

Vaccine hesitancy and acceptance: an examination of predictive factors in COVID-19 vaccination in Saudi Arabia

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Summary

Vaccine hesitancy is a global health issue and can be affected by several variables. We explored the predictive factors and causes of vaccine hesitancy among adults in Saudi Arabia. An online survey method with multiple regression analysis was used to identify factors predicting of vaccine hesitancy in 558 adults (46.24% women and 53.76% men). The prevalence of vaccine hesitancy is 20.6%, with higher rates among females, young people and single people. About 70% of the participants believe that vaccine hesitancy is due to concerns about the safety and efficacy of the vaccine, a lack of information about the disease and vaccine or social media. The vaccine acceptance rate is 71.3%; 17.2% are not willing to accept a COVID-19 vaccine and 11.5% are unsure. Males and married people are more accepting of the vaccine. The risk factors that predict vaccine hesitancy include age, gender, belief in conspiracy theories and psychosocial factors. Meanwhile, age, gender, belief in conspiracy theories, concerns about the safety and efficacy of the vaccine and psychosocial factors significantly predict vaccine acceptance. The high rate of vaccine hesitancy could undermine efforts to combat COVID-19. Factors predicting vaccine hesitancy can be used in interventions to address this issue during major epidemics.

Key words: vaccine hesitancy, vaccine acceptance, predict factors, conspiracy theory, COVID-19

INTRODUCTION

Coronavirus vaccines were quickly produced and approved on an emergency basis to contain and control the epidemic; they appear to prevent the spread of COVID-19 (Hotez *et al.*, 2021). Some of these vaccinations use a new technology based on mRNA, which has raised the fears of many people due to concerns about the speed of development of the vaccine (Chou and Budenz, 2020; Mills *et al.*, 2020). Such concerns have increased vaccine hesitation around the world.

According to the World Health Organization, vaccine hesitancy is the ‘delay in acceptance or refusal of vaccination despite [the] availability of vaccination services’ (MacDonald and SAGE, 2015). It is one of the 10 major threats to global health (WHO, 2020) and is considered one of the most disruptive factors affecting progress in vaccinating people against infectious diseases (Geoghegan *et al.*, 2020). In many countries, misinformation and vaccine hesitation are major obstacles to achieving community immunity (Larson *et al.*, 2014).

Vaccine hesitancy is a global problem associated with multiple and complex causes depending on when and where vaccination occurs, which vaccine is involved, the target audience for the vaccine (Palamenghi *et al.*, 2020; Lazarus *et al.*, 2021) and psychological, cognitive and demographic factors (Hornsey *et al.*, 2018; Akande *et al.*, 2021). It also varies with culture, geography, the timing of vaccine delivery and confidence in the vaccine itself (Palamenghi *et al.*, 2020; Robertson *et al.*, 2021). Earlier studies revealed regional variations in perceptions of the effectiveness and safety of vaccination; it has been noted that hesitancy is a major problem in high-income countries (Wagner *et al.*, 2019; Kennedy, 2020; Lin *et al.*, 2020; Sallam, 2021). Lower-income regions had the highest certainty regarding vaccine safety and effectiveness (Wagner *et al.*, 2019; Lin *et al.*, 2020; Sallam, 2021), while there is a relatively high trend toward acceptance of the COVID-19 vaccine in middle-income countries (Lazarus *et al.*, 2021).

In Saudi Arabia, especially at the beginning of the emergence of the COVID-19 vaccine, many incorrect ideas about the vaccine spread through social media. Most of them revolve around conspiracy theories and question the effectiveness of the vaccine, indicating that medical companies and institutions seek profit and do not care about people's health. These rumors and fabricated news affect the intention to receive the vaccination. Therefore, it is appropriate for future intervention programs to target these rumors and misinformation and to refute them.

In this context, the acceptance rate among Malaysians was high (Sallam, 2021; Syed Alwi *et al.*, 2021). A percentage of the population in the USA said they would not be vaccinated (Chou and Budenz, 2020); this percentage ranged between 18.8% and 27.3% (Akel *et al.*, 2021). In other communities, about one-quarter of parents were reluctant to take the vaccine, whether for themselves, their spouses or their children (Xu *et al.*, 2021). A recent review revealed that the highest vaccine acceptance rates were found in Ecuador, Malaysia, Indonesia and China. Meanwhile, the Arab countries topped the list of nations with a low acceptance rate for the COVID-19 vaccine; the lowest acceptance rates were in Kuwait, Jordan, Italy, Russia, Poland, USA and France. Low rates of vaccine acceptance were found in the Middle East, in addition to Russia, Africa and several European countries (Sallam, 2021). Vaccine hesitancy was higher among urban residents, females, older adults and those without reported symptoms. The differences were not significant according to other social and economic characteristics, behaviors, health conditions and labor market variables (Oliveira *et al.*, 2021).

In a study that included a large sample of 19 countries, 71.5% of participants reported that they would take the COVID-19 vaccine. The participants who had high confidence in information obtained from government sources were more accepting of the vaccine (Lazarus *et al.*, 2021). In total, 67% confirmed that they would accept the COVID-19 vaccine (Malik *et al.*, 2020). Studies have also shown an association between demographic, social, economic and behavioral variables with acceptance of the COVID-19 vaccine, while 22% of respondents said that they were not willing to take the vaccine (Kadoya *et al.*, 2021).

The high rates of vaccine hesitation are a clear indication of the obstacles that stand in the way of vaccination (Xu *et al.*, 2021) and are considered an international threat to progress in the fight against vaccine-preventable infectious diseases. This makes hesitancy a central issue in COVID-19 immunization plans (Oliveira *et al.*, 2021). However, most causes of vaccine hesitancy remain unclear and complex, as they include demographic, socioeconomic, cultural, behavioral and psychological factors (Palamenghi *et al.*, 2020), such as the effectiveness, safety, and people's trust of the vaccine, which will inevitably affect the vaccine's acceptance.

Despite the importance of exploring the factors associated with this problem, studies in Saudi Arabia and Arab countries are still rare. This issue requires further investigation due to the role that cultural differences might play in factors influencing vaccine hesitancy.

Therefore, understanding vaccine hesitancy related to COVID-19 and its associated factors is critical to designing a successful immunization program. Also, it will help with the development of evidence-based interventions to address anti-vaccine attitudes (Malik *et al.*, 2020), which further increases the importance of research in this area.

This study aims to identify prevalence rates and the predictive factors of COVID-19 vaccine hesitancy and acceptance among adults in Saudi Arabia.

METHODS

Study design

This study collected self-reported data through online scales from an adult sample in Saudi Arabia to assess vaccine hesitancy, the reasons for hesitancy and factors that correlate with vaccine hesitancy. Data were collected from 8 to 27 July 2021. The questionnaire was distributed online in the Arabic language with a link from Google Forms and was designed to avoid missing

values. Before answering the questionnaire, participants provided online written informed consent. Ethics approval was obtained from the competent authorities.

Participants

Most of the participants were recruited online via emails, SMS messages and announcements about the questionnaire on Saudi psychological forums (mental health and psychotherapy forums or the websites of counseling and psychotherapy centers located in most Saudi cities). Individuals who gave their email addresses or phone numbers, the questionnaire was sent to them via email or SMS message. Only 412 (19.49%) of the 2113 who were contacted via email or phone message, agreed to participate in this study.

The other participants were recruited online through the SOADAA Center.

Eligible individuals were age 18 years and above, fluent in Arabic and resided in the Saudi Arabia.

Measures

Vaccine hesitancy and related variables were assessed as follows:

- a. Vaccine Hesitancy Questionnaire (VHQ): A four-item questionnaire about hesitancy and acceptance of the COVID-19 vaccine (e.g. willingness and acceptance of taking the vaccine, whether they had gotten the COVID-19 vaccine or still hesitated, the number of shots received if one had taken the vaccine, and whether they had refused a vaccination—such as the influenza vaccine—in the past). The response options for this question were ‘yes’, ‘no’ and ‘not sure’.
- b. Questionnaire of Vaccine Hesitancy Reasons (QVHR): A 38-item questionnaire with a five-point scale (1=strongly agree, 5=strongly disagree) was prepared for this study to assess the cases or conditions that might be among the reasons for hesitating to take the COVID-19 vaccine. The questionnaire was prepared after a review of the scales and literature in this area [e.g. (Jolley and Douglas, 2014; Larson *et al.*, 2015; Shapiro *et al.*, 2016, 2018; Wallace *et al.*, 2019; Majid and Ahmad, 2020; Cerda and García, 2021; Truong *et al.*, 2021)]. In this questionnaire, we inquired about the reasons why people hesitate to receive the COVID-19 vaccine. We provided several possible reasons (38 items drawn from previous literature), and the respondent had to choose the appropriate answer for each item from five alternatives.

The items were divided into eight subscales: lack of information about the disease and vaccine (six

items), belief in conspiracy theory (five items), the role of social media (three items), concerns about the safety and efficacy of the vaccine (seven items), psychological and social factors (five items), distrust of health institutions (four items), vaccine risks (six items) and religious reasons (two items).

- c. Vaccine Conspiracy Beliefs Scale (VCBS): Developed by Jolley and Douglas (Jolley and Douglas, 2014) and validated by Shapiro *et al.* (Shapiro *et al.*, 2016). It consists of six items on a seven-point scale for assessing the belief in a conspiracy theory regarding the safety and efficacy of the vaccine. In this study, we used a five-point scale (1=strongly distrust, 5=strongly trust).

Demographic variables covered socio-demographic characteristics, such as gender, age, education, marital status and previous infection with corona or not.

Statistical analysis

Statistical analysis was performed using the IPM SPSS software (version 25). The dataset included 558 participants, which is a sufficient sample size to detect the effect of independent variables on vaccine hesitancy using multiple regression. The independent variables included age, gender, educational level, marital status and overall score on the VCBS, as well as the overall score on the eight subscales on the QVHR.

To examine the psychometric properties of the scales, the reliability coefficients of Cronbach's alpha and split-half were conducted and internal consistency was examined. The prevalence rates of vaccination hesitancy and acceptance in the total sample were estimated at the 95% confidence level. Pearson's chi-square test ($\alpha=0.05$) was used to estimate the prevalence rates based on independent variables.

We relied on linear regression analysis (Inter method) to detect factors predicting vaccine hesitancy and acceptance. All independent variables were entered one by one. The final model was obtained by keeping variables in the analyses with $p < 0.05$.

RESULTS

Sample characteristics and psychometric properties of questionnaire

The study's sample ($n=558$) included 46.24% women and 53.76% men. Age ranged between 18 and 65 years (mean 38.66 ± 9.067). The majority of respondents were married (73.8%), while (21.3%) were single and (4.8%) were divorced or widowed. A total of 58.2% had tertiary education, 9% had attended secondary

school, 22% had a master's degree and 10.6% had a doctorate. A total of 58.6% had received one shot of the COVID-19 vaccine, 21% had received two shots and 20.4% had not received the vaccine yet. The percentage of those who refused or hesitated to previously receive any vaccination (such as the influenza vaccine) was 37.8%. The descriptive statistics of the sample are shown in Table 1.

The questionnaire of vaccine hesitancy was validated and had good psychometric properties. The reliability coefficient of *Cronbach's alpha* was (0.589), while it was (0.46) in the *split-half reliability* (the Spearman–Brown coefficient was 0.63). In the QVHR, the reliability coefficient of *Cronbach's alpha* was (0.908), while it was (0.896) in the *split-half reliability* (the Spearman–Brown coefficient was 0.945). The VCBS is a validated scale (Jolley and Douglas, 2014; Shapiro *et al.*, 2016). In this study, the reliability coefficient was (0.926) in *Cronbach's alpha* and (0.857) in the *split-half reliability* (the Spearman–Brown coefficient was 0.92).

The internal consistency of questionnaires was calculated; the correlation ranged between 0.267 and 0.827 on the VHQ. It ranged between 0.195 and 0.645 in the QVHR. Meanwhile, the correlation ranged between 0.70 and 0.91 on the VCBS. All correlations were significant at the 0.01 level (2-tailed).

Vaccine hesitancy and vaccine acceptance

Vaccine hesitancy among participants was 20.6%. Females reported higher hesitancy than males, and the gender differences were significant ($\chi^2 = 7.251$, $p = 0.007$). Married people were less hesitant (17.47%) than single (29.41%) and divorced/widowed people (29.63%). The differences were significant ($\chi^2 = 9.451$, $p = 0.009$). Vaccine hesitancy was higher among younger people (between 18 and 37 years old) than among participants aged between 38 and 47 or between 48 and 65 ($\chi^2 = 10.450$, $p = 0.005$), as shown in Table 2.

Vaccine hesitancy was higher among secondary school than university degree holders and higher degree holders, but the differences were not significant ($\chi^2 = 6.606$, $p = 0.086$), as shown in Figure 1.

Vaccine acceptance was 71.3% ($n = 398$); 17.2% ($n = 96$) were not willing to accept a COVID-19 vaccine, and 11.5% ($n = 64$) were unsure. Males were more accepting of the vaccine (77.33%) than females (64.34%), and the differences were significant ($\chi^2 = 11.448$, $p = 0.001$).

Married people were more accepting of the vaccine (74.76%) than single people (65.55%) and divorced/widowed people (44.4%). The differences were significant ($\chi^2 = 13.855$, $p = 0.001$). Older people (from 48 to 65 years old) were more accepting of the vaccine

Table 1: Descriptive statistics of the participants

Sex	Male		Female					
	<i>n</i>	%	<i>n</i>	%				
	300	53.76	258	46.24				
Age gropes	18–37		38–47		48–65			
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%		
	223	40	255	45.7	80	14.3		
Marital status	Single		Married		Divorced/widowed			
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%		
	119	21.3	412	73.8	27	4.8		
Education levels	Secondary school		Graduate		Master		Doctorate	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
			325	58.2	123	22	59	10.6
Vaccine doses	One shot		Two shots		Unvaccinated			
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%		
	327	58.6	117	27	114	20.4		
Previous vaccine hesitation (e.g. influenza vaccination)	Yes		No		Not sure			
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%		
	211	37.8	301	53.9	46	8.2		

Table 2: Differences in vaccine hesitancy according to demographic variables

		Hesitators		Non-hesitators		Total
		<i>n</i>	%	<i>n</i>	%	
Education	Secondary	16	31.13	35	68.62	51
	Graduate	70	21.54	255	78.46	325
	Master	18	14.63	105	85.36	123
	Doctorate	11	18.64	48	81.14	59
Total		115	20.60	443	79.39	558
Pearson chi-square = 6.606						<i>p</i> < 0.086
Age groups		Hesitators		Non-hesitators		Total
		<i>n</i>	%	<i>n</i>	%	
	18–37	61	27.35	162	72.64	223
	38–47	40	15.69	215	84.31	255
	48–65	14	17.5	66	82.5	80
Pearson chi-square = 10.450						<i>p</i> < 0.005
Marital status		Hesitators		Non-hesitators		Total
		<i>n</i>	%	<i>n</i>	%	
	Single	35	29.41	84	70.59	119
	Married	72	17.47	340	82.52	412
	Divorced or widowed	8	29.63	19	70.37	27
Pearson chi-square = 9.451						<i>p</i> < 0.009
Sex		Hesitators		Non-hesitators		Total
		<i>n</i>	%	<i>n</i>	%	
	Male	49	16.33	251	83.66	300
	Female	66	25.58	192	74.42	258
Pearson chi-square = 7.251						<i>p</i> < 0.007

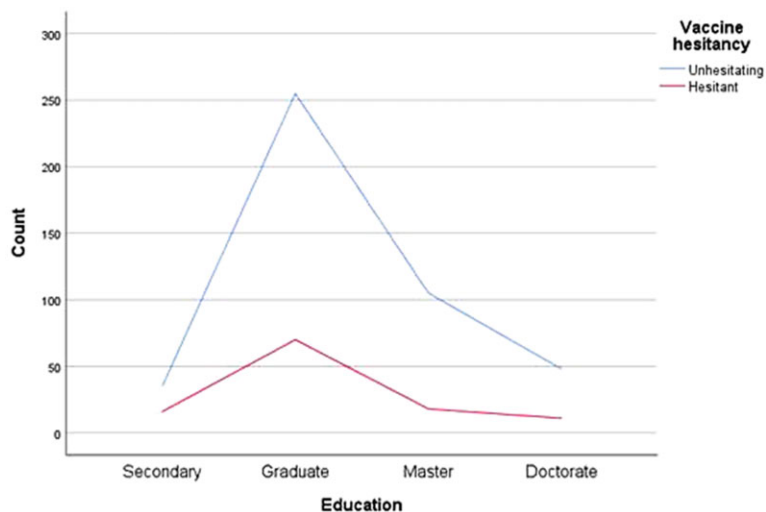


Fig. 1: Differences in vaccine hesitancy according to education levels.

(76.3%) than other age groups, but without significant differences ($\chi^2 = 4.601, p = 0.100$). The differences in vaccine acceptance were not significant according to educational level ($\chi^2 = 0.501, p = 0.919$).

Table 3 shows the response rate to the QVHR.

As per Table 3, 85.7% of respondents believed that ‘concerns about the side effects of the vaccine, such as allergies, blood clots, etc.’ are the cause of vaccine hesitancy, while 84% of the participants thought that the vaccine hesitancy was related to the belief that ‘the disease is new and unknown previously’. Meanwhile, ‘the lack of confidence in the efficacy of the vaccine’ and ‘the long-term effects of vaccines are not known’ got 83% and 82%, respectively.

Table 4 shows the response rate to the subscales in the QVHR.

As per Table 4, most respondents (76.22%) attributed vaccine hesitancy to concerns about the safety and efficacy of the vaccine, 73.33% to a lack of information about the disease and vaccine, 70.8% to social media, 67.9% to conspiracy theories and 62% to psychological and social factors.

The results of this study revealed that few participants agreed with conspiracy theories regarding the COVID-19 vaccine, as shown in Table 5.

Factors predicting vaccine hesitancy and acceptance

We used multiple regression analysis employing the Inter method to detect the factors predicting vaccine hesitancy. The results are shown in Table 6 and Figure 2 below.

Table 6 shows that age, gender, total score of the conspiracy belief scale and total score of the second and fifth subscales of the QVHR significantly predicted vaccine hesitancy.

The factors that predicted vaccine acceptance included age, gender, total score of the conspiracy belief scale and total score of the second, the fourth and the fifth subscales in the QVHR. Table 7 shows these results.

DISCUSSION

We conducted a study of COVID-19 vaccine hesitancy and acceptance among adult participants. Vaccine hesitancy in the current study was relatively high and comparable to that of previous studies (Cerdeira and García, 2021; Robinson *et al.*, 2021; Xu *et al.*, 2021). These results reflect the persistence of hesitation in a

significant proportion of adults, which requires further treatment.

Compared to other studies (Fisher *et al.*, 2020; Majid and Ahmad, 2020; Malik *et al.*, 2020; Martin *et al.*, 2021; Oliveira *et al.*, 2021; Robinson *et al.*, 2021; Truong *et al.*, 2021), females, single people and younger people were more hesitant than other groups. Potential impacts of demographic variables (such as gender, marital status, age and education) on public attitudes toward vaccines should be considered. We believe that the best way to deal with vaccine hesitancy and enhance vaccine acceptance among the population is to employ factors that affect vaccine acceptance, such as gender, age, education level, beliefs in conspiracy theories and psychosocial factors. For example, psychological counseling can be used to counter fake news in the context of these factors (Atehortua and Patino, 2021; Talabi *et al.*, 2021).

In this study, vaccine acceptance was fairly high. It became clear that about one-third of the participants either would not accept a COVID-19 vaccine or were not sure. These results point to the need to enhance vaccine acceptance among the population in Saudi Arabia through education campaigns and are consistent with the results of previous studies (Malik *et al.*, 2020; Akel *et al.*, 2021; Chigozie *et al.*, 2021; Kadoya *et al.*, 2021; Lazarus *et al.*, 2021; Oliveira *et al.*, 2021).

In this regard, researchers realize that vaccines, even if they are highly effective, do not work for everyone (Madison *et al.*, 2021), with the potential for side effects. Other factors playing a prominent role in the increase in attitudes against the COVID-19 vaccine include misinformation and social media (Broadbent, 2019; Kennedy, 2020; Wilson and Wiysonge, 2020; Piedrahita-Valdés *et al.*, 2021), where skeptical voices emerged with evidence of low vaccine acceptance (Bendau *et al.*, 2021). It has been found that gender, age and the use of social media are highly predictive of a belief that vaccines are unsafe. In addition, the spread of misinformation is of great statistical importance in predicting a decline in response to vaccination (Fisher *et al.*, 2020; Malik *et al.*, 2020; Wilson and Wiysonge, 2020; Martin *et al.*, 2021; Robinson *et al.*, 2021).

On the other hand, researchers have found several factors that can increase the likelihood of accepting a COVID-19 vaccination. These factors include being male, being married, being aware of a high risk of infection, having received the influenza vaccine, believing in the vaccine’s efficacy and valuing doctors’ recommendations regarding the COVID-19 vaccine (Wang *et al.*, 2020). The most significant factors associated with vaccine hesitancy included misinformation about the

Table 3: Response rates in the questionnaire of vaccine hesitancy factors

Domain	Items	Disagree ^a		Agree ^b		Not sure		Mean	SD
		n	%	n	%	n	%		
1	Lack of information about disease and vaccine	45	8	469	84	44	7.9	4.14	0.923
2	The disease is new and unknown previously	83	14.9	429	76.8	46	8.2	3.94	1.073
3	There is not enough information about the vaccine mRNA is a new technology that we do not know much about	27	4.8	321	57.6	210	37.6	3.74	0.896
4	The long-term effects of vaccines are not known	27	4.8	458	82.1	73	13	4.25	0.891
5	Spreading misinformation about the vaccine	33	5.9	409	73.3	116	20.8	4.03	0.941
6	Ignorance of the importance of vaccination in eliminating the epidemic	94	16.9	366	65.6	98	17.6	3.69	1.089
7	The conspiracy theory is the reason why people are reluctant to receive the vaccine	50	8.9	399	71.6	109	19.5	3.94	1.022
8	The ambiguity of vaccine manufacturers' positions toward compensating those affected by vaccines	48	8.6	350	62.7	160	28.7	3.81	0.974
9	Concern about the motives of companies producing coronavirus vaccines	62	11.1	360	64.5	136	24.4	3.75	0.999
10	The belief that COVID-19 was invented by politicians and pharmaceutical companies	61	11	377	67.6	120	21.5	3.87	1.057
11	Exaggerate the effect of the coronavirus	62	11.1	408	73.1	88	15.8	3.95	1.042
12	Social media played a negative role in inciting people against the vaccine	47	6.4	405	72.6	106	19	3.91	0.966
13	Intensive shadowing efforts to question the efficacy and safety of the vaccine	37	6.7	426	76.4	95	17	3.99	0.921
14	The spread of media rhetoric between doctors who support and oppose the vaccine	70	12.5	354	63.4	134	24	3.75	1.035
15	Concerns about the side effects of the vaccine, such as allergies, blood clots, etc.	16	2.9	478	85.7	64	11.5	4.23	0.789
16	Concerns about the safety of the vaccine	40	7.1	405	72.6	113	20.3	3.94	0.956
17	Concerns about the effectiveness of the vaccine	60	10.8	394	70.7	104	18.6	3.86	0.988
18	Inconsistent data on the effectiveness of the vaccine against the virus or the mutant	40	7.1	403	72.3	115	20.6	3.96	0.928
19	Some cases of coronavirus infection despite receiving the vaccine	27	4.8	466	83.5	65	11.6	4.25	0.870
20	The rapid development of vaccines has raised fears and doubts	46	8.2	440	78.8	72	12.9	4.11	0.951
21	Lack of confidence in the vaccine	70	12.5	391	70	97	17.4	3.88	1.050
22	Psychological and social factors	52	9.3	355	63.6	151	27	3.77	0.960
	Increased psychological and emotional responses to illness, such as anger, stress, fear and anxiety, led to vaccine hesitation								
23	Some negative reactions may lead to vaccine hesitation	45	8.1	419	75.1	94	16.8	3.92	0.898
24	Lack of social responsibility may be a reason for anti-vaccine attitudes	117	21	325	58.3	116	20.8	3.49	1.155

(continued)

Table 3: (Continued)

Domain	Items	Disagree ^a		Agree ^b		Not sure		Mean	SD
		n	%	n	%	n	%		
25	Poor social awareness may be a reason for anti-vaccine attitudes	106	19	352	63.1	100	17.9	3.59	1.120
26	Some people believe that herd immunity will protect them	107	19.1	281	50.3	170	30.5	3.42	1.069
27	Distrust in public health physicians	88	15.8	329	59	141	25.3	3.64	1.009
28	Lack of campaigns and educational programs in the field of corona vaccine	183	32.8	258	46.2	117	21	3.20	1.193
29	Weak efforts to enhance trust between health institutions and citizens	132	23.7	292	52.4	134	24	3.42	1.141
30	Doubts about the credibility of some scientific and health institutions	62	11.1	368	66	128	22.9	3.80	1.001
31	Corona vaccine may lead to infertility or difficulties in childbearing and pregnancy	67	12	280	50.2	211	37.8	3.58	0.979
32	Vaccine side effects	53	9.5	394	70.6	111	19.9	3.86	0.948
33	It is difficult to get rid of the negative consequences of corona vaccines	112	20.1	174	31.2	272	48.7	3.22	1.074
34	Concerns about the effect of the vaccine on the health of the fetus and the expectant mother.	72	12.9	269	48.2	217	38.9	3.52	1.037
35	Suspicion that the vaccine is still risky	52	9.3	377	67.6	129	23.1	3.84	1.001
36	Concerns about a potential conflict between the vaccine and chronic disease	46	8.2	354	63.5	158	28.3	3.76	0.954
37	Religious reasons	388	59.5	58	10.4	112	20.1	2.06	1.112
38	The vaccine is contrary to God, saying, 'Do not throw yourselves into destruction'	341	61.1	85	15.2	132	23.7	2.26	1.215

^aTotal of strongly disagree and disagree.^bTotal of strongly agree and agree.

Table 4: Response rates on the subscales of the questionnaire of vaccine hesitancy factors

Domains	Disagree	Agree	Not sure	Mean	SD
1 Lack of information about disease and vaccine	9.21%	73.23%	15.35%	23.79	3.309
2 Belief in conspiracy theory	10.14	67.9	21.98	3.86	1.018
3 The role of social media	8.53%	70.8%	20%	3.88	0.974
4 Concerns about the safety and efficacy of the vaccine	7.62%	76.22%	16.13%	4.032	0.93
5 Psychological and social factors	15.3%	62.08%	22.6%	3.638	1.04
6 Distrust of health institutions	20.85%	55.9%	23.3%	3.51	1.086
7 Vaccine risks	12%	55.22%	32.78%	3.63	0.998
8 Religious reasons	60.3%	12.8%	21.9	2.16	1.164

Table 5: Responses to the items of the VCBS

Items	Disagree ^a		Agree ^b		Not sure		Mean	SD
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%		
1 Vaccine safety data are often fabricated	156	27.96	167	29.93	235	42.1	3.4	1.128
2 Vaccines are harmful and this fact is hidden	263	47.13	81	14.5	214	38.4	2.57	1.083
3 Pharmaceutical companies cover up the dangers of vaccines	164	29.3	173	31.0	221	39.6	3.05	1.203
4 People are deceived about vaccine efficacy	214	38.35	147	26.3	197	35.3	2.89	1.179
5 Vaccine efficacy data are often fabricated	215	38.53	148	26.5	195	34.9	2.88	1.175
6 People are deceived about vaccine safety	226	40.5	142	25.44	190	34	2.85	1.156

^aTotal of strongly disagree and disagree.

^bTotal of strongly agree and agree.

vaccine, refusal of a previous vaccine (such as influenza), concerns about the safety and efficacy of the vaccine and psychological factors (Broadbent, 2019; Fisher *et al.*, 2020; Kennedy, 2020; Lin *et al.*, 2020; Malik *et al.*, 2020; Wilson and Wiysonge, 2020; Bendau *et al.*, 2021; Martin *et al.*, 2021; Piedrahita-Valdés *et al.*, 2021; Robinson *et al.*, 2021).

As an extension of those previous studies (Broadbent, 2019; Fisher *et al.*, 2020; Kennedy, 2020; Malik *et al.*, 2020; Wilson and Wiysonge, 2020), we found that gender, age (between 38 and 47 years old), vaccine conspiracy beliefs and two subscales in the QVHR—the second subscale (belief in conspiracy theory) and the fifth subscale (psychological and social factors)—significantly predicted vaccine hesitancy.

With regard to the responses to the items on the QVHR, we found that the items relating to the side effects of the vaccine, such as Item No. 15 ‘concerns about the side effects of the vaccine, such as allergies, blood clots, etc.’, Item No.1 ‘The disease is new and previously unknown’ and Item No. 4 ‘The long-term effects of vaccines are not known’, had the highest rate of agreement among the participants. The items that talked about the inconsistency between vaccination and the Islamic religion were less accepted among the

respondents. On the other hand, ‘concerns about the safety and efficacy of the vaccine’, ‘lack of information about the disease and vaccine’ and ‘the role of social media’ were the most accepted reasons for vaccine hesitancy. The ‘belief in conspiracy theory’ obtained the agreement of two-thirds of participants. The percentage of psychological and social factors was not high. Reasons related to ‘distrust of health institutions’ and ‘vaccine risks’ were accepted by almost half of the respondents (Table 4). Consistent with the results of this study, studies have found that fears over unknown future effects are the main reason for hesitancy (Robertson *et al.*, 2021). Reasons for vaccine hesitancy included fears of vaccination, a lack of trust, anti-vaccine beliefs or attitudes, a need for more information (Fisher *et al.*, 2020) and concerns regarding side effects, safety, lack of information and vaccine effectiveness (Syed Alwi *et al.*, 2021). In addition, individuals with conspiratorial beliefs were less willing to vaccinate (Jennings *et al.*, 2021).

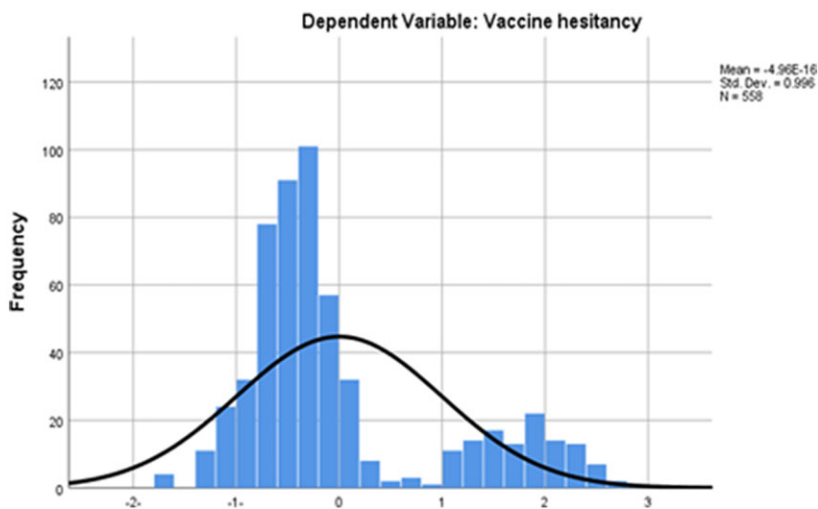
In this study, we hypothesized that conspiracy theory beliefs would be a significant predictor of vaccine hesitancy and vaccine acceptance. The results supported this hypothesis, as conspiracy theory beliefs (through the total score on the conspiracy beliefs scale) significantly

Table 6: Multiple regression for predictive factors of vaccine hesitancy

Model summary						
Model ^b	R	R ²	Adjusted R ²	Std. error of the estimate		
1	0.401 ^a	0.161	0.154	0.372		
ANOVA ^a						
Model	Sum of squares	df	Mean square	F	Sig.	
Regression	14.717	5	2.943	21.217	0.000 ^b	
Residual	76.582	552	0.139			
Total	91.299	557				
Coefficients ^a						
Model 1	Unstandardized coefficients		Standardized coefficients		t	Sig.
	B	Std. error	Beta			
(Constant)	1.456	0.131			11.156	0.000
Age groups	-0.060	0.023	-0.102		-2.560	0.011
Gender	0.074	0.032	0.092		2.305	0.022
Vaccine conspiracy beliefs scale	0.020	0.003	0.296		7.023	0.000
Subscale 2	-0.015	0.006	-0.119		-2.650	0.008
Subscale 5	-0.018	0.005	-0.162		-3.688	000
Mahal. distance	Minimum	Maximum	-0.102			SD
	0.937	33.368	4.991			3.237

^aDependent variable: vaccine hesitancy.

^bPredictors: (Constant), gender, age groups, total score of vaccine conspiracy beliefs scale and Subscales 2 and 5 in the questionnaire of vaccine hesitancy reasons.

**Fig. 2:** Regression standardized residual.

predicted vaccine hesitancy and acceptance (see [Tables 6](#) and [7](#)). These results may be attributed to the spread of information related to conspiracy theories surrounding

the coronavirus and about vaccines since the beginning of the coronavirus pandemic, as well as since the start of vaccination.

Table 7: Predictive factors of vaccine acceptance

Model summary					
Model ^b	R	R ²	Adjusted R ²	Std. error of the estimate	
1	0.635 ^a	0.403	0.397	0.352	
ANOVA ^a					
Model	Sum of squares	df	Mean square	F	Sig.
Regression	46.004	6	7.667	62.020	0.000 ^b
Residual	68.118	551	0.124		
Total	114.122	557			
Coefficients ^a					
Model 1	Unstandardized coefficients		Standardized coefficients	t	Sig.
	B	Std. error	Beta		
(Constant)	0.913	0.127		7.200	0.000
Age groups	-0.046	0.022	-0.071	-2.105	0.036
Gender	0.084	0.031	0.092	2.716	0.007
Vaccine conspiracy beliefs scale	0.034	0.003	0.440	10.842	0.000
Subscale 2	-0.025	0.006	-0.183	-4.339	0.000
Subscale 4	0.023	0.004	0.246	5.379	0.000
Subscale 5	-0.023	0.005	0.189	-5.058	0.000
Mahal. distance	Minimum	Maximum	Mean		SD
	1.125	35.860	5.989		3.727

^aDependent variable: vaccine acceptance.

^bPredictors: (Constant), age groups, gender, vaccine conspiracy beliefs scale and the second, fourth and fifth subscales of the questionnaire of vaccine hesitancy reasons.

The relationship between belief in conspiracy theories about the COVID-19 vaccine and hesitation or acceptance with regard to the vaccine can be understood by looking at the differences between hesitating and unhesitating people. The average scores of the hesitating people on the conspiracy beliefs scale and the second subscale, 'belief in conspiracy theory' (on the QVHR), were greater than those of unhesitating participants. This also applies to vaccine acceptance. The appropriate interpretation of these results is that when a person believes that vaccines are unsafe, are ineffective, or may have negative effects in the future, such beliefs will be reflected in the person's attitudes toward the vaccine and will manifest as a hesitation or refusal of the COVID-19 vaccine.

It was noteworthy that the psychological and social factors mentioned in the QVHR included fear, anxiety and negative emotions toward the vaccine. In this regard, a significant relationship was found between anxiety or fears of COVID-19 and vaccine acceptance (Bendau *et al.*, 2021). There is also credible evidence that psychological factors correlate with the prevalence and severity of vaccine side effects, and that anxiety,

stress, depression, unhealthy behaviors and loneliness can impair the immune system's response to the vaccine (Madison *et al.*, 2021).

Factors that contributed to the increased acceptance of the COVID-19 vaccine included being male, older age and married. Males, older people and married people were less hesitant than females, young people and single or divorced people. Also, this study revealed that the total score on the conspiracy belief scale and the second (belief in conspiracy theory), fourth (concerns about the safety and efficacy of the vaccine) and fifth (psychological and social factors) subscales in the QVHR and gender significantly predicted vaccine acceptance.

An Italian survey found that, compared to other countries, the proportion of participants intending to get the COVID-19 vaccine was very small (Palamenghi *et al.*, 2020). Approximately 42.4% of respondents in the USA either were unsure or did not intend to receive a COVID-19 vaccine (Fisher *et al.*, 2020). The percentage of those who said they would not take the COVID-19 vaccine was 5.2%, without significant differences between males and females in the average willingness to accept the vaccine. Also, age and educational level were

found to have a significant and positive relationship with vaccination acceptance (Bendau *et al.*, 2021). Fisher *et al.* (Fisher *et al.*, 2020) found that lower educational level, younger age and previous refusal to receive the influenza vaccine were the factors most associated with vaccine hesitancy. Mesele (Mesele, 2021) reported that over half of the participants confirmed that they would not accept the COVID-19 vaccine. The elderly were more accepting of the vaccine than the younger, males were more accepting than females and holders of university or postgraduate degrees were more accepting than those without a university degree. Unemployed participants were less accepting of the vaccine compared to the employed or retired (Malik *et al.*, 2020).

In contrast to the results of our study, the novelty of the disease and concerns about the safety and efficacy of the vaccine have caused a significant proportion of vaccination refusals in the USA (Chou and Budenz, 2020) and Brazil (Oliveira *et al.*, 2021).

Finally, this study revealed important results that will have an impact on efforts to combat vaccine hesitancy among adults.

CONCLUSIONS

Our findings provide support for the importance of studying the factors associated with vaccine hesitancy and acceptance during major epidemics.

There is a high rate of vaccine hesitancy among adults. One-fifth of the respondents hesitated to receive the vaccine, and nearly one-third did not accept the COVID-19 vaccine. Most participants agreed that factors related to the safety and efficacy of the vaccine, and long-term side effects, were the most common reasons for vaccine hesitancy.

There is an urgent need to implement more awareness of the importance of the vaccine to eliminating the COVID-19 pandemic.

FUNDING

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

CONFLICTS OF INTERESTS

There is no conflict of interest.

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