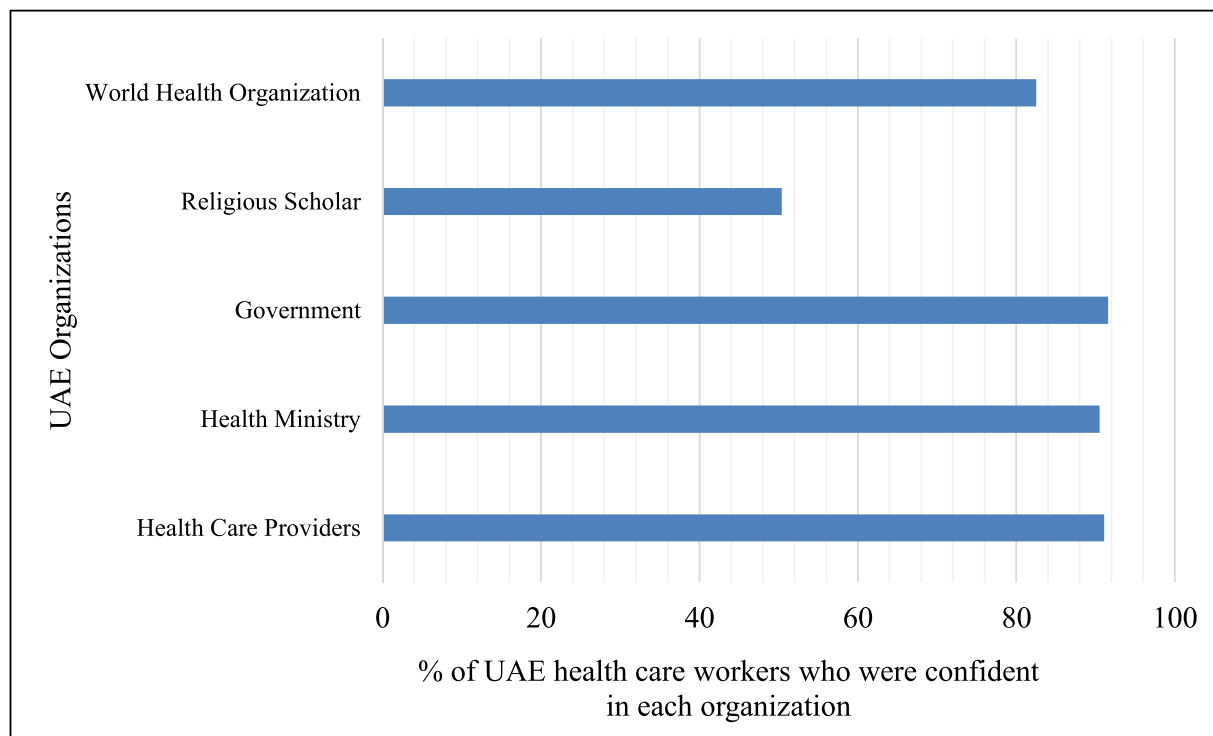


Figure 3. Confidence in organizations as sources of COVID-19 information

to an increase in the vaccination rate. The UAE had fully vaccinated 65.8% of its population by July 2021, with 75.7% receiving at least one dose (OWID, 2021a). Moreover, literature on the high effectiveness of the COVID-19 vaccines is accumulating following decreases in rates of transmission, morbidity, and mortality (Fauci, 2021).

In the UAE, incentives and policies were introduced to promote vaccination among HCWs and the general population, with intensive awareness campaigns, which could have contributed heavily to our finding of a high COVID-19 vaccine rate. The acceptance rate from our study was also significantly higher than the internationally re-

ported HCW rates (Barry et al., 2021; Elharake et al., 2021; Fu et al., 2020; Shekhar et al., 2021; Verger et al., 2021). Furthermore, a systematic review of 35 studies worldwide showed that the extent of COVID-19 vaccination hesitancy among HCWs ranged from 4.3% to 72% (giving an average rate of 22.51% across studies) (Biswas et al., 2021); in our study, the rate of refusal was around 10.8%. On the other hand, a study carried out in the Democratic Republic of Congo showed that only 28% of HCWs were agreeing to take the vaccine (Kabamba Nzaji et al., 2020). However, these rates may be shifting, with changes in knowledge of COVID-19 vaccine effectiveness and safety, perceived risk, country-specific regulations, and healthcare system resources.

There was a significant association between the decision to take the vaccine and HCWs who were males and older. This may be because males and older individuals are at higher risk of a worse outcome following infection with COVID-19 (Kim et al., 2021). These findings were similar to those of many studies across the world (Di Gennaro et al., 2021; Fu et al., 2020; Harapan et al., 2020; Kuter et al., 2021; Shekhar et al., 2021; Verger et al., 2021). Additionally, being a physician/surgeon was associated with better acceptance of the COVID-19 vaccine, while those of South Asian heritage were more likely to accept the vaccine than other ethnic groups, such as those of GCC and Middle East ethnicity. Other studies have shown similar results (Biswas et al., 2021; Daly et al., 2021; Shaw et al., 2021). Variations in vaccine acceptance among different ethnicities and the preference for inactivated vaccines compared with the newer mRNA vaccines needs to be studied further, particularly through a qualitative design. These results must be considered in the planning and implementation of vaccination programs (Ledda et al., 2021).

The association between the willingness of HCWs to receive the COVID-19 vaccine and recommending it to their high-risk patients was an important finding. This personal choice of the healthcare providers was a determining factor in advising their patients in a study in Greece (Maltezou et al., 2021). Such association has important implications for successful community vaccination coverage as HCWs are considered a trusted source of information in the UAE population and should be explored in future studies (Alremeithi H, 2021). Government information sources about the vaccine were the most accepted reliable source, with the highest level of confidence. This is a valuable finding for the UAE healthcare authorities in supporting the promotion of COVID-19 information via the government.

Strengths and limitations

Our UAE study was conducted in a period when the vaccine was already available for the HCWs, and some already had received it. Therefore, comparisons with other studies may not be completely valid. Although HCWs in the UAE are required to be competent users of computers and speak English at a satisfactory level, some administrative HCWs, such as receptionists, may not have had the required English language skills to complete this survey. Other limitations were the lack of verification of this reported positive attitude, and the potential for these results to change with accumulating evidence of COVID-19 vaccine safety and effectiveness, and increasing perception of the COVID-19 risk (Nature, 2021). While our study included an adequate sample size, and the approximate number of HCWs who were registered with the Abu Dhabi Emirate had been established, it was not possible to track the number of emails that were received, bounced back, or went to spam. Therefore, we were unable to calculate an accurate response rate.

Another limitation was that merging the 'Do not know' and 'No' groups may have resulted in some loss of statistical variability when dichotomizing the outcome variable — COVID-19 vaccine acceptance. Furthermore, while the purpose of our study was to evaluate COVID-19 vaccine acceptance, we did not consider knowledge and attitude questions in our analyses. If we had included these factors in our analyses, our overall findings may have shown that UAE HCWs did not have a

high level of knowledge about COVID-19 vaccines, especially because our study was conducted during the early phases of the COVID-19 vaccine rollout. Therefore, we recommend that these questions should be explored in future studies. Lastly, our findings may have been influenced by a social desirability bias, with the HCWs responding to the survey questions in a manner that would be viewed favorably by others.

Conclusions

While our study found a high level of acceptance of the COVID-19 vaccine across the UAE HCW population, vaccine acceptance differed according to several demographic characteristics. These determinants of acceptance may also vary with changing disease epidemiology, pharmacovigilance data updates, country-specific regulations, and/or changes in healthcare system resources. For example, concerns about vaccine efficacy are raised with the emergence of each new COVID-19 virus variant, while the accumulative post-authorization vaccine safety data are being constantly reviewed and updated. Therefore, follow-up studies are needed. Overall, information from our study findings can be used to support the UAE and other national healthcare authorities in developing public health messaging campaigns for HCWs, in order to best address COVID-19 vaccine concerns — especially in countries that are vaccinating their general populations.

Declaration of competing interests

All authors declare no conflicts of interest.

Author contributions

J.A.E., B.G., K.K., S.B.O., and Z.A.M. conceptualized the study. S.M.M. and A.A.M. designed the initial survey questionnaire. F.A.H, S.A.M, S.A.M., and B.A.S. adapted the survey for a UAE context. J.A.E. cleaned the data and performed the analyses. All authors interpreted the data. L.B.K., A.A.Z., and A.A.N. wrote the initial draft of the manuscript. All authors read, edited, and approved the final version of the manuscript.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at [doi:10.1016/j.ijregi.2021.08.003](https://doi.org/10.1016/j.ijregi.2021.08.003).

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