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RESEARCH ARTICLE

# REVISED Hesitancy towards the COVID-19 vaccine among health care practitioners in the Kingdom of Saudi Arabia: a cross-sectional study [version 5; peer review: 1 approved, 1 approved with reservations, 1 not approved]

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## Open Peer Review

### Approval Status ✓ ✗ ✓

|  | 1 | 2 | 3 |
| --- | --- | --- | --- |
| version 6 (revision) 12 Jun 2023 |  |  | ✓ view |
| version 5 (revision) 13 Apr 2023 |  |  | ? view |
| version 4 (revision) 27 Mar 2023 |  |  | ? view |
| version 3 (revision) 09 Mar 2023 |  |  | ? view |
| version 2 (revision) 28 Nov 2022 | ✓ view |  | ? view |
| version 1 11 Jan 2022 | ? | ✗ |  |

## Abstract

**Background:** The coronavirus disease 2019 (COVID-19) pandemic is a major public health crisis worldwide. In less than 12 months since the World Health Organization declared the outbreak, several different COVID-19 vaccines have been approved and deployed mostly in developed countries since January 2021. However, hesitancy to accept the newly developed vaccines is a well-known public health challenge that needs to be addressed. The aim of this study was to measure willingness and hesitancy toward COVID-19 vaccines among health care practitioners' (HCPs) in Saudi Arabia.
**Methods:** A cross-sectional study using an online self-reported survey was conducted among HCPs in Saudi Arabia between April 4th to April 25th 2021 using snowball sampling. Multivariate logistic regression was employed to identify the possible factors affecting HCPs' willingness and hesitancy to receive COVID-19 vaccines.

Results: Out of 776 participants who started the survey, 505 (65%) completed it and were included in the results. Among all HCPs, 47 (9.3%) either said "no" to receive the vaccine [20 (4%)] or were hesitant to receive it [27 (5.3%)]. Of the total number of the HCPs, 376 (74.5%) already received the COVID-19 vaccine, and 48 (9.50%) were registered to receive it. The main reason of agreement to receive the COVID-19 vaccine was "wanting to protect self and others from getting the infection" (24%).

Conclusion: Our findings have shown that hesitancy toward receiving COVID-19 vaccines among HCPs in Saudi Arabia is limited and therefore may not be a serious issue. The outcomes of this study may help to understand factors that lead to vaccine hesitancy in Saudi Arabia and help public health authorities to design targeted health education interventions aiming to increase uptake of these vaccines.

**Keywords**

vaccine acceptance, COVID-19 vaccine, coronavirus, Saudi Arabia, vaccine hesitancy

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## Introduction

The coronavirus disease 2019 (COVID-19) pandemic is a major public health issue worldwide. Up to November of 2022, 628 million confirmed cases and over six million deaths were registered worldwide.[1] This led to development of vaccines in an expected way. For example, in less than 12 months since the World Health Organization (WHO) declared the outbreak, several numbers of COVID-19 vaccines have already been approved and deployed mostly in developed countries since January 2021. In the Kingdom of Saudi Arabia (KSA), four vaccines have been approved by the health regulatory bodies (i.e., Oxford-AstraZeneca, Johnson & Johnson's Janssen, Moderna, and Pfizer/BioNTech),[2] with a priority to vaccinate health care practitioners (HCPs) alongside other groups who are at a higher risk of COVID-19.[3]

HCPs are more likely to be infected by COVID-19 virus as they are in direct contact with infected patients. In a study by Nguyen *et al.* (2020) conducted on more than 200,000 HCPs, they found that HCPs at the frontline of care had a threefold increased risk of being infected with COVID-19.[4] Asua and colleagues (2021) reported that COVID-19 infection rates among HCPs have ranged between 10% and 20% in Spain.[5] In KSA, Barry *et al.* (2021) concluded that almost 13% of the HCPs have been infected with COVID-19.[6] Because of the difficulty in applying social distancing in health care facilities, HCPs might spread the virus within themselves and in between patients. This situation could be worsened in case of the shortages of personal protection equipment.[7,8]

Multiple countries have decided to initially provide COVID-19 vaccines to the most vulnerable groups including HCPs.[5,6,9–11] Achieving a high vaccination coverage level among HCPs will ensure the presence of an adequate number of protected workforces to deal with the pandemic more effectively and efficiently.[12] Prioritizing HCPs to receive COVID-19 vaccines is essential to keep the health care system running, protect very sick individuals during the pandemic, and to ensure the provision of the vaccines to be running for the public.[10]

Hesitancy to accept the newly developed vaccines is a well-known public health challenge,[13] which might be exaggerated after documenting rare thromboembolic events among vaccinated individuals.[14]

Also, Shekhar *et al.* (2021) reported that concerns about vaccine efficacy, adverse effects, and rapidity of the production were the most important factors affecting hesitancy to receive the COVID-19 vaccine.[15] Hesitancy to accept COVID-19 vaccines could also be complicated by misinformation, conspiracy beliefs, and theories that the virus is man-made and used for population control.[16,17]

Several studies have sought to determine the level of willingness to receive COVID-19 vaccines as well as the factors influencing vaccine acceptance. COVID-19 vaccine acceptance levels were varied between studies conducted in different countries. Levels of vaccine acceptance in these studies were reported to be 63% in Hong Kong as of April 2020,[18] 77% in France as of July 2020,[19] 72% in France and French-speaking Belgium and Quebec as of November 2020,[20] 81% in Canada as of December 2020.[21] To examine this further, a study conducted in KSA prior to the development of the vaccines demonstrated that only 50% of the HCPs were willing to receive the vaccine.[22] Moreover, the acceptance level to receive COVID-19 vaccines among HCPs in KSA (as of November 2020) was reported to be 70%.[6]

There has been no research conducted after the approval of the COVID-19 vaccines in KSA. Therefore, this study aimed to measure hesitancy and willingness toward COVID-19 vaccines among HCPs in Saudi Arabia.

## Methods

### Design

We conducted a cross-sectional study to assess willingness and hesitancy toward COVID-19 vaccines among HCPs in KSA. We created an online self-reported survey using the Question Pro survey tool hosted at Imam Abdulrahman Bin Faisal University (IAU). The survey was offered only in English because most of the HCPs in Saudi speak and understand English. The questions asked in the survey are available as part of the *underlying data*.[37] Responses were collected anonymously and no personally identifying information was collected. This study was approved by the IAU's Institutional Review Board (IRB-2021-03-149).

**Table 1.** Sociodemographic characteristics of the study participants (n = 505).

| Demographic variables | | Number (%) |
|---|---|---|
| **Gender** | Male | 259 (51.3) |
| | Female | 246 (48.7) |
| **Nationality** | Saudi | 438 (86.7) |
| | Non-Saudi | 67 (13.3) |
| **Age** | 18-24 | 152 (30.1) |
| | 25-29 | 98 (19.4) |
| | 30-34 | 70 (13.9) |
| | 35-39 | 82 (16.2) |
| | 40-44 | 45 (8.9) |
| | 45-49 | 24 (4.8) |
| | 50-54 | 21 (4.2) |
| | more than 54 | 13 (2.6) |
| **Residency province in Kingdom of Saudi Arabia** | West | 44 (8.7) |
| | Central | 102 (20.2) |
| | Eastern | 345 (68.3) |
| | South | 10 (2) |
| | Northern | 4 (0.8) |
| **Health profession** | Physician | 89 (17.6) |
| | Nurse | 61 (12.1) |
| | Dentist | 12 (2.4) |
| | Pharmacist | 28 (5.5) |
| | Other Health Care Specialists (respiratory therapy, physiotherapy, clinical nutrition, etc.) | 289 (57.2) |
| | Technician in allied medical sciences | 26 (5.1) |
| **Current state of health** | Excellent | 246 (48.7) |
| | Very good | 173 (34.3) |
| | Good | 75 (14.9) |
| | Fair | 10 (2) |
| | Bad | 1 (0.2) |
| **Having chronic diseases** | Yes | 88 (17.4) |
| | No | 417 (82.6) |
| **Infected with COVID-19** | Yes | 86 (17) |
| | No | 419 (83) |
| **Family member infected with COVID-19** | Yes | 424 (84) |
| | No | 81 (16) |
| **Received COVID-19 vaccine** | Yes | 376 (74.5) |
| | I have registered | 48 (9.5) |
| | No | 81 (16) |
| **Would you like to receive COVID-19 vaccine?** | Yes, I would like to | 34 (6.7) |
| | I would be hesitant | 27 (5.3) |
| | No, I would refuse | 20 (4) |
| **Preferable vaccine to receive** | Pfizer | 20 (59) |
| | AstraZeneca | 2 (6) |
| | No Preference | 12 (35) |

## Sampling

We started the data collection via convenience sampling to HCPs and via hospital's email lists. Also, the survey was distributed via online links posted on social media platforms (e.g., Twitter, LinkedIn, and WhatsApp). In addition, we shared the survey link with multiple health care organizations, scientific societies, and associations to send it to their HCPs/members and encourage them to further share it to reach the target population. Data were collected from April 4th to April 25th 2021.

## Participants

All HCPs currently working in healthcare facilities in KSA, regardless of the level of patient contact and their clinical role, were eligible to participate in the study. Informed consent was obtained from all the participants prior to starting the survey. A participation consent statement was added on the study information page as follows: "If you are a health care practitioner in Saudi Arabia and consent to participate in this survey, please proceed to the next page to start the survey." Only those who agreed to participate where allowed to complete the survey. Proceeding to the survey page was therefore taken as consent to participate.

**Table 2. Associations between the sociodemographic characteristics of health care professionals and willingness to receive the COVID-19 vaccines.**

| Variables | | Agree n = 387 | Not sure n = 86 | Disagree n = 32 | p-values |
|---|---|---|---|---|---|
| **Age** | 18-24 | 32.3% | 25.6% | 15.6% | 0.30 |
| | 25-29 | 18.1% | 24.4% | 21.9% | |
| | 30-34 | 13.7% | 12.8% | 18.8% | |
| | 35-39 | 15.8% | 16.3% | 21.9% | |
| | 40-44 | 9.3% | 4.7% | 15.6% | |
| | 45-49 | 4.9% | 4.7% | 3.1% | |
| | 50-54 | 4.1% | 5.8% | 0.0% | |
| | more than 54 | 1.8% | 5.8% | 3.1% | |
| **Gender** | Male | 52.7% | 43.0% | 56.3% | 0.26 |
| | Female | 47.3% | 57.0% | 43.8% | |
| **Nationality** | Saudi | 85.8% | 91.9% | 84.4% | 0.30 |
| | Non-Saudi | 14.2% | 8.1% | 15.6% | |
| **Health profession** | Physician | 17.3% | 16.3% | 25.0% | 0.13 |
| | Nurse | 10.3% | 16.3% | 21.9% | |
| | Dentist | 2.6% | 2.3% | 0.0% | |
| | Pharmacist | 4.4% | 8.1% | 12.5% | |
| | Other Health Care Specialists | 60.2% | 51.2% | 37.5% | |
| | Technician in allied medical sciences | 5.2% | 5.8% | 3.1% | |
| **Residency province in Kingdom of Saudi Arabia** | West | 8.5% | 9.3% | 9.4% | 0.34 |
| | Central | 18.1% | 26.7% | 28.1% | |
| | Eastern | 71.1% | 59.3% | 59.4% | |
| | South | 1.8% | 2.3% | 3.1% | |
| | Northern | .5% | 2.3% | 0.0% | |
| **Current state of health** | Excellent | 48.8% | 44.2% | 59.4% | 0.03 |
| | Very good | 34.6% | 33.7% | 31.3% | |
| | Good | 14.2% | 20.9% | 6.3% | |
| | Fair | 2.1% | 1.2% | 3.1% | |
| **Having chronic diseases** | Yes | 18.3% | 17.4% | 6.3% | 0.25 |
| | No | 81.7% | 82.6% | 93.8% | |

**Table 3. Bivariate analysis of hesitancy scale items for health care professionals who agreed to receive the COVID-19 vaccine.**

| Hesitancy scale items | Strongly agree | Agree | Neutral | Disagree | Strongly disagree | p-values |
|---|---|---|---|---|---|---|
| The COVID-19 vaccine is important for my health | 53.7% | 34.6% | 10.6% | 0.8% | 0.3% | 0.001 |
| I am in a good health; I do not need to be vaccinated against COVID-19 | 5.4% | 4.4% | 8.3% | 38.2% | 43.7% | 0.001 |
| The COVID-19 pandemic has been alleviated, and there is no need to be vaccinated against COVID-19 | 3.4% | 3.6% | 6.7% | 40.1% | 46.3% | 0.001 |
| I think COVID-19 vaccines will be very effective in preventing COVID-19 | 33.1% | 48.6% | 14.0% | 2.8% | 1.6% | 0.001 |
| COVID-19 vaccines can protect people (family, friends, colleagues) around me from infection | 40.6% | 47.5% | 8.8% | 2.1% | 1.0% | 0.001 |
| I doubt the safety of COVID-19 vaccines | 8.3% | 12.9% | 28.9% | 32.3% | 17.6% | 0.001 |
| I am worried about the possible side effects of COVID-19 vaccines | 7.5% | 32.0% | 31.3% | 20.4% | 8.8% | 0.001 |
| If the COVID-19 vaccine is recommended by the government, I believe vaccination is beneficial | 41.6% | 45.0% | 12.1% | .8% | 0.5% | 0.001 |
| The recommendation for the COVID-19 vaccine by doctors, the community and other professionals has a great influence on me | 35.4% | 47.0% | 14.7% | 2.3% | 0.5% | 0.001 |

## Measures

The survey collected participants' demographics and health information and assessed HCPs' attitude and perception of COVID-19 and COVID-19 vaccines. Furthermore, the survey assessed the HCPs' willingness to receive COVID-19 vaccines as well as hesitancy level as measured by the vaccine hesitancy scale (VHS). The VHS includes 10 items measured on a 5-point Likert scale ranging from strongly disagree to strongly agree. The VHS is developed by the WHO Strategic Advisory Group of Experts (SAGE) to capture parental attitudes, beliefs, and behaviors surrounding vaccination.[23] The COVID-19 vaccines hesitancy scale,[24] which was adopted in this study, is a modified version of the VHS. The validity and reliability of the COVID-19 VHS was established in another study.[24] However, we pre tested the survey with nine HCPs currently practicing in KSA to assure the clarity of the questions and to evaluate the face validity of the scale. The internal consistency of the scale used in this study was assessed by Cronbach's alpha (0.75).

## Statistical analysis

For descriptive analysis, frequency count and percentages were calculated and presented in a table format. A bivariate analysis to evaluate the associations between HCP's willingness to the receive COVID-19 vaccines and their demographic characteristics, awareness, and health status was done using Chi-Square/Fisher Exact where appropriate. The differences in the VHS between participants who reported their willingness to receive the vaccine and those who had no intention to receive the vaccine were determined. Responses about willingness to receive the vaccine (item 10 of the VHS) were set as the dependent variable while all the other 9 items of the VHS were set as the independent variable and associations were evaluated using Chi-square test. All analyses were performed using SPSS 26.0 (IBM Corporation, New York, NY, United States). The level of statistical significance was set at $p < 0.05$ for this analysis.

## Results

Out of 776 participants who started the survey, 505 (65.1%) completed it and were included in the analysis. The remaining 271 did not complete the survey fully; therefore, they were excluded. The demographical characteristics of the participants are presented in Table 1. Among 505 HCPs who completed the survey, 47 (9.3%) either said "no" to receive the vaccine [20 (4%)] or were hesitant to receive it [27 (5.3%)]. Of the total number of the HCPs, 376 (74.5%) had already received the COVID-19 vaccine, and 48 (9.5%) were registered to receive it. Out of the 34 participants (6.7%) who wanted to receive the vaccine, the majority of them [20 (59%)] preferred the Pfizer-BioNTech vaccine because they believed it had fewer side effects and was more effective than AstraZeneca vaccine.
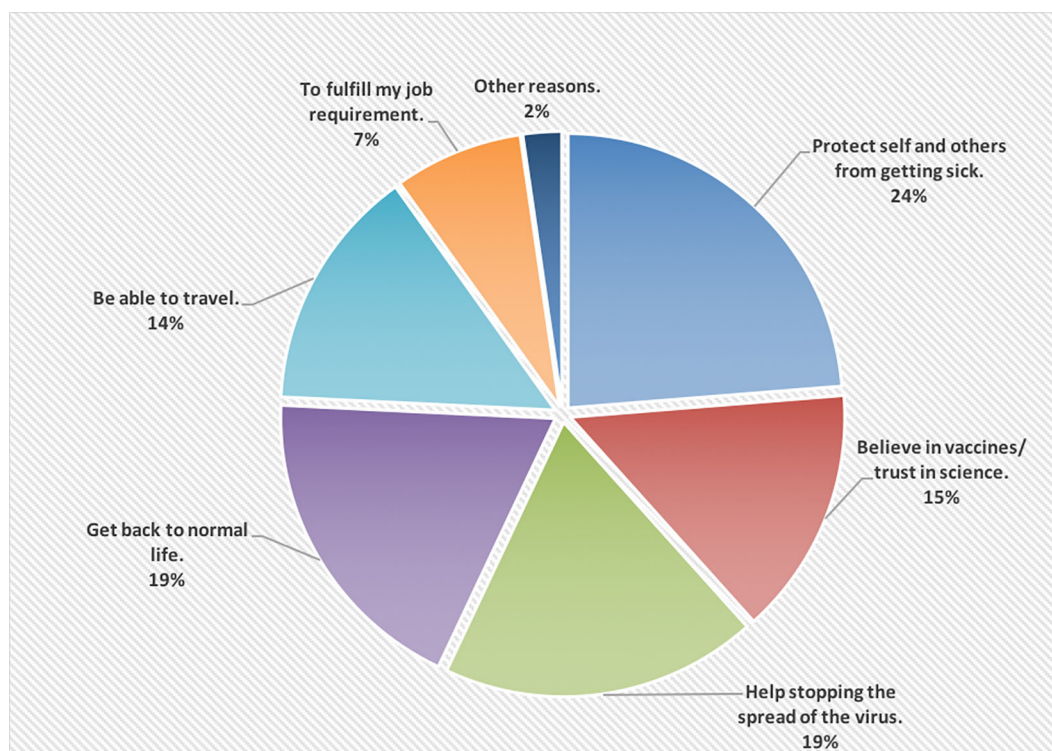


**Figure 1. The main reasons of accepting to receive the COVID-19 vaccine.**
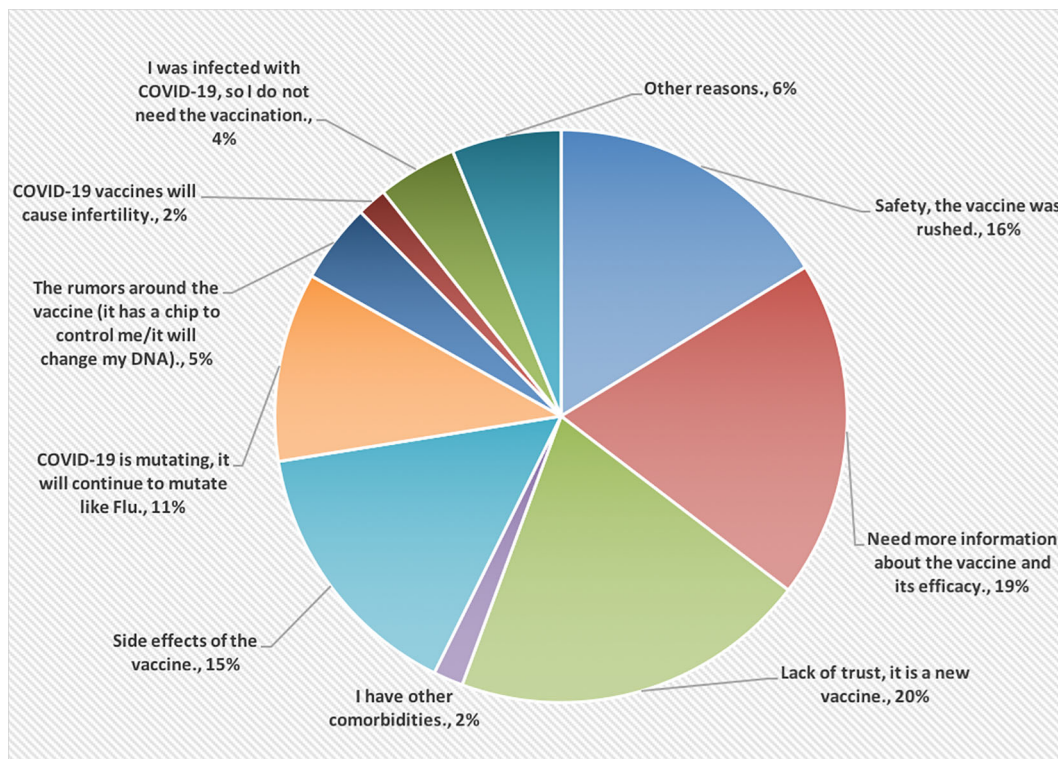
**Figure 2.** The main reasons for not accepting COVID-19 vaccines.

The associations between the demographic characteristics of the HCPs and their willingness to receive COVID-19 vaccines is presented in Table 2. Female HCPs were less willing to receive the vaccine (47.3%) compared to male HCPs. However, no statistically significant association was found between gender and willingness to receive the vaccine ($p =$ 0.26). Significant association was only found between having excellent or good health condition and the willingness to receive the COVID-19 vaccine ($p = 0.03$).

Table 3 represents the bivariate analysis of hesitancy scale items for the HCPs who agreed to receive the COVID-19 vaccine. The majority of the participants who agreed to receive the vaccine were found to agree (53.7%) or strongly disagree (34.6%) that "the COVID-19 vaccine is important for my health". Also, most of the participants were found to agree (33.1%) or strongly agree (48.6%) that "COVID-19 vaccines will be very effective in preventing COVID-19". Only 21.2% of the HCPs doubt the safety of COVID-19 vaccines, and 28.9% were neutral about the vaccine's safety.

Dependent variable: willingness to receive the vaccine (Item 10 of the VHS) "I am willing to be vaccinated".

Figure 1 shows the reasons of accepting to receive the COVID-19 vaccine; wanting to protect self and others from getting the infection was the main reason (24%). Figure 2, however, shows the reasons for not accepting COVID-19 vaccines. Most of the HCPs were lacking the trust in this vaccine because it is new (20%).

## Discussion
The main finding of this study was that 9.3% of the HCPs either didn't want to receive the vaccine or were hesitant to receive it. This indicates that the vaccine hesitancy among the HCPs in our sample from Saudi Arabia may not be of a serious issue. Although there are few studies assessed the hesitancy toward vaccination, our results are consistent with the current literature.[25,26] Civelek *et al.* (2021) found that 68.4% of physicians in Turkey were willing to get vaccinated.[25] Robertson *et al.* (2021) reported that 82% of UK population were willing to get vaccinated.[26] However, willingness level to receive the vaccine may differ between countries and communities. In a recent study, sampled from 19 countries with more than 13,000 participants, the acceptance of COVID-19 vaccines ranged from 54.8% in Russia to 88.6% in China.[27] Data collected from Saudi Arabia before the vaccination campaign showed that the COVID-19 vaccines' acceptance level among the population was 64.7%.[28]

The results of this study showed that 76.6% of the Saudi HCPs were willing to receive COVID-19 vaccines. A previous study on HCPs in Saudi Arabia, prior to the vaccination campaign, showed that the COVID-19 vaccines' acceptance level was reported to be 50.5%.[22] This surge in the acceptancy level by more than 26% following the vaccine campaign can be attributed to several factors, but one major factor was that the government of Saudi Arabia prohibited unvaccinated people from traveling, entering private establishments and government buildings, or performing Hajj and Umrah.[29] However, our results showed that 23% of HCPs were hesitant to receive the vaccine. Not receiving the vaccine will place HCPs at higher risk of getting infected and spread the infection to their patients and other HCPs. Compliance with public safety measures (social distancing, face mask, and hygiene) could help to reduce the transmission of the virus.[8] However, the increased demand on health care services during the pandemic with the severe shortages in HCPs make it very challenging to comply with those measures. This is complicated by to the difficulty in implementing social distancing in health care facility and the shortages in personal protective equipment.[8]

Our study showed that the majority of those who agreed to receive the vaccine were young, up to 24 years. This result is similar to a study conducted by Al-Mohaithef et al. (2020) in which they found that the majority of those who agree to receive the vaccine were from the age group between 26 to 35.[28] Qattan et al. in 2021 measured Saudi HCPs' acceptance of the COVID-19 vaccine and found that the majority of those who agreed to receive the vaccine were from the age group between 30 to 39 years.[22] However, several other studies showed that the willingness to receive COVID-19 vaccines were higher in old ages (50 years and above) for HCPs,[15] and for the general population.[30] One justification for this contradiction between Saudi HCPs and others can be attributed to the youth population of Saudi Arabia compared to the western countries. In total, 37% of the Saudi population are between the age of 15 to 34 years.

Interestingly, our study results showed that the factors that influenced the HCPs willingness to receive the vaccine were:

1) Perceived their health status as excellent or very good; and

2) Believed that vaccines will relieve the pandemic.

These findings support the conclusions of several previous studies[31–33] that showed health issues such as mental illness, chronic health problems or physical health problems may lead to both vulnerability and inequality.[31] Therefore, even if the vaccines uptake falls short in some high-risk groups, a trivial increase in vaccines uptake will have significant health benefits.[33]

We also determined the reasons for accepting or rejecting to receive COVID-19 vaccines as reported by the HCPs. Our findings contradict the results from Verger et al. (2021) about the safety concerns of COVID-19 vaccines.[20] Verger and colleagues concluded that concerns about the safety of the COVID-19 vaccines was, by far, the most important factor for hesitancy or reluctance and for moderate acceptance.[20] Contrarily, Shekhar et al. (2021) found that most HCPs (86%) believe that the COVID-19 vaccine is safe.[15] However, Qattan et al. (2021) study showed that 16.82% of the HCPs in KSA have safety and efficacy concerns about COVID-19 vaccines, and 26.73% have fear of the adverse side effects of the vaccines.[22] Even though our study was conducted after the beginning of the vaccine campaigns, we found that 21% of the HCPs doubt the safety of the vaccines, and 39.5% were worried about the possible side effects of COVID-19 vaccines. The increased percentage of HCPs with concerns regarding the COVID-19 vaccines in our study could be explained by the recent reports about the possible vaccine's adverse effects, such as the formation of blood clots in large arteries.[34]

Previous studies suggested that believing in the conspiracy theory behind COVID-19 was a factor of rejection.[22,35,36] This is similar to our findings which suggested that 5% of the HCPs rejected the vaccine because they believed rumors about the vaccines such as the "chip theory". Although 5% seems low, it may reflect the fact that our population only included HCPs and this percentage could rise if we conducted the study in the general population and amongst those who do not trust any source of information on COVID-19 vaccines. However, Qattan et al. reported that only 0.6% of the HCPs believed that COVID-19 does not exists.[22]

## Limitations
This study has some limitations. First, although the sample size in our study was objectively determined, we used a snowball sampling method to distribute the survey link among HCPs in the KSA. This method may have caused a selection bias since most of our sample were from the eastern province of KSA. Therefore, our sample may not be representative of all HCPs in KSA, which can limit the generalizability of the findings. In addition, this was a cross-sectional study. Therefore, we could not draw causal relationships between the factors and COVID-19 vaccine acceptance. Finally, the study's questionnaire was published online in the English language only, which produced a selection bias favoring English-literate HCPs only and those who have Internet connections.

## Future studies
Despite the limitations, our study was able to explore some of the unknown factors associated with COVID-19 vaccine acceptance and rejection which were not explored in previous studies. Also, given the representative sample size across KSA, the findings comprehensively demonstrated health care practitioners' intention to uptake the COVID-19 vaccine. Future research is therefore needed to assess this study's findings and to examine additional challenges around vaccinations in the Saudi population. Further investigations of the vaccine's safety awareness and promotion strategies to encourage individuals to get the vaccine, as well as exploring key barriers towards receiving the COVID-19 vaccination are needed.

## Conclusion
Our findings have shown that hesitancy toward receiving COVID-19 vaccines among HCPs in Saudi Arabia is limited and therefore may not be of a serious issue. Also, the outcomes of this study help to understand factors that lead to vaccine hesitancy in Saudi Arabia and help public health authorities to design targeted health education interventions aiming to increase vaccine's acceptance and uptake.

## Data availability
### Underlying data
Harvard Dataverse: Hesitancy of COVID-19 vaccine among health care practitioners in the Kingdom of Saudi Arabia, https://doi.org/10.7910/DVN/E90NQL.[37]

The project contains the following underlying data:

- SurveyReport-8303281-04-22-2021-T042516.666.tab (raw data from questionnaire).

Data are available under the terms of the Creative Commons Zero "No rights reserved" data waiver (CC0 1.0 Public domain dedication).

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**Publisher Full Text**

# Open Peer Review

## Current Peer Review Status: ✔ ✖ ❓

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**Version 5**

Reviewer Report 05 May 2023

https://doi.org/10.5256/f1000research.146333.r169458

❓ **Ali Azeez Al-Jumaili** ⓘD

Clinical Pharmacy Department, University of Baghdad College of Pharmacy, Baghdad, Iraq

Dear authors,

I disagree with your statistical analysis choice for table 3 since Chi-square cannot be done for 2*5 tables with such small numbers within the cells. I also disagree with considering Likert scale as categorical variable. It is better to redo the analysis using T-Test or binary Logistic regression.

Best
Dr Ali Al-Jumaili, PhD

*Competing Interests:* No competing interests were disclosed.

*Reviewer Expertise:* Pharmacy Practice, Social and Administrative Pharmacy and Public Health

**I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.**

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**Version 4**

Reviewer Report 28 March 2023

https://doi.org/10.5256/f1000research.145971.r167816

**?**   **Ali Azeez Al-Jumaili** iD

¹ Clinical Pharmacy Department, University of Baghdad College of Pharmacy, Baghdad, Iraq
² Clinical Pharmacy Department, University of Baghdad College of Pharmacy, Baghdad, Iraq

It is unclear which analysis was conducted in Table 3? Which type of regression? Please identify the outcome variable (below the table) and the beta-coefficients in a column as all regression analysis should include beta-coefficient in addition to P-value.

Please resend the revised manuscript with new Table 3 as recommended above.

*Competing Interests:* No competing interests were disclosed.

*Reviewer Expertise:* Pharmacy Practice, Social and Administrative Pharmacy and Public Health

**I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.**

> Author Response 26 Apr 2023
> **Abdullah Almojaibel**
>
> Dear Reviewer, Thanks you for the follow up questions.
>
> We have mentioned in the statistical analysis section (revised) that bivariate analysis was done between the variables. The dependent variable is the response of the participants who showed willingness to receive the COVID-19 vaccine (responded with YES for item #10 of the VHS) and the independent variables were the VHS 9 items using Chi-Square test. We did not run Regression analysis. We only did the Chi-Square for associations.
>
> Also, we stated the dependent variable below table 3 for clarification.
>
> Thank You.
>
> *Competing Interests:* No competing interests were disclosed.

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**Version 3**

Reviewer Report 10 March 2023

https://doi.org/10.5256/f1000research.145267.r165896

**?**    **Ali Azeez Al-Jumaili** (iD)

¹ Clinical Pharmacy Department, University of Baghdad College of Pharmacy, Baghdad, Iraq
² Clinical Pharmacy Department, University of Baghdad College of Pharmacy, Baghdad, Iraq
³ Clinical Pharmacy Department, University of Baghdad College of Pharmacy, Baghdad, Iraq

I have one more comment:

- ○ Table 3. Bivariate analysis of hesitancy scale items for health care professionals who agreed to receive the COVID-19 vaccine. Which one was the dependent (outcome) variable in the regression analysis? Please clarify below the table and in the title.

*Competing Interests:* No competing interests were disclosed.

*Reviewer Expertise:* Pharmacy Practice, Social and Administrative Pharmacy and Public Health

**I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.**

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**Version 2**

Reviewer Report 14 February 2023

**?**    **Ali Azeez Al-Jumaili** (iD)

¹ Clinical Pharmacy Department, University of Baghdad College of Pharmacy, Baghdad, Iraq
² Clinical Pharmacy Department, University of Baghdad College of Pharmacy, Baghdad, Iraq
³ Clinical Pharmacy Department, University of Baghdad College of Pharmacy, Baghdad, Iraq
⁴ Clinical Pharmacy Department, University of Baghdad College of Pharmacy, Baghdad, Iraq

**Hesitancy towards the COVID-19 vaccine among health care practitioners in the Kingdom of Saudi Arabia: a cross-sectional study**

Thank you for inviting me to review this manuscript. I invite authors to resubmit your manuscript after addressing all comments. Please carefully consider all issues I mentioned in a file including the authors' responses to reviewer comments, and outline every change made point by point on the manuscript using track changes. Thanks

**Methods**
The main sampling method was convenience. I am not sure how the authors can verify the snowballing sampling?

**Statistical analysis**
Please clarify that the multivariable regression model was logistic regression.

**Results**
Did the authors conduct the validity or reliability tests such as Cronbach alpha? If yes, include them in a table if no add this to the limitation section.
Table 3 does not seem like Bivariate analysis since it includes one p-value.
Where is the table for multivariate analysis?

**Is the work clearly and accurately presented and does it cite the current literature?**
Yes

**Is the study design appropriate and is the work technically sound?**
Yes

**Are sufficient details of methods and analysis provided to allow replication by others?**
Partly

**If applicable, is the statistical analysis and its interpretation appropriate?**
Partly

**Are all the source data underlying the results available to ensure full reproducibility?**
Yes

**Are the conclusions drawn adequately supported by the results?**
Yes

***Competing Interests:*** No competing interests were disclosed.

***Reviewer Expertise:*** Pharmacy Practice, Social and Administrative Pharmacy and Public Health

**I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.**

Reviewer Report 05 December 2022

https://doi.org/10.5256/f1000research.141163.r156821

✔ **Mohammad Al-bsheish** 🆔
[1] Healthcare Administration Department, Batterjee Medical College, Jeddah, Saudi Arabia

[2] Healthcare Administration Department, Batterjee Medical College, Jeddah, Saudi Arabia

[3] Healthcare Administration Department, Batterjee Medical College, Jeddah, Saudi Arabia

[4] Healthcare Administration Department, Batterjee Medical College, Jeddah, Saudi Arabia

Dear Authors,
Thank you for improving the manuscript.
You did all comments, and I don't have any further comments.

**Is the work clearly and accurately presented and does it cite the current literature?**
Yes

**Is the study design appropriate and is the work technically sound?**
Yes

**Are sufficient details of methods and analysis provided to allow replication by others?**
Yes

**If applicable, is the statistical analysis and its interpretation appropriate?**
Yes

**Are all the source data underlying the results available to ensure full reproducibility?**
Yes

**Are the conclusions drawn adequately supported by the results?**
Yes

*Competing Interests:* No competing interests were disclosed.

*Reviewer Expertise:* Healthcare Administration, Occupational Safety and Quality Management, Nursing Science

**I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.**

> Author Response 26 Apr 2023
> **Abdullah Almojaibel**
>
> Thanks Dr. Mohammad Al-bsheish.
> The research team would like to thank you for your valuable feedback and comments that improved the manuscript.
> Regards,
>
> *Competing Interests:* No competing interests were disclosed.

## Version 1

Reviewer Report 06 September 2022

https://doi.org/10.5256/f1000research.78348.r148319

✗ **Sun Caijun** 🆔

[1] School of Public Health (Shenzhen), Shenzhen Campus of Sun Yat-sen University, Shenzhen, China

[2] School of Public Health (Shenzhen), Shenzhen Campus of Sun Yat-sen University, Shenzhen, China

[3] School of Public Health (Shenzhen), Shenzhen Campus of Sun Yat-sen University, Shenzhen, China

[4] School of Public Health (Shenzhen), Shenzhen Campus of Sun Yat-sen University, Shenzhen, China

[5] School of Public Health (Shenzhen), Shenzhen Campus of Sun Yat-sen University, Shenzhen, China

This manuscript mainly investigated the COVID-19 vaccine acceptance and intentions among healthcare workers in Saudi Arabia. There have been many similar investigations, so the authors should compare their work with the published data and provide explanation of possible discrepancy.

Only 505 valid participants were investigated in this survey. Please state how to calculate the minimum sample size of participants in this survey.

Please also state the inclusion and exclusion criteria for these participants in this survey. Selection bias may exist if the participants with small sample size were recruited without reasonable inclusion and exclusion criteria.

The study was conducted in April, 2021, but the pandemic situation and vaccination policies changed greatly during this year. This change always influenced people's attitudes towards COVID-19 vaccination, and therefore the conclusion might be changed.

**Is the work clearly and accurately presented and does it cite the current literature?**
Partly

**Is the study design appropriate and is the work technically sound?**
Partly

**Are sufficient details of methods and analysis provided to allow replication by others?**

Partly

**If applicable, is the statistical analysis and its interpretation appropriate?**
Partly

**Are all the source data underlying the results available to ensure full reproducibility?**
Partly

**Are the conclusions drawn adequately supported by the results?**
Partly

*Competing Interests:* No competing interests were disclosed.

*Reviewer Expertise:* Vaccine; infectious diseases; antiviral drugs

**I confirm that I have read this submission and believe that I have an appropriate level of expertise to state that I do not consider it to be of an acceptable scientific standard, for reasons outlined above.**

Author Response 26 Apr 2023
**Abdullah Almojaibel**

**Dear Reviewer, Thanks for the feedback.**

1- This manuscript mainly investigated the COVID-19 vaccine acceptance and intentions among healthcare workers in Saudi Arabia. There have been many similar investigations, so the authors should compare their work with the published data and provide explanation of possible discrepancy.

**In the discussion section we compared our findings with the other studies conducted in Saudi Arabia and other countries and explained the differences.**

2- Only 505 valid participants were investigated in this survey. Please state how to calculate the minimum sample size of participants in this survey.

**There was no calculation of the minimum sample size in this study since we used a simplified-snowball sampling technique. The invited participants were requested to share the invitation link with their WhatsApp contacts and other social media platforms. Our data collection period was predetermined by certain dates. We stopped the data collection once we reach the predetermined date and reached a sample size close to a previous study conducted in Saudi Arabia by Qattan *et al*. in 2021 where they received 673 completed responses.**

3- Please also state the inclusion and exclusion criteria for these participants in this survey. Selection bias may exist if the participants with small sample size were recruited without reasonable inclusion and exclusion criteria.

**We have mentioned the inclusion criteria for this study in the Participants section "All HCPs currently working in healthcare facilities in KSA, regardless of the level of patient contact and their clinical role, were eligible to participate in the study." No exclusion criteria were stated.**

4- The study was conducted in April, 2021, but the pandemic situation and vaccination policies changed greatly during this year. This change always influenced people's attitudes towards COVID-19 vaccination, and therefore the conclusion might be changed.

**Yes, agree. We aimed to investigate vaccine acceptance in Saudi Arabia wright after the approval of the COVID-19 vaccines. Prior studies were already conducted before this milestone which provided different prospective and conclusion. However, more studies need to be conducted after the changes in the pandemic situation and the policies which have influenced HCPs' attitude toward the vaccines.**

**Thank You.**

***Competing Interests:*** No competing interests were disclosed.

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Reviewer Report 24 January 2022

**?**  **Mohammad Al-bsheish** iD
1 Healthcare Administration Department, Batterjee Medical College, Jeddah, Saudi Arabia
2 Healthcare Administration Department, Batterjee Medical College, Jeddah, Saudi Arabia
3 Healthcare Administration Department, Batterjee Medical College, Jeddah, Saudi Arabia
4 Healthcare Administration Department, Batterjee Medical College, Jeddah, Saudi Arabia
5 Healthcare Administration Department, Batterjee Medical College, Jeddah, Saudi Arabia

Dear authors,

Thank you for your submission of your article entitled "Hesitancy towards the COVID-19 vaccine among health care practitioners in the Kingdom of Saudi Arabia: a cross-sectional study" for F1000Research.

Here are some comments for improvement. I hope these comments are useful!

Title: your study aims to measure willingness and hesitancy toward COVID-19 vaccines among health care practitioners (HCPs) in Saudi Arabia. However, "willingness" is conspicuously absent from the title; I suggest adding the willingness to the title.

**Introduction**

Due to massive changes in the number of cases every day, mentioning the date you got the statistics increases the accuracy for the readers.

The problem statement in the introduction needs to be enriching more by mentioning:
- The impact of COVID-19 on HCPs by presenting governmental statistics and previous studies
- More international and national literature on hesitancy and willingness of receiving the vaccine
- The motive to conduct this study in particular if we consider the high percentage vaccination rate in Saudi Arabia and how the compensation mechanism of HCPs who are declining to receive the vaccine is affected, as they are able and trained to protect patients by using the safety compliance behaviours and adhering to PPE. Please see "Al-Bsheish, M., Jarrar, M. T., & Scarbrough, A. (2021). A Public Safety Compliance Model of Safety Behaviors in the Age of the COVID-19 Pandemic. INQUIRY: The Journal of Health Care Organization, Provision, and Financing, 58, 1–6".

**Methods**
- In the ***Participant's*** part, you mentioned "All adults (>18 years of age) currently working in healthcare facilities in KSA" while your investigation is among HCPs! ...This may confuse the readers.
- In the ***Measures*** part, you wrote "we piloted the survey with nine HCPs currently practicing in KSA to assure the clarity of the questions and to evaluate the face and content validity of the scale on the targeted population", did you mean pre-test? Because you examined the face and content validity, however, the pilot study investigates the reliability of the scale by Cronbach's alpha, and the minimal size to conduct it is 30 participants. Please See "Sekaran, U., & Bougie, R. (2016). Research methods for business: A skill-building approach. John Wiley & Sons".

**Results**
- You wrote "Women were more hesitant to receive the vaccine (47.3%) compared to men". While Table 2 shows the willingness to receive the COVID-19 vaccines. There is a difference between willingness and hesitancy. I would change this to "Women were less willing to receive the vaccine".

**Discussion**
- Well written and interesting, however, it is better to focus on the conspiracy theories in your introduction to enrich your problem statement in this study.
- It is better to add the limitations and future studies in separate parts after the discussion.

Lastly, please revise the manuscript for flow and English language edits and update any references

Again, thank you for your work, and good luck.
MAG

**References**

1. Al-Bsheish M, Jarrar M, Scarbrough A: A Public Safety Compliance Model of Safety Behaviors in the Age of the COVID-19 Pandemic. *INQUIRY: The Journal of Health Care Organization, Provision, and Financing*. 2021; **58**. Publisher Full Text
2. Sekaran U, Bougie R: Research Methods for Business: A Skill-Building Approach. *Wiley*.

**Is the work clearly and accurately presented and does it cite the current literature?**
Yes

**Is the study design appropriate and is the work technically sound?**
Yes

**Are sufficient details of methods and analysis provided to allow replication by others?**
Yes

**If applicable, is the statistical analysis and its interpretation appropriate?**
Yes

**Are all the source data underlying the results available to ensure full reproducibility?**
Yes

**Are the conclusions drawn adequately supported by the results?**
Yes

*Competing Interests:* No competing interests were disclosed.

*Reviewer Expertise:* Healthcare Administration, Occupational Safety and Quality Management, Nursing Science

**I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.**

Author Response 15 Nov 2022
**Abdullah Almojaibel**

**Dear reviewer,**

We would like to thank you for your valuable feedback.

We have modified the manuscript based on your suggestions. The introduction section is now modified with more literature about COVID-19 from KSA and other countries presenting the issues, and more statistics. All other valuable comments from the reviewer were also addressed/corrected in this version. Based on the additional citations, the reference list is now modified too.

Regards,

*Competing Interests:* No competing interest.

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