

Vaccine Hesitancy among Healthcare Providers at the Beginning of a Pandemic: The Case of COVID-19 Vaccines

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Keywords

Vaccine confidence · COVID-19 · Pandemics · Vaccine acceptance · Healthcare workers

Abstract

Background: Trust in vaccines is a major global health issue. This study aimed to assess vaccine hesitancy among healthcare providers. **Methods:** This was a multicenter cross-sectional survey conducted among healthcare providers in Riyadh between October and November of 2020. COVID-19 vaccine hesitancy was assessed using eight structured items adapted from the 5Cs. **Results:** About 34.6% (95% CI: 27.6–42.4%) of participants were willing to vaccinate against COVID-19, and 44% (95% CI: 36.5–51.9%) will recommend the vaccine to their patients. About 45% of participants were neutral regarding vaccine safety, and 40% were neutral regarding vaccine effectiveness. Almost 70% believe that the duration of clinical studies of the COVID-19 vaccines affects their confidence in the effectiveness and safety of the vaccine. Those who never hesitated or delayed taking any of the recommended vaccination were more likely to be willing to vaccinate against COVID-19 (OR: 5.46, 95% CI: 2.49–11.98). **Conclusions:** With the development of COVID-19 vaccines,

hesitancy toward vaccines was observed among healthcare providers due to concerns regarding their safety, effectiveness, and rapid development of vaccines. Improving the level of vaccine confidence among healthcare providers is essential to help implement an effective national vaccine program to enhance vaccination uptake among both HCPs and the public during pandemics.

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Published by S. Karger AG, Basel

Introduction

Lack of vaccine confidence has a significant impact on public vaccine acceptance, which lowers the vaccine coverage in the community. This phenomenon can be explained by vaccine hesitancy. Vaccine hesitancy is defined as a *delay in acceptance or refusal of vaccination despite availability of vaccination services* [1]. According to the WHO, vaccine hesitancy is influenced by confidence as one of the major factors [2]. Lack of public confidence in vaccines led to a drop in vaccination rates and subsequently led to disease outbreaks in the community. Therefore, vaccine hesitancy is challenging vaccination goals at the national and global levels [3].

Despite the regulatory monitoring of vaccine safety and evidence that vaccines work and save lives, critics of vaccines and their safety exist in local and global communities. The WHO has recognized vaccine hesitancy as one of the top public and global health threats in this century that causes health outbreaks due to vaccination delay or refusal in the community [4]. Concerns exacerbated the vaccine hesitancy during the COVID-19 pandemic [5]. With the mass use of media and social media, misinformation and conspiracy theories have circulated widely. It exists even among healthcare providers, who play an important role as the frontline of infection control and trusted source for information by their patients [6, 7].

Vaccine hesitancy among healthcare providers was found to be prevalent [8]. Healthcare providers' beliefs on the vaccine have a powerful impact on vaccine hesitancy. It was found that one of the main barriers to taking vaccines is distrust of published vaccines efficacy data [7, 9]. Moreover, healthcare providers' knowledge about the particular vaccine mechanisms and their safety help in building their vaccine confidence and their willingness for vaccine uptake and recommending vaccines to others.

With the emergence of vaccine hesitancy in the last decades, healthcare providers were reported as the most influential source among patients on vaccine decision-making [6]. Assessing the current vaccine hesitancy and understanding of vaccines among healthcare providers during pandemics is needed as their crucial role in infection control and educating patients [10]. Hesitancy from the population toward vaccines and concerns regarding their safety and efficacy was raised with the development of COVID-19 vaccines [10].

Two studies were recently published to assess the vaccine hesitancy among healthcare providers in Saudi Arabia [11, 12]. However, the majority of published studies have not yet reported data on COVID-19 vaccine hesitancy based on a valid tool. Assessing the vaccine hesitancy necessitates the use of valid tools to strengthen the accuracy and reliability of reported data. With the lack of data about vaccine acceptance and determinants based on a validated tool in Saudi Arabia, this study aimed to assess healthcare workers' vaccine acceptance and hesitancy during the beginning of the COVID-19 pandemic.

Methods

This cross-sectional study was conducted using an electronic survey to assess healthcare providers' vaccines acceptance and hesitancy during the COVID-19 pandemic. This was a multicenter cross-sectional survey conducted among healthcare providers in

Riyadh, the capital of Saudi Arabia. Healthcare providers working in one main public hospital and two major military hospitals located in Riyadh were invited to participate in the study.

A cross-sectional sample was chosen based on the study inclusion criteria [13]. The study target population was estimated to be 12,000 healthcare workers. Based on a previous study conducted in Saudi Arabia, the prevalence of vaccine hesitancy among healthcare providers was 17% [13]. The sample size of 152 was calculated based on a proportion of 0.17, population size of 12,000, desired precision of the estimate of 0.05, and a confidence level of 0.90. This study used a convenient sampling technique to recruit the required sample.

The inclusion criteria were being (1) currently a healthcare worker including physicians, nurses, and paramedics and (2) over 18 years of age. Data collection was carried out between October and November of 2020 through a Web-based survey. Invitation messages supplied with a link of an electronic questionnaire were sent to healthcare providers' phone numbers at the study target hospitals. Invitation messages include a brief on the study and its objectives. The first page includes the consent form where participants voluntarily check if they want to proceed with the study. The second page includes eligibility questions: age, do you currently work in the healthcare sector? Are you a healthcare professional? and your current profession. Eligible participants proceeded with the survey to complete the questionnaire. A written consent form was obtained from all participants at the beginning of the questionnaire. All data obtained from this study were used for the research purpose and was stored securely. Participation in this research was completely voluntary.

Data were collected using a self-administrated electronic structured survey. Sociodemographic data including age, gender, educational level, employment position, health status (morbidity or multimorbidity, or self-reported history of diagnosed chronic disease), and the level of the working institute.

COVID-19 vaccine hesitancy was assessed using eight structured items, the notions of these items adapted from literature investigated vaccine hesitancy determinants including: confidence, complacency, calculation, and collective responsibility (Table 1) [14]. Seven items of the survey were adapted from the 5Cs that assesses the psychological antecedents of vaccination [14]. One confidence assessment item was added to assess the effect of the duration of COVID-19 vaccines research and clinical trials during emergency pandemic in their confidence level in vaccines. These items were assessed on an agreement Likert scale of 5 from strongly agree to strongly disagree. The instruction for questions was as follows: "Please evaluate how much you disagree or agree with the following statements regarding COVID-19 vaccine." (1 = *strongly disagree*, 2 = *disagree*, 3 = *neutral* (or: *neither disagree nor agree*), 4 = *agree*, 5 = *strongly agree*). All questionnaire items were presented in both Arabic and English. From previous studies, the English and Arabic versions of the 5Cs demonstrated good internal consistency and validity [15, 16].

Intention to vaccinate for COVID-19, as well as previous vaccination behaviors including refusal or delays and hesitancy of recommended vaccinations from the Ministry of Health were assessed. Healthcare providers were also asked to whether they will be recommending the COVID-19 vaccine to their patients. Their belief in who should be at vaccine priority if vaccines become available was also assessed.

Table 1. Assessment item constructs adopted from the 5Cs

Category	Assessment items
Confidence	I am completely confident that COVID-19 vaccines will be safe I am completely confident that COVID-19 vaccines will be effective I am confident in the judgment of public health authorities that they will act in the best interest of the community regarding vaccinations The duration of clinical studies of the COVID-19 vaccines affects my confidence in the efficacy and safety of the vaccine
Complacency	The immune system is strong enough to fight COVID-19 infection COVID-19 is a nonserious disease that requires no vaccination for protection
Calculation	When I think of being/getting vaccinated, I weigh its benefits and risks to make the best decision possible
Collective responsibility	Vaccination is a collective action to prevent the spread of the disease

The survey assessed the main information sources about the vaccines and their safety. Their level of trust in the information and recommendations that they receive about vaccines and its safety was also assessed based on a Likert scale of 5.

A pilot sample of 10 healthcare workers participants was recruited to assess the face validity of the questionnaire. The content validity of questionnaire was conducted by three healthcare workers on the field to assess importance, relevance, and clarity of the questionnaire. Data from the pilot phase were not included in the overall analysis of this study's findings.

Descriptive data variables were presented as frequencies and proportion with 95% CIs. Differences were assessed using χ^2 and ordered regression analysis. All statistical analyses were performed using STATA.

Results

A total of 200 healthcare providers were invited to the study with a response rate of 79.5%. Of those, 159 completed the survey. More than half of the participants were between the ages of 25–34 years. Mean age of participants was 35 ± 8 years. The majority were male with a bachelor's degree in education. Almost 38% of participants were physicians, 35% nurses, and 27% other health professionals. Almost half of participants work in primary healthcare institutes, 13% secondary, and 34% tertiary. The majority (81%) was never diagnosed with a chronic condition, and few (14%) were diagnosed with one and very few (5%) with multiple diseases. Table 2 presented the sociodemographic characteristics of participants.

Participants' Vaccination Uptake and Intention to Be Vaccinated against COVID-19

The majority of participants (84.9%, 95% CI: 78.4–89.7%) have never refused any of the recommended vaccinations from the Ministry of Health, while some (42.1%,

95% CI: 34.7–50.0%) reported that they have ever hesitated to take the recommended vaccinations from the Ministry of Health. About 34.6% (95% CI: 27.6–42.4%) of participants were willing to vaccinate against COVID-19, and 44% (95% CI: 36.5–51.9%) would recommend the vaccine to their patients.

A total of 32% of female participants in this study were willing to be vaccinated compared to 36% of male participants. The majority (54%) of those willing were aged between 25 and 34 years, with differences noticed when data separated by the age-group; willingness was higher among young adults (57%) compared with older adults (30%). About 23% of physicians, 48% nurses, and 33% of other healthcare professionals were willing to get vaccinated against COVID-19.

Vaccine Hesitancy Determinants

About 45% of participants were neutral regarding vaccine safety, and 40% were neutral regarding vaccine effectiveness. Almost 70% of participants believe that the duration of clinical studies of the COVID-19 vaccines affects their confidence in the efficacy and safety of the vaccine. The majority of participants (86.8%) reported that they weigh benefits and risks to make the best decision possible when thinking of getting vaccinated.

Moreover, the majority (67.3%) were confident in the judgment of public health authorities that they will act in the best interest of the community regarding vaccinations. The majority (76%) agree that vaccination is a collective action to prevent the spread of the disease. About 32% of participants were neutral, while 37% agree that the immune system is strong enough to fight COVID-19 infection. The majority (57%) disagree that COVID-19 is a nonserious disease that requires no vaccination for protection.

Table 2. Participants' sociodemographic characteristics

Characteristics	Category	N	Intent to be vaccinated					
			%*	%**	p value	OR 95% CI		
Age (Mean ± SD 35.21 ± 7.96 years)	18–24	7	4.4	57.14	0.53	0.74	0.45	1.21
	25–34 years	86	54.09	36.05	–	–	–	–
	35–44 years	56	35.22	30.36	–	–	–	–
	≥45 years	10	6.29	30	–	–	–	–
Gender	Female	59	37.11	32.2	0.6	1.18	0.6	2.34
	Male	100	62.89	36	–	–	–	–
Education	Diploma	22	13.84	59.09	<0.001	0.61	0.45	0.83
	Bachelor	65	40.88	40	–	–	–	–
	Board/fellowship	34	21.38	23.53	–	–	–	–
	Master	15	9.43	33.33	–	–	–	–
	PhD	23	14.47	13.04	–	–	–	–
Employment current position	Physician	60	37.74	23.33	0.02	1.29	0.86	1.95
	Nurse	56	35.22	48.21	–	–	–	–
	Other health professionals	43	27.04	32.56	–	–	–	–
Level of the working institute	Primary	84	52.83	36.9	0.53	0.95	0.66	1.36
	Secondary	21	13.21	23.81	–	–	–	–
	Tertiary	54	33.96	35.19	–	–	–	–
Morbidity	Never been diagnosed with chronic condition	129	81.13	40.31	0.01	0.27	0.47	0.94
	Diagnosed with a chronic condition	22	13.84	9.09	–	–	–	–
	Diagnosed with multiple chronic conditions	8	5.03	12.5	–	–	–	–
Previous vaccination refusal	Yes	24	15.09	20.83	0.12	2.24	0.79	6.36
	No	135	84.91	34.04	–	–	–	–
Previous vaccination delay or hesitancy	Yes	67	42.14	14.93	<0.001	5.46	2.49	11.98
	No	92	57.86	48.91	–	–	–	–

* % by the total sample. ** % by the same category.

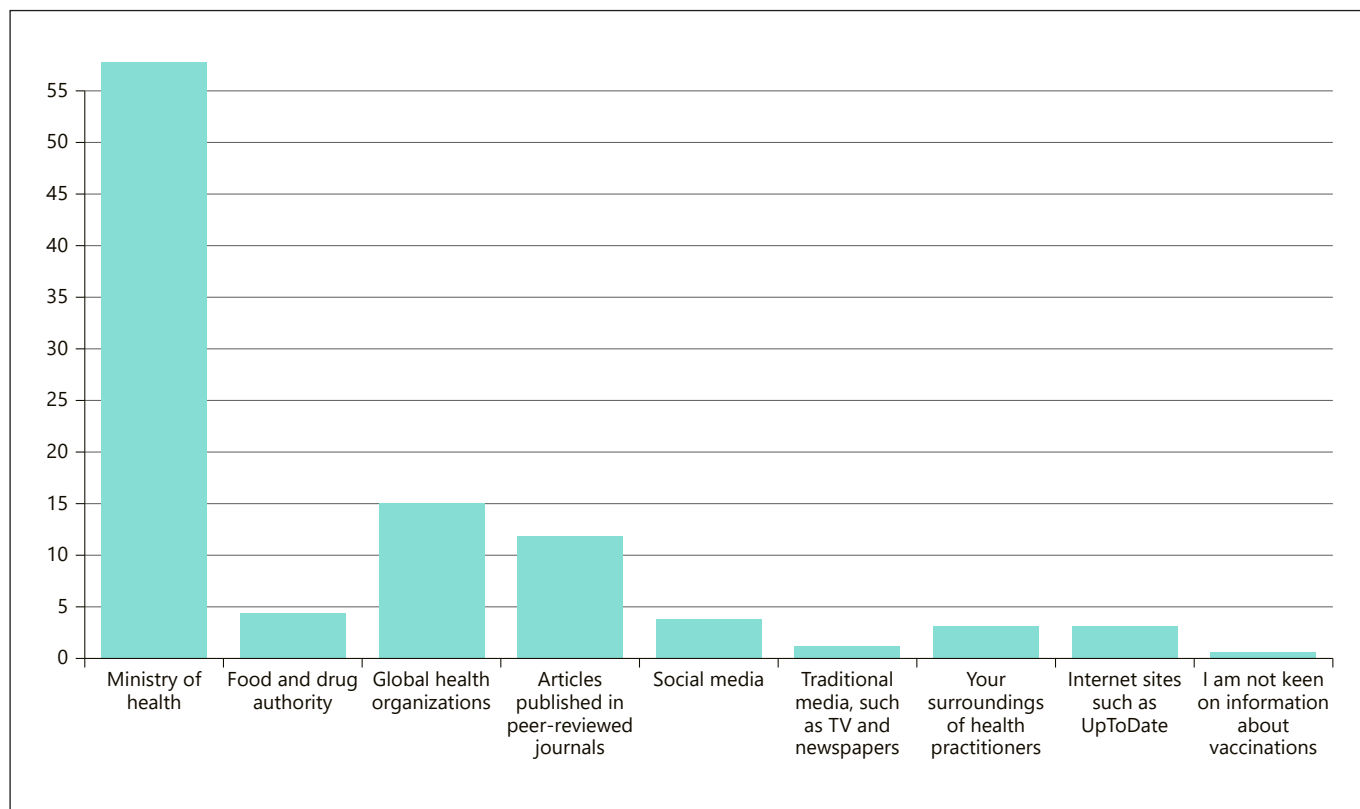


Fig. 1. The main source of information about vaccines recommendations and their safety by percentage.

Factors associated with vaccination intent were education and morbidity (Table 2). As participants were more educated (OR: 0.61, 95% CI: 0.45–0.83), they were less likely to have an intention to be vaccinated against COVID-19. Moreover, those diagnosed with chronic disease (OR: 0.27, 95% CI: 0.47–0.94) have a lower intention to be vaccinated. Those who never hesitated or delayed taking any of the recommended vaccination were more likely to be willing to vaccinate against COVID-19 (OR: 5.46, 95% CI: 2.49–11.98).

Vaccine hesitancy items associated with intent to be vaccinated against COVID-19 are shown in Table 3. The lower confidence in vaccine safety (Coef 3.85, 95% CI: 2.90–4.81), effectiveness (Coef 2.57, 95% CI: 1.77–3.36), public health authorities judgments (Coef 1.48, 95% CI: 0.81–2.16) were associated with less willingness to be vaccinated against COVID-19. The higher disagreement that vaccination is a collective action to prevent the spread of the disease was associated with lower vaccination intent (Coef 1.50, 95% CI: 0.80–2.20). The less trust in vaccine information sources was associated with lower intent to be vaccinated (Coef 2.38, 95% CI: 1.61–3.15). The dura-

tion of clinical studies of the COVID-19 vaccines affects participants confidence in the efficacy and safety of the vaccine (Coef –0.78, 95% CI: –1.42 to –0.15).

Figure 1 shows the main sources of vaccine information among HCPs. The majority of participants (58%) reported the Ministry of Health as the main source for vaccine recommendation and safety, followed by global health organizations (15%) and articles published in peer-reviewed journals (12%). About 44% have a neutral trust level regarding information they receive about vaccines' safety.

Discussion

This study assessed the vaccine acceptance among healthcare workers and their confidence and hesitancy of COVID-19 vaccines and their determinants. About 34.6% (95% CI: 27.6–42.4%) of participants were willing to vaccinate against COVID-19, and 44% (95% CI: 36.5–51.9%) would recommend the vaccine to their patients. About 45% of participants were neutral regarding vaccine safety,

Table 3. Vaccine hesitancy determinates

Items	Category	Freq	%	95% CI		p value*	p value**	Z	Coef	95% CI	
I am completely confident that vaccines will be safe	Strongly disagree	4	2.52	0.94	6.56	<0.001	<0.01	7.89	3.85	2.9	4.81
	Disagree	22	13.84	9.26	20.18	-	-	-	-	-	-
	Neutral	72	45.28	37.66	53.13	-	-	-	-	-	-
	Agree	43	27.04	20.67	34.53	-	-	-	-	-	-
	Strongly agree	18	11.32%	7.22	17.31	-	-	-	-	-	-
I am completely confident that vaccines will be effective	Strongly disagree	6	3.77	1.69	8.19	<0.001	<0.01	6.34	2.57	1.77	3.36
	Disagree	16	10.06	6.23	15.85	-	-	-	-	-	-
	Neutral	63	39.62	32.27	47.48	-	-	-	-	-	-
	Agree	60	37.74	30.49	45.57	-	-	-	-	-	-
	Strongly agree	16	8.81	5.26	14.37	-	-	-	-	-	-
The immune system is strong enough to fight COVID-19 infection	Strongly disagree	4	2.52	0.94	6.56	0.029	0.14	1.49	0.49	-0.16	1.14
	Disagree	25	15.72	10.82	22.29	-	-	-	-	-	-
	Neutral	51	32.08	25.24	39.78	-	-	-	-	-	-
	Agree	59	37.11	29.90	44.93	-	-	-	-	-	-
	Strongly agree	20	12.58	8.23	18.75	-	-	-	-	-	-
I am confident in the judgment of public health authorities that they will act in the best interest of the community regarding vaccinations	Strongly disagree	2	1.26	0.31	4.94	<0.001	<0.01	4.29	1.48	0.81	2.16
	Disagree	9	5.66	2.96	10.57	-	-	-	-	-	-
	Neutral	41	25.79	19.54	33.20	-	-	-	-	-	-
	Agree	68	42.77	35.25	50.63	-	-	-	-	-	-
	Strongly agree	39	24.53	18.42	31.87	-	-	-	-	-	-
COVID-19 is a nonserious disease that requires no vaccination for protection	Strongly disagree	46	28.93	22.37	36.51	<0.001	0.16	-1.40	-0.44	-1.05	0.18
	Disagree	45	28.30	21.80	35.85%	-	-	-	-	-	-
	Neutral	27	16.98	11.88	23.69	-	-	-	-	-	-
	Agree	27	16.98	11.88	23.69	-	-	-	-	-	-
	Strongly agree	14	8.81	5.26	14.37	-	-	-	-	-	-
When I think of getting vaccinated, I weigh benefits and risks to make the best decision possible	Strongly disagree		0.00	0.00	0.00	0.004	0.91	0.11	0.04	-0.63	0.7
	Disagree	4	2.52	0.94	6.56	-	-	-	-	-	-
	Neutral	17	10.69	6.73	16.58	-	-	-	-	-	-
	Agree	77	48.43	40.70	56.23	-	-	-	-	-	-
	Strongly agree	61	38.36	31.08	46.21	-	-	-	-	-	-
Vaccination is a collective action to prevent the spread of the disease	Strongly disagree	0	0.00	0.00	0.00	<0.001	<0.01	4.21	1.5	0.8	2.2
	Disagree	7	4.40	2.10	8.99	-	-	-	-	-	-
	Neutral	31	19.50	14.02	26.45	-	-	-	-	-	-
	Agree	57	35.85	28.73	43.65	-	-	-	-	-	-
	Strongly agree	64	40.25	32.86	48.11	-	-	-	-	-	-
The duration of clinical studies of the COVID-19 vaccines affects my confidence in the efficacy and safety of the vaccine	Strongly disagree	2	1.26	0.31	4.94	0.012	0.02	-2.42	-0.78	-1.42	-0.15
	Disagree	13	8.18	4.79	13.62	-	-	-	-	-	-
	Neutral	32	20.13	14.57	27.14	-	-	-	-	-	-
	Agree	54	33.96	26.98	41.72	-	-	-	-	-	-
	Strongly agree	58	36.48	29.32	44.29	-	-	-	-	-	-
Trust in information sources about vaccines	Strongly disagree	0	0.00	0.00	0.00	<0.001	<0.01	6.03	2.38	1.61	3.15
	Disagree	6	3.77	1.69	8.19	-	-	-	-	-	-
	Neutral	70	44.03	36.45	51.88	-	-	-	-	-	-
	Agree	58	36.48	29.32	44.29	-	-	-	-	-	-
	Strongly agree	25	15.72	10.82	22.29	-	-	-	-	-	-

* Unadjusted. ** Adjusted with age, gender and education.

and 40% were neutral regarding vaccine effectiveness. Almost 70% believe that the duration of clinical studies of the COVID-19 vaccines affects their confidence in the efficacy and safety of the vaccine.

The overall rate of vaccine willingness found in this study was fairly low compared with other studies. Studies recently conducted to assess the vaccine hesitancy among healthcare providers in Saudi Arabia found that 35% would not accept a COVID-19 vaccine and majority (58.5%) reported fear of potential side effects [11, 12]. A national survey conducted among the public in Qatar, a neighboring country, found that 20% of participants refuse to be vaccinated against COVID-19, and 20% were unsure [17]. In a study conducted among healthcare providers in France, 76.9% were willing to be vaccinated against COVID-19 [18]. However, a study conducted in the USA among healthcare providers found a similar percentage of 36% of HCPs were willing to be vaccinated against COVID-19 [19].

Vaccine hesitancy leads to a drop in immunization rates that are required to ensure herd immunity. This drop puts public and global health at risk of developing vaccine preventable diseases and leads to disease outbreaks [20]. Achieving herd immunity requires a higher proportion of the population to be vaccinated, especially healthcare providers are at the frontline of combating the COVID-19 pandemic and identified as a priority group for COVID-19 vaccines. Therefore, it is important to assess factors that guide vaccine hesitancy.

Those who never hesitated or delayed taking any of the recommended vaccinations were more likely to be willing to vaccinate against COVID-19 (OR: 5.46, 95% CI: 2.49–11.98). This finding is in line with a cross-sectional study conducted in Saudi Arabia during the H1N1 pandemic in 2009. H1N1 vaccine acceptance was significantly associated with previous acceptance of seasonal influenza vaccine (OR: 8; $p < 0.01$) [21].

In this study, healthcare providers with comorbidities showed more hesitancy toward vaccines. This is contradictory to other studies that found a positive relationship between comorbidity and vaccine acceptance [22–24]. This study highlighted that older healthcare providers are more hesitant than younger ones to accept COVID-19 vaccines. This hesitancy among HCPs suffering from comorbidities could be related to concerns about the side effects [25]. Moreover, this could be due to concerns about the nature of participants recruited for the vaccine's studies and the fact that older individuals and people suffering from multiple comorbidities were excluded in early studies, especially in the early phases [26].

Healthcare providers' concerns about vaccines play an important role in their acceptance. This study showed reluctance by healthcare providers with a higher degree of education to take the vaccine. This is contradictory to findings from other studies of which showed that higher educated individuals are more inclined to accept the vaccine [27–29]. The complexity of understanding vaccine hesitancy determinants including the education level has been noticed in systematic reviews [30, 31]. These study findings could be attributed to the fact that higher educated healthcare providers in our study are more skeptical of vaccine clinical trials. Healthcare providers show reluctance to take the vaccine due to their beliefs that the duration of the clinical trials of COVID-19 vaccines is short. Educated people were more skeptical about the duration of the trials and the safety and efficacy of vaccines [32]. Losses of confidence in vaccines can lead to vaccine hesitancy [31].

Exposure to vaccine messages through media outlets and social media, especially negative ones is another contributor to vaccine hesitancy. The focus of media outlets on the side-effect profiles of COVID-19 vaccines and the short duration of trials play a significant role in vaccine hesitancy. In a study conducted in Saudi Arabia, majority (58.5%) of healthcare providers reported fear of potential side effects of COVID-19 vaccines (11). Healthcare providers in our study show reluctance to take the vaccine due to their beliefs the concerns and uncertainty about the COVID-19 vaccines safety (61%) and effectiveness (53%). Being exposed to these kinds of negative messages surrounded in the media causes reluctance toward accepting the vaccine [33]. The effect of negative stories might decrease over time, especially when vaccination rates increase, and the side effects of the vaccine become more apparent in the near future. Despite these beliefs, the majority of HCPs (57%) reported relying on the Ministry of Health as their main source of information on vaccines.

Moreover, this study highlighted that the majority of HCPs (67%) were confident in the judgment of public health authorities that they will act in the best interest of the community regarding vaccinations. In addition, the majority (76%) recognize the collective importance to prevent the spread of the disease. These beliefs drive their confidence in vaccines and their role in educating others on the importance of vaccines to control the spread of COVID-19. Still, with concerns and neutral beliefs on vaccine safety and effectiveness of vaccine reported, there is a need to increase healthcare workers confidence in order to maintain high vaccine intake among HCPs as well as the general population.

Previous studies found that healthcare providers were the most trusted influencers of vaccination decisions among the public [7]. Confidence of healthcare providers varies as they are faced with limited resources and lack information to address their patients' questions regarding vaccinations [7]. Knowledge about vaccines, their efficacy, and safety helped in building HCPs trust in vaccines and their willingness to recommend vaccines to their surroundings and their patients. Therefore, education, conversations, and building trust in vaccines with HCPs are needed especially during pandemics and newly emergence diseases to reduce hesitancy.

Effective communications and education about the safety, importance, and efficacy of vaccines, especially for newly developed is of vital importance for healthcare providers to help their patients to make informed decisions about vaccination [34]. Moreover, there is a need to strengthen trust between healthcare providers and health authorities and involve them in policymaking and recommendation in raising vaccine confidence and education among the public [34, 35].

Given the cross-sectional nature of this study, there was no substantial evidence to claim a temporal relationship among factors. Another limitation of this study was that the sample did not reflect the entire population; therefore, these findings cannot be generalized to the whole population. The study design and sampling method of this study might have resulted in selection bias and favored data collection from people who had a positive attitude toward participation in research. However, given the high response rate of almost 80%, this multicenter study provides a snapshot of the healthcare providers' willingness to be vaccinated against COVID-19 and its determinants during the pandemic in three major hospitals in Riyadh the capital of Saudi Arabia. Vaccine hesitancy is a multifactorial problem, especially when it concerns healthcare providers. To understand the reasons behind vaccine hesitancy among this group, more research is needed, and it is better to conduct a qualitative study in order to better understand healthcare providers' beliefs and behaviors.

Conclusion

Vaccine hesitancy is prevalent in all societal groups including healthcare providers as highlighted in this study. It is a multifactorial problem that needs to be addressed, especially when it concerns healthcare providers as a major role in combating the pandemic. Vaccine hesitancy

needs to be addressed among HCPs by listening to their most reported concerns on vaccines safety, effectiveness, and relevance of vaccines especially during pandemics as in the COVID-19 pandemic case. Assessing the level of confidence in vaccines among HCPs is an essential step to implement an effective national vaccine program to enhance vaccination uptake and control infections spread during pandemics.

Acknowledgments

We would like to thank the cooperative healthcare providers who participated in the study or its pilot phase.

Statement of Ethics

Written informed consent to participate in the study was obtained from all participants and their anonymity was preserved. All the authors complied with all relevant ethical regulations. The research was reviewed and approved by the Prince Sultan Medical Military City Ethics Committee (IRB Approval # 1427).

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Funding Sources

The authors received no financial support for the research, authorship, and publication of this article.

Author Contributions

F.A.: study design, data collection, analysis, and writing; O.A.: data collection and writing; M.A.: data collection and writing; A.A.: conceptualization, study design, analysis, and writing.

Data Availability Statement

The datasets analyzed during the current study are available from the corresponding author on reasonable request.

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