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Factors related to COVID-19 vaccine hesitancy in Saudi Arabia

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ABSTRACT

Objectives: To assess the amount of vaccine hesitancy and its determinants in relation to various demographic, social, and personal characteristics among the Saudi population.
Study design: Cross-sectional study.
Methods: we utilized a structured questionnaire on a five point-Likert scale that included immunization process awareness, perception towards immunization and factors leading to vaccine refusal.
Results: The study included 5965 participants characterized according to various demographical factors. The participant's knowledge, perception, and the factors affecting the decision of taking the vaccine were calculated. About 40.7% had enough information about COVID-19 vaccines and were willing to take it. The participant's perception towards COVID-19 vaccines is proportional to their knowledge and varied with the personal characteristics. Factors influencing vaccine use varied also with personal characteristics. Intent to be vaccinated was higher among older age groups, advanced education, retirees, and higher income persons ($P < 0.001$). Moreover, the influence of heterogeneity in personal perception towards COVID-19 vaccines has been discussed. Vaccine barriers scores were significantly higher among lower educational and income levels ($P = 0.004$). The leader's influence on vaccine decision was high ($p < 0.001$). The side effects of COVID-19 vaccine is the most important barrier to vaccine acceptance. Knowledge and perception score were consistently and significantly higher among the group who received their information from official websites, followed by those who had used both websites and social media ($p < 0.001$).
Conclusion: Additional approaches will be needed to effectively meet the needs of the hesitant population, particularly the safety and efficacy concerns, the speed of vaccine development, and the distrust in government and health organizations.

1. Introduction

Worldwide, strict control measures have been adopted to contain the deadly COVID-19 pandemic, including mass vaccine administration. It is well known that herd immunity limits the person-to-person spread of disease when a large portion of a community becomes immune to a disease. Availability of vaccine alone does not always indicate its use by the public [1]. The public's reluctance to be vaccinated or refusal of available vaccines undoubtedly contributes to its low acceptability [2]. In 2009, when a vaccine for influenza H1N1 vaccine was made available during the pandemic, the vaccination coverage was far below expectations, ranging from 0.4 to 59% across 22 countries [3].

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A June 2020 survey carried out in 19 countries to determine the possible COVID-19 vaccine compliance rates and causes of hesitancy indicated a wide range of potential acceptance rates from 55% to 90% in Russia and China, respectively [4].

Previous reports have shown that the level and causes of vaccine hesitancy are complex and varied by the vaccine itself, geographic region, health system, availability and accessibility and can be influenced by emotional, cultural, social, and political factors as much as cognitive ones [5]. Reasons for vaccine hesitancy also vary greatly according to personal characteristic and demographical factors [6].

Accurate knowledge and awareness largely affect vaccine acceptance or hesitancy [7]. Lack of knowledge may result in misperceptions that lead to vaccine hesitancy. Other individual factors influencing vaccine acceptance are related to the beliefs and perceptions towards disease prevention. Knowledge and perceptions towards immunization and prevention of diseases were frequently mentioned in the literature among the factors that might contribute to vaccine hesitancy [8].

Previous particular vaccine experience such as knowledge of someone who suffered from a vaccine preventable disease or an adverse event following immunization may also influence hesitancy or willingness to vaccinate. Historical influences of a previously unaccepted vaccine can also bring about vaccine hesitancy. Trust in government and healthcare providers brings about trust in vaccines and vaccination campaigns. A previous study revealed that higher levels of trust in government information sources are more likely to improve vaccine acceptance upon employer's advice [4].

Complex immunization procedures contribute largely to vaccine hesitancy. Perceptions of the potential risks and side effects of vaccination can affect vaccine acceptance. Moreover, risk awareness, advance education level and higher household income have been shown to increase the vaccine acceptance.

The media environment can negatively influence vaccination acceptance and contribute to vaccine hesitancy [9]. Influential leaders, immunization campaign leadership, and anti- or pro-vaccination groups can also influence the vaccine coverage. Religion, culture, gender, socio-economic are also among the vaccine hesitancy contributing factors [10]. Other factors may include vaccine accommodation facilities, perception of the pharmaceutical industry, personal experience with vaccination, including fear of pain [11]. Reliability and/or source of supply of vaccine and/or vaccination equipment were also mentioned. Moreover, the schedule of the vaccination program and mode of delivery (e.g., routine program or mass vaccination campaign) can affect the vaccine acceptance [12]. Generally, females, the young, and those of lower income or education level were consistently associated with less intention to be vaccinated [13].

Characterizing COVID-19 vaccine intentions, perceptions, and trust in local government and healthcare providers that influence vaccine decision-making are essential [14].

The extent of COVID-19 vaccine hesitancy by the Saudi community is not yet known. Therefore, this study has been proposed to assess the amount of vaccine hesitancy and its determinants among the Saudi population.

2. Methods

This cross-sectional study utilized a structured questionnaire designed according to the study's objectives by the research group following an extensive review of the literature.

The Ethics Review Board of Prince Sultan Military College of Health Sciences, Dhahran approved this study (IRB Number IRB-2021-CLS-001). Every participant signed a written informed consent.

The questionnaire includes the demographical variables such as age, gender, nationality, educational level, employment status, and monthly household income.

The second part includes 17 statements on a five-point Likert scale ranging from strongly agree to strongly disagree. These questions were grouped under three parameters that included immunization process awareness (4 questions), perception towards immunization (5 questions), and factors leading to vaccine refusal (8 questions).

A heterogeneous purposive sample of the community who were more than 18 years old and were residing in Saudi Arabia during the COVID-19 pandemic were included in the study. Questions were first validated through a pilot test of 61 participants, who were not included in the study. Data collected from the pilot test were evaluated for the internal consistency reliability of the questionnaire using Cronbach's alpha reliability coefficient, which demonstrated a value of 0.80.

The questionnaire was administered to the participants by a web link through various social media applications and was made available from February 1 to 31 April 28, 2021.

2.1. Statistical analysis

The participants' knowledge and perception were measured by questions on a five-point Likert scale rating, ranging from strongly agree (5), agree (4), neutral (3), disagree (2), and strongly disagree (1). The mean score of every question was calculated out of five. The average scores of the immunization process awareness were calculated out of 20 points for the four related questions. The average scores of the participant's perception towards immunization were calculated out of 25 points for the five related questions. The average scores of the factors leading to vaccine refusal by the respondents were measured out of 40 points for the eight related questions.

Descriptive statistics (frequencies) were completed for all items. The results were analyzed with the use of SPSS software version 20.0 (SPSS, Chicago, Illinois). Internal consistency reliability of the questionnaire was measured by Cronbach's alpha, where coefficients of ≥ 0.7 demonstrate acceptable internal consistency. We used bivariate correlation between the knowledge, perception, and the factors affecting the COVID-19 vaccine use decision, and one way ANOVA to test the significant differences due to various demographic variables. The statistical significance was set at $P < 0.05$ for all analyses.

3. Results

Younger age groups of 18–24, 25–34, 35–44, and 45–54, were represented by 22.0%, 27.5%, 22.4%, and 17.5%, respectively (Table 1). Whereas older age groups of 55–64, 65–74, and 75+ were represented by 8.7%, 1.8%, and 0.2%, respectively. The results indicated an almost equal representation of males and females of 49.2% and 50.8, respectively. The majority of the participants (94.1%) were Saudi citizen. The majority of the respondents had a university degree (65.7%) or postgraduate studies (20.8%), whereas those with primary, elementary, and high schools education were represented by 0.3%, 1.4%, and 11.7%, respectively. The majority of the participants were employed (52.6%), while unemployed, retirees, and students were represented by 16.8%, 10.8%, and 19.8%, respectively. Most of the participant belonged to the middle classes with a monthly household's income of 5001–10000 SAR, 10001–20000 SAR, and 20001–40000 SAR, represented by 22.0%, 32.3%, and 22.2%, respectively, whereas lower income of less than 5000 SAR, higher incomes of 40001–60000 SAR, and greater than 60001 SAR were represented by 8.3%, 6.3%, and 9.0%, respectively. Of the total participants of the study 32.5% reported that they had obtained their information about COVID-19 vaccine from either official websites (governmental/non-governmental), 13.6% from social media (Facebook/Twitter/WhatsApp), 47.2% from both sources. Additionally, 6.8% reported a multiple of sources that included broadcasting (television/radio) journals (newspapers/magazines) and other sources (Family/Friends/Schools).

The participant's response to the questionnaire in a five point-Likert scale is shown in Table 2. The participant's knowledge, perception, and the factors affecting the decision of vaccine use were calculated as the total of those who strongly agreed or agreed and their average score (out

Table 1
Demographic factors of the total participants (n = 5965).

Demographic Characteristics	Frequency	Percentage
Age group		
18–24	1310	22.0
25–34	1639	27.5
35–44	1337	22.4
45–54	1044	17.5
55–64	517	8.7
65–74	105	1.8
75 and above	13	0.2
Gender		
Male	2932	49.2
Female	3033	50.8
Nationality		
Saudi	5611	94.1
Non – Saudi	354	5.9
Employment		
Employed	3137	52.6
Student	1180	19.8
Retired	646	10.8
Unemployed	1002	16.8
Monthly Income (SAR)		
Below 5000	493	8.3
5001–10000	1311	22.0
10,001–20,000	1925	32.3
20,001–40,000	1325	22.2
40.001–60,000	375	6.3
>60,001	536	9.0
Data Source		
Websites	1932	32.5
Social Media	808	13.6
Websites & Social Media	2806	47.2
Others	402	6.8

Table 2
The participant's response to the COVID-19 questionnaire in a five point-Likert scale (n = 5965).

	SA	A	N	D	SD
Knowledge					
I have enough information about COVID-19 vaccines and their safety and willing to take it.	11.8	28.9	35.8	18.6	5.0
COVID-19 vaccines are important for the prevention of the infection	33.8	31.8	19.4	10.9	4.1
It is important to get vaccinated to protect others	38.3	33.7	17.5	7.6	3.0
COVID-19 vaccines are effective and safe	22.9	34.4	26.9	11.2	4.6
Time spent on developing safe and effective COVID-19 vaccines was enough	10.8	27.3	31.0	22.4	8.5
Perception					
I believe COVID-19 vaccine is more important than other vaccines	14.3	25.3	30.0	22.7	7.6
I trust pharmaceutical companies in providing safe and effective COVID-19 vaccine.	15.4	31.2	31.4	14.0	8.0
If COVID-19 cases decline, vaccines are no longer needed	7.6	16.5	19.4	42.9	13.6
I would rather wait to see what other people do	18.4	28.2	27.4	21.4	4.6
Factors affecting the vaccine acceptance decision					
The decision to get vaccinated is affected by					
• Media	17.1	21.5	32.8	19.9	8.7
• Leader encouragement	33.9	26.0	21.7	12.7	5.6
• Religion beliefs	4.1	7.2	8.0	39.2	41.5
• Schedule, and long waiting time	8.8	17.2	20.9	35.8	17.4
• The side effects of COVID-19 vaccine	18.5	25.0	26.5	24.5	5.5
• Fear of needle	3.8	9.0	12.3	49.3	25.6
• Vaccine campaign location	5.4	12.5	16.0	45.2	20.9
• Previous vaccine refusal history	7.0	17.1	29.2	35.3	11.4

of 5) on the 5-point Likert scale (see Table 3).

About 40.7% (3.24 out of 5) reported they had enough information about COVID-19 vaccines and were willing to take it. The importance of

Table 3
The participant's knowledge, perception, and the factors affecting the decision of COVID-19 vaccine acceptance as the total of those who strongly agreed or agreed and their average score (out of 5) on the 5-point Likert scale (n = 5965).

	SA + A	Out of 4
Knowledge		
I have enough information about COVID-19 vaccines and their safety and are willing to take it.	40.7	3.24
COVID-19 vaccines are important for the prevention of the infection	65.6	3.80
It is important to get vaccinated to protect others	72.0	3.97
COVID-19 vaccines are effective and safe	57.3	3.60
Time spent on developing safe and effective COVID-19 vaccines was enough	38.1	3.10
Perception		
I believe COVID-19 vaccine is more important than other vaccines	39.6	3.16
I trust pharmaceutical companies in providing safe and effective COVID-19 vaccine.	46.6	3.32
If COVID-19 cases decline, vaccines are no longer needed	24.1	2.61
I would rather wait to see what other people do	46.6	3.10
Factors affecting the vaccine acceptance decision		
Media influence	38.6	3.18
Leader encouragement	59.9	3.70
Religion beliefs	11.3	1.93
Schedule, and long waiting time	26.0	2.64
The side effects of COVID-19 vaccine	43.5	3.27
Fear of needle	12.8	2.16
Vaccine campaign location	17.9	2.36
Previous vaccine refusal history	24.1	2.73

COVID-19 vaccine use by everyone was agreed upon by 65.6% (3.80) and 72% (3.97) agreed on the importance of vaccination to protect others. Out of the total participants 57.3% (3.60) classified COVID-19 vaccine as safe. Only 38.1% (3.10) indicated that the time spent on developing safe and effective COVID-19 vaccine was enough. About 39.6% (3.16) believed that COVID-19 vaccine is more important than other vaccines. In addition, 46.6% (3.32) trusted pharmaceutical companies in providing safe and effective COVID-19 vaccine. Only 24.1% (2.61) thought that if COVID-19 cases declined, vaccines are no longer needed. A substantial number of 46.6% preferred to wait to see what other people do with regard to the vaccine acceptance. Out of the total respondents, 38.6% (3.18 out of 5) of the participants agreed that the media had influenced their vaccine use decision. The leader's influence on vaccine decision was reported by 59.9% (3.7 out of 5). The influence of religion on vaccine use decision was reported by 11.3% of the participants (1.93 out of 5). The side effects of COVID-19 vaccine is an important barrier to taking the vaccine reported by 43.5% of the participants (3.27 out of 5). Complicated procedure and long waiting time reported by 26.0% of the participants (2.64 out of 5). Moreover, 24.1% (2.73 out of 5) reported that previous vaccine refusal history influenced their decision to be vaccinated. Other minor vaccine barriers included vaccine campaign location (17.9% and 2.36 out of 5), fear of needle (12.8%, and 2.16 out of 5), and the least one was religion influence (11.3% and 1.93 out of 5).

Table 4 showed average knowledge score (out of 25), perception (out of 20), and barriers (out of 40) and the significance difference of these parameters with respect to various demographical factors.

The average knowledge scores of male is higher than the females being 15.78 and 15.57, respectively. Knowledge significantly increased as age and education level increased. No marked difference was noticed with either nationality, employment, or household income. Similarly, the perception scores of males was higher than their female peers, being 14.71 and 14.22, respectively. The average perception scores significantly increased as the age advanced. The average perception scores significantly varied with employment status, and household income, but not with nationality and education levels. Retirees and students showed better perception than the employed ones. The unemployed group

Table 4
Average knowledge, perception, and barriers against COVID-19 vaccines with the 95% confidence interval (CI) and significance level (P) of the participants according to various demographical variable (n = 5965).

Variables	No.	Average knowledge score out of 25 (95% CI)	P	Average perception score out of 20 (95% CI)	P value	Average barriers score out of 40 (95% CI)	
Age group							
18–24	1310	15.64 (15.49–15.79)	0.001	14.79 (14.58–15.00)	<0.001	21.69 (21.42–21.97)	<0.001
25–34	1639	15.49 (15.36–15.62)		14.05 (13.86–14.24)		21.76 (21.51–22.00)	
35–44	1337	15.65 (15.52–15.79)		14.27 (14.08–14.47)		22.27 (22.00–22.54)	
45–54	1044	15.93 (15.78–16.08)		14.57 (14.37–14.78)		22.38 (22.10–22.67)	
55–64	517	15.87 (15.69–16.06)		14.99 (14.70–15.28)		21.67 (21.27–22.06)	
65–74	105	15.93 (15.49–16.38)		15.49 (14.93–16.05)		22.26 (21.27–23.25)	
≥75	13	15.23 (12.22–18.24)		15.31 (12.80–17.82)		24.38 (19.53–29.23)	
Total	5965	15.68 (15.61–15.74)		14.46 (14.37–14.56)		21.97 (21.85–22.10)	
Gender							
Male	2932	15.78 (15.69–15.88)	0.002	14.71 (14.58–14.84)	<0.001	21.98 (21.79–22.16)	0.962
Female	3033	15.57 (15.48–15.67)		14.22 (14.09–14.36)		21.97 (21.80–22.14)	
Nationality							
Saudi	5611	15.66 (15.60–15.73)	0.119	14.48 (14.38–14.58)	0.150	21.90 (21.77–22.03)	<0.001
Non Saudi	354	15.88 (15.60–15.17)		14.18 (13.79–14.58)		23.19 (22.63–23.75)	
Education level							
Primary	18	15.52 (15.37–15.66)	0.007	14.35 (14.14–14.56)	0.091	24.11 (20.92–27.30	0.001
Elementary	82	15.79 (15.25–16.33)		14.43 (14.32–14.55)		22.73 (21.88–23.58)	
High school	699	15.96 (15.76–16.16)		14.75 (14.49–15.02)		22.46 (22.11–22.82)	
University	3920	15.67 (15.59–15.75)		14.78 (14.11–15.45)		21.97 (21.81–22.12)	
Postgraduate	1243	16.28 (14.38–18.18)		15.56 (13.86–17.26)		21.64 (21.35–21.93)	
Total	5962	15.68 (15.61–15.74)		14.46 (14.37–14.55)		21.97 (21.85–22.10)	
Employment							
Employed	3137	15.69 (15.60–15.78)	0.189	14.46 (14.33–14.59)	<0.001	22.11 (21.93–22.28)	0.170
Student	1180	15.67 (15.52–15.83)		14.64 (14.41–14.86)		21.77 (21.47–22.06)	
Retiree	646	15.83 (15.64–16.01)		15.08 (14.84–15.33)		21.85 (21.48–22.21)	
Unemployed	1002	15.54 (15.38–15.71)		13.87 (13.64–14.10)		21.89 (21.60–22.17)	
Total	5965	15.68 (15.61–15.74)		14.46 (14.37–14.56)		21.97 (21.85–22.10)	
Average monthly household income (SAR)							
<5000	493	15.65 (15.39–15.92)		14.05 (13.71–14.39)	0.004	22.69 (22.24–23.14)	<0.001
5001–10000	1311	15.59 (15.45–15.73)		14.24 (14.03–14.44)		22.57 (22.30–22.84)	
10001–20000	1925	15.76 (15.64–15.87)		14.55 (14.38–14.71)		21.94 (21.72–22.16)	
20001–40000	1325	15.62 (15.49–15.74)		14.54 (14.34–14.74)		21.51 (21.25–21.78)	
40001–60000	375	15.65 (15.37–15.92)		14.78 (14.41–15.14)		21.54 (21.03–22.04)	
>60000	536	15.78 (15.56–16.00)		14.69 (14.39–14.99)		21.42 (21.00–21.83)	
Total	5965	15.68 (15.61–15.74)	0.423	14.46 (14.37–14.56)		21.97 (21.85–22.10)	

reported the least perception score. Vaccine barriers scores are significantly higher among non-Saudis than the indigenous population. Lower educational levels showed significantly higher barriers scores. Similarly, the barrier's scores significantly increased as the average households income decreased. No difference was seen in the barriers scores with gender and employment status.

Knowledge and perception scores were consistently and significantly higher among the group who received their information from official (governmental/nongovernmental) websites, followed by those who had used websites and social media. The use of social media alone resulted in the least knowledge and perception scores (Table 5).

Vaccine hesitancy is higher consistently and significantly higher among the group who received their information from the social media.

The most common hesitancy reason mentioned among the group who received their information from the social media were the side effects of COVID-19 vaccine, complex procedure and negative previous vaccine experience.

4. Discussion

Our findings indicated that the awareness level about the importance of COVID-19 vaccine among the participants is average. About 40.7% reported they had enough information about COVID-19 vaccines and were willing to take it. A study conducted among the United States adults prior to the implementation of the vaccine campaign indicated that half of them intended to get a vaccine when made available while 40% were uncertain and the rest preferred to wait and learn [14]. Our study indicated that the average knowledge scores of male is higher than the females being 15.78 and 15.57, respectively. Similar findings were obtained in the US where more males intended to get the vaccine than females [14,15]. Knowledge significantly increased as age and education level increased. Younger age groups have been identified before as one of the factors associated with lower intention to vaccinate [14]. No marked difference was noticed with either nationality, employment, or household income. Similarly, the perception scores of males was higher than their female peers, being 14.71 and 14.22, respectively. Intent to get vaccinated was higher among those over 60 years of age and those with a Bachelor's degree or higher, similar to previous reports [14]. However, another study in the US noted that the intention to take the vaccine is not always translated into positive behavior [16]. Moreover, the influence of heterogeneity in personal perceptions towards COVID-19 vaccines has been reported before [17]. The average perception scores of our respondents significantly varied with age, employment status, and household income, but not with nationality and education levels. Retirees and students showed better perception than the employed ones. The unemployed group reported the lowest perception score. The importance of COVID-19 vaccine acceptance by everyone was agreed upon by 65.6% and 72% agreed on the importance of vaccination in protecting others. A study in Australia indicated that 80% of their respondents agreed that being vaccinated for COVID-19 would protect them from infection [18].

The decision to receive a vaccine is influenced by a number of the factors including the individual's perception of the vaccine and the social environment. The low vaccine acceptance rates are more often attributed to awareness, perceptions of risk from both the disease and the vaccine, access to health care trust, social norms, and beliefs regarding the efficacy of vaccine [19–22].

Out of the total participants, 57.3% believed that COVID-19 vaccine

Table 5
The participant's knowledge, perception, and the factors affecting the decision of COVID-19 vaccine acceptance according to their information source and significance level (P).

	W n = 1932	SM n = 808	MX n = 2806	O n = 402	P
Knowledge					
I have enough information about COVID-19 vaccines and their safety and I am willing to take it.	3.42	2.92	3.20	3.28	<0.001
COVID-19 vaccines are important for the prevention of the infection	3.97	3.59	3.78	3.67	<0.001
It is important to get vaccinated to protect others	4.10	3.79	3.95	3.88	<0.001
COVID-19 vaccines are effective and safe	3.79	3.36	3.55	3.49	<0.001
Time spent on developing safe and effective COVID-19 vaccines was enough	3.22	3.15	3.01	3.03	<0.001
Perception					
I believe COVID-19 vaccine is more important than other vaccines	3.28	3.14	3.10	3.04	<0.001
I trust pharmaceutical companies in providing safe and effective COVID-19 vaccine	3.51	3.13	3.26	3.25	<0.001
If COVID-19 cases decline, vaccines are no longer needed	2.5	2.9	2.6	2.5	<0.001
I would rather wait to see what other people do	3.20	3.54	3.40	3.22	<0.001
Factors affecting the vaccine acceptance decision					
• Media	3.04	3.39	3.23	3.10	<0.001
• Leader encouragement	3.90	3.51	3.65	3.48	<0.001
• Religion beliefs	1.96	1.99	1.89	2.00	0.024
• Complex procedure, schedule, and long waiting time	2.63	2.76	2.63	2.52	0.006
• The side effects of COVID-19 vaccine	3.14	3.47	3.30	3.23	<0.001
• Fear of needle	2.20	2.31	2.08	2.20	<0.001
• Vaccine campaign location	2.41	2.39	2.31	2.41	0.019
• Previous vaccine refusal history	2.71	2.87	2.70	2.67	0.001

W = Official websites, SM = Social Media, MX = Mixed sources. O = others (broadcasting, press, schools, families, and friends).

is safe. Concerns over vaccine safety was mentioned frequently among the factors leading to its hesitancy [23]. Only 38.1% thought that the time spent on developing safe and effective COVID-19 vaccine was enough. There has been a fear that the rapid production of COVID-19 vaccine, based on an underpowered trial, might result in a weakly effective vaccine that might lead to catastrophic consequences [24].

Vaccine barriers scores in our study were significantly higher among non-Saudis than the indigenous population. Lower educational levels showed significantly higher barriers scores. Similarly, the barrier's scores significantly increased as the average households income decreased. However, no difference was seen in the barriers scores with gender and employment status.

The leader's influence on vaccine decision was reported by 59.9%. Public health and healthcare practitioners, political leaders and policymakers, and communication experts can substantially contribute to COVID-19 vaccine rollout [25]. There will be a need to involve community leaders with the promotion of a vaccine including cultural, religious, and political leaders. Leadership may play an important role in denying the misleading information that resulted in the mistrust of vaccines. For example, public health leaders have to advise the public on the expected vaccine side effects [14]. The influence of religion on vaccine use decision was reported by 11.3% of the participants.

Vaccine hesitancy varied worldwide [26,27]. Worldwide surveys indicated that between 50% and 60% of all respondents were willing to take a COVID-19 vaccine, with wide variations across countries [13,28]. A previous study in Saudi Arabia indicated that 64.7% of the total respondents expressed their willingness to take the vaccine when made available [29]. The side effects of COVID-19 vaccine is an important barrier to vaccine acceptance reported by 43.5% of the participants [30]. Complex procedure and long waiting time was reported by 26.0% of the participants in a similar manner to a previous report [31].

About 24.1% reported that previous vaccine refusal history influenced their decision to be vaccinated. Experience from the influenza vaccines have shown vaccine acceptance has not been optimal, and this new vaccine, even though it is not approved, is already showing layperson skepticism compounded by political influences [16]. A previous study indicated a strong relationship between influenza vaccine history and COVID-19 skepticism.

Other minor vaccine barriers included vaccine campaign location (17.9%), fear of the needle (12.8%), and the least one was religion influence (11.3%). Although variation in COVID-19 vaccination rates is also seen between religious groups [32], Islam has no prohibition to vaccination. There have been several gatherings of Muslim leaders, scholars, and philosophers to address the theological implications of the vaccine. In the Muslim community, the COVID-19 vaccine has been portrayed as a "Western plot" to sterilize Muslim women [33]. It is therefore important to proactively investigate the likely predictors of COVID-19 hesitancy among religious groups and start to mobilize key actors within existing religious, scientific, and political structures toward a common goal of vaccination.

Knowledge and perception scores were consistently and significantly higher among the group who received their information from official (governmental/nongovernmental) websites, followed by those who had used websites and social media. The use of social media alone resulted in the least knowledge and perception scores.

Since the availability of COVID-19 vaccine, there has been a broad range of disinformation and conspiracy theories about its side effects and effectiveness that led to mistrust and hence contributed to vaccine hesitancy [34]. The positive impact of social media in disseminating and encouraging influenza vaccine intake has been reported before [35]. Another study has revealed an association between the use of social media and public doubts about vaccine safety. There is a considerable relationship between foreign disinformation and decreasing rate of vaccination [36]. A substantial group of the UK adult population have expressed their intention to use social media and personal messaging applications to encourage others to get COVID-19 vaccine [37]. Overall, people who use all media sources, are more likely than other who use less media types to be associated with the encouragement of vaccination. Our study indicated that vaccine hesitancy is higher consistently and significantly higher among the group who received their information from the social media. A previous study revealed a significant relationship between social media and public doubts of vaccine safety [36].

The most common hesitancy reason mentioned among the group who received their information from the social media were the side effects of COVID-19 vaccine, complex procedure and negative previous vaccine experience. Rumors and conspiracy theories may lead to mistrust contributing to vaccine hesitancy [34]. Similar studies conducted before in Saudi Arabia indicated that the main factors resulted in vaccine hesitancy included lack of knowledge, perception toward vaccine effectiveness, and safety concerns [38–41].

This study clearly indicated that the intention to take the COVID-19 vaccine varied across demographics, awareness, beliefs, and successful implementation of a COVID-19 campaign.

Immunization programs can meet the immediate needs of the acceptors by making vaccines available and accessible. However, additional approaches will be needed to effectively meet the needs of the hesitant population, particularly the safety and efficacy concerns, the speed of vaccine development, and the distrust in government and

health organizations [14]. Because of low trust in healthcare providers and public health, other sources such as community leaders may be effective in amplifying these messages. Emphasizing equity in reaching those most vulnerable to COVID-19 and the value of vaccination as a step toward protecting the community would speak to those who hold egalitarian and communitarian worldviews. Vaccine use, and its universal acceptance, is a social challenge that requires the consideration of several human factors [25].

The major limitation of this study is that despite the recruitment of the participants through a heterogeneous purposive sample, the majority of them belonged to higher educational levels and middle or higher classes of income. The study's findings would have been better generalized if more lower classes of education and income were more represented.

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Authors' contributions

Yaser Al Naam, Salah Elsafi, Eidan, Ibrahim Al Balawi, Eidan Al Zahrani: Conceptualization, Formal analysis, Writing - original draft, Writing - review & editing.

Zeyad Alkharraz, Thekra Almaqati, Arulanantham Z. Jebakumar[d]: Formal analysis, Writing - review & editing.

Ahmed M. Alomar, Aisha A. Ghazwani, Saleh S. Almusabi, Sattam Albusaili, Fahad A. Mashwal: Data collection, Formal analysis, Writing - review & editing.

Ethics statement

Ethical clearance was obtained from the Ethics Review Board of Prince Sultan Military College of Health Sciences; Dhahran approved this study (IRB Number IRB-2021-CLS-001).

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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