

REVIEW

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## COVID-19 vaccine hesitancy and acceptance among the public in the Gulf Cooperation Council countries: A review of the literature

Muath A. Alsalloum<sup>a</sup>, Yusuf M. Garwan<sup>a</sup>, Jimmy Jose<sup>b</sup>, Abrar K. Thabit<sup>c</sup>, and Nour Baghdady<sup>c</sup>

<sup>a</sup>Department of Pharmacy Practice, College of Clinical Pharmacy, Imam Abdulrahman Bin Faisal University, Dammam, Saudi Arabia; <sup>b</sup>School of Pharmacy, University of Nizwa, Nizwa, Sultanate of Oman; <sup>c</sup>Pharmacy Practice Department, Faculty of Pharmacy, King Abdulaziz University, Jeddah, Saudi Arabia

### ABSTRACT

Vaccine hesitancy has a significant impact on tackling infectious diseases as it has resulted in reemergence of vaccine-preventable diseases. This review aims to provide an up-to-date evaluation of COVID-19 vaccine hesitancy among the public in the Gulf Cooperation Council countries. We searched the PubMed and SCOPUS databases for manuscripts published on vaccine hesitancy and/or acceptance among the public in GCC countries up till April 1<sup>st</sup>, 2022. Forty-nine studies met the inclusion criteria and were reviewed. The average vaccine hesitancy rate across GCC countries was 43%. Concerns about vaccine safety (n = 32) and effectiveness (n = 26) were most frequently associated with hesitancy. Being male (n = 25) and having positive behavior regarding the influenza vaccine or vaccines in general (n = 22) were most frequently associated with acceptance. Collaborative efforts of governments, academic bodies, and the media to provide evidence of vaccines' effectiveness throughout history and strictly manage the spread of the vaccine safety-related rumors are warranted.

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### Introduction

Coronavirus disease (COVID-19) is an infectious respiratory disease caused by a novel coronavirus, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), which was identified at the end of 2019.<sup>1</sup> The total number of COVID-19 cases among individual Gulf Cooperation Council (GCC) countries [(Saudi Arabia, Oman, the United Arab Emirates (UAE), Kuwait, Qatar, and Bahrain)] by late April, 2022, was more than 350,000 to 850,000 per country, with a mortality rate ranging between 0.19% and 1.21%.<sup>1</sup>

COVID-19 vaccination in the GCC countries commenced on November 4<sup>th</sup>, 2020, and was followed by a decline in the rate of new cases, hospitalization, intensive care unit admissions, and mortality.<sup>1-4</sup> The most available COVID-19 vaccines in the GCC countries are those manufactured by Pfizer-BioNTech, Moderna, Johnson & Johnson, and Oxford-AstraZeneca. Tables 1 and 2 illustrate the available COVID-19 vaccines and the current vaccination status in each GCC country.<sup>1-8</sup>

According to the World Health Organization's (WHO) Strategic Advisory Group of Experts (SAGE) working group on immunization, vaccine hesitancy is defined as a "delay in acceptance or refusal of vaccines despite availability of vaccine services."<sup>9</sup> It has been reported as a global phenomenon due to various reasons, such as perceived risk versus benefit, psychosocial factors, and religious beliefs.<sup>10</sup> Vaccine hesitancy can have detrimental consequences on an individual level, for those refusing or delaying vaccination, and on a public level. Vaccine hesitancy has resulted in reemergence of vaccine-preventable diseases, like measles and pertussis.<sup>11,12</sup> According to the latest

data from the WHO's vaccine-preventable diseases monitoring system in 2019, vaccination rates among GCC countries for all the listed childhood vaccines exceed 90%.<sup>13</sup>

To the best of our knowledge, no previous review has evaluated vaccine hesitancy for the COVID-19 vaccines in the general public in the GCC countries. In this paper, we aim to summarize published data on the prevalence of vaccine hesitancy among the public in the GCC countries. We also explore some of the factors that might be associated with vaccine hesitancy and acceptance.

### Search strategy

A literature search was performed using the PubMed and SCOPUS databases without language or date restrictions from January 1<sup>st</sup>, 2020 till April 1<sup>st</sup>, 2022. The following keywords were used: "COVID-19 vaccine" AND "hesitancy" OR "reluctance" OR "delay" OR "refusal" OR "acceptance" AND "Saudi Arabia" OR "Kuwait" OR "United Arab Emirates" OR "Qatar" OR "Oman" OR "Bahrain." Papers discussing other vaccines and those assessing hesitancy among healthcare workers, students at schools of health sciences, or special populations were excluded as special populations would skew our study and would not be reflective of the general population.

### Quality assurance and data synthesis

Given that this is a narrative review, we did not follow a particular quality assurance method. Articles that did not meet the inclusion criteria were excluded. The quality

**Table 1.** The COVID-19 vaccines available in each GCC country.

Vaccine	Saudi Arabia					
	UAE	Kuwait	Qatar	Oman	Bahrain	
PfizerBioNTech – Comirnaty	✓	✓	✓	✓	✓	✓
Moderna – Spikevax	✓	✓	✓	✓	✓	✓
Janssen – Ad26.COV 2-S	✓	✓	✓	✓	✓	✓
AstraZeneca – Vaxzevria	✓	✓	✓	✓	✓	✓
Beijing CNBG – BBIBP-CorV		✓	✓			✓
Sinovac – CoronaVac				✓		✓
Gamaleya – Gam-COVID-Vac		✓		✓		✓
Gamaleya – Sputnik-Light		✓				✓
SII – Covishield		✓		✓		✓
National Vaccine and Serum Institute – CHO Cell		✓				✓
Bharat Biotech – Covaxin						✓
Valneva – VLA2001						✓

✓ the vaccine is available.

assurance of the included studies was assessed by looking into various variables, including sample size justification, target population, sampling frame, and statistics.

The evidence from the included studies was narratively summarized. Findings were not stratified by vaccine type or nationality as most of the included studies surveyed their population for COVID-19 vaccine acceptance in general regardless of that.

## Results

A total of 298 papers was retrieved from both databases. After the removal of duplicates, a total of 214 titles and abstracts were screened for inclusion, 163 of which were excluded. The full texts of the remaining 51 studies were screened, and 49 of them met the eligibility criteria and were included. The reasons for exclusion are listed in the PRISMA flowchart in Figure 1. All the included studies were cross-sectional and survey-based and disseminated to adults through social media platforms (WhatsApp, Twitter, Facebook, and/or Instagram) or via e-mail.<sup>14–61</sup> Most of the studies were conducted in Saudi Arabia (n = 32),<sup>14–45</sup> followed by Kuwait (n = 6),<sup>29–46–50</sup> the UAE (n = 6),<sup>51–56</sup> Qatar (n = 4),<sup>57–60</sup> and Oman (n = 1).<sup>61</sup>

All the studies were conducted during the period between March 2020 and August 2021, and 14 were conducted prior to the introduction of COVID-19 vaccines in the respective countries. Overall, the number of participants per study ranged between 154 and 8,056. Of the chosen studies, 24 included <1000 participants, 11 studies included 1000–2000 participants, 7 studies included 2000–3000 participants, and another 7 studies included >3000 participants. Table 3. summarizes the findings stratified per country.

**Table 2.** Vaccination status in each GCC country as of April 30<sup>th</sup>, 2022.

Estimated vaccination status	Saudi Arabia	UAE	Kuwait	Qatar	Oman	Bahrain
Vaccination start date*	01/06/21	12/14/20	12/28/20	12/23/20	12/29/20	11/04/20
Total doses	64,212,008	4,959,691	7,969,160	1,529,091	7,030,077	3,433,683
Total doses per 100 population**	184	50	187	53	138	202

\*Date format: month/day/year.

\*\*Rounded to whole numbers.

## Vaccine hesitancy by country

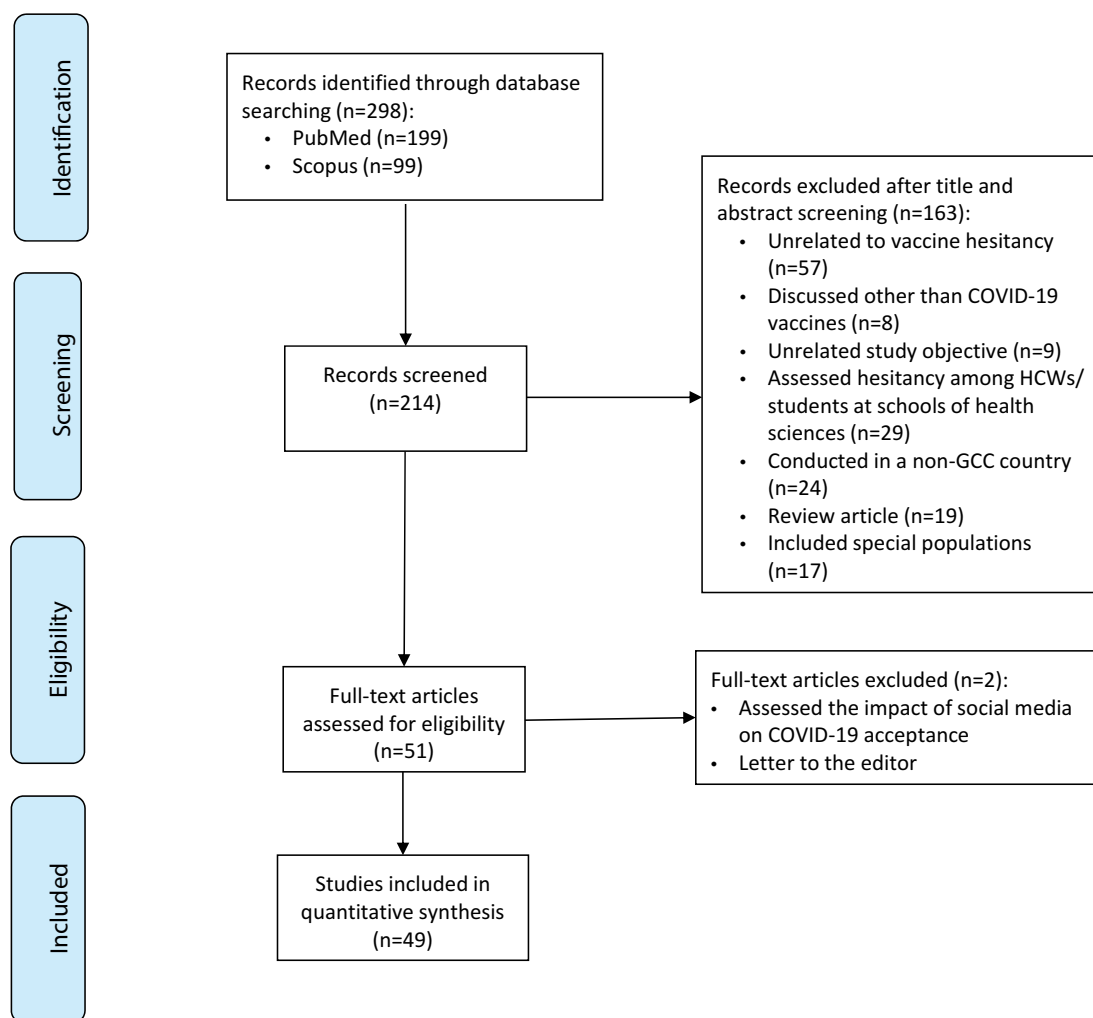
Figure 2 shows the median proportion of vaccine hesitancy reported by each GCC country. Figures 3 and 4 illustrate the most frequently reported predictors of COVID-19 vaccine acceptance and hesitancy per country, respectively.

### Saudi Arabia

A total of 32 studies assessed COVID-19 vaccine hesitancy and acceptance among the general public in Saudi Arabia.<sup>14–45</sup> Two studies additionally included participants from neighboring countries. Abu-Farha et al.<sup>14</sup> included participants from Saudi Arabia, Jordan, Iraq, and Lebanon, and Sallam et al.<sup>29</sup> included participants from Saudi Arabia, Kuwait, and Jordan. The dates of survey distribution ranged between May 2020 and August 2021. Most of the surveys were conducted during the first half of 2021 (19 of 32), when vaccination clinics were established in Saudi Arabia. Only seven studies were conducted before vaccines became available in Saudi Arabia.<sup>14,15,22,27,29,34,39</sup>

Certain sociodemographic variables were associated with vaccine acceptance ( $p < 0.05$ ), including being male (n = 15),<sup>14–15–18–22–24–25–28–29–34–39–40–44</sup> being younger (n = 5),<sup>18,22,24,32,39</sup> and being married (n = 3).<sup>17,27,40</sup> Other predictors of vaccine acceptance were positive behavior regarding the influenza vaccine or vaccines in general (n = 12),<sup>14,15,19,20,22,23,26,29,33,37,39,42</sup> a high risk perception of contracting COVID-19 (n = 12),<sup>14–15–18–21–22–25–27–28–36–38–42</sup> trust in the government/healthcare system (n = 7),<sup>17–25–27–33–37–43</sup> a history of chronic illnesses (n = 4),<sup>28,29,36,39</sup> being a healthcare worker (n = 2),<sup>14,23</sup> and being a smoker (n = 2).<sup>21,39</sup> In one study, being female was associated with better knowledge of, attitudes toward, and perception of the vaccine.<sup>32</sup>

Overall, the COVID-19 vaccine hesitancy rate in Saudi Arabia varied significantly between studies, ranging from 5% to 82%. The lowest hesitancy rates (<10%) were reported by 2 studies,<sup>26,45</sup> whereas higher rates (>30%) were reported in 22 studies.<sup>14–17–19–24–27–33–35–37–39–44</sup> Several factors were found to be associated with vaccine hesitancy, including concerns about vaccine safety (n = 18),<sup>16–20–22–26–29–31–36–38–40–42–45</sup> concerns about vaccine effectiveness (n = 16),<sup>16–17–19–22–24–30–33–36–38–40–42–45</sup> belief that the vaccine has not been tested sufficiently (n = 7),<sup>20–24–26–30,31–45</sup> belief in conspiracy theories (n = 4),<sup>22,29,39,40</sup> belief in natural immunity following COVID-19 infection (n = 2),<sup>30,39</sup> a history of chronic illnesses (n = 2),<sup>31,45</sup> a fear of injections (n = 2),<sup>30,44</sup> and mistrust in pharmaceutical companies (n = 1).<sup>31</sup>



**Figure 1.** PRISMA flowchart of literature search and review.

Alshahrani et al.<sup>18</sup> assessed the intention of Saudi Arabian travelers to receive the COVID-19 vaccine prior to travel. A survey was distributed among domestic air travelers in waiting areas of airports. Of 2,236 participants, 36% thought that the COVID-19 vaccine should be obligatory, 49% thought it should be optional, and 15% described it as being unnecessary for travelers. Frequent travelers were significantly more willing to accept the vaccine. Similar results were reported in another study in which vaccine acceptance was more common among those who liked to travel internationally.<sup>19</sup>

One paper described responders' suggestions to enhance vaccine acceptance.<sup>44</sup> Most outlined the importance of providing enough evidence of safety and efficacy (45%) and of putting a government mandate in place (43%). Other responders emphasized peer pressure (5%), making it a requirement for travel (3%), physicians' recommendations (3%), and employers making it mandatory (1%).

### Kuwait

Overall, the COVID-19 vaccine hesitancy rate in Kuwait ranged between 17% and 76%, with a median of 54%.<sup>29-46-50</sup> The survey periods took place between March 2020 and April 2021. Most of the studies (5 of 6) were conducted before the vaccine rollout in Kuwait.<sup>29-46-48</sup> Burahmah et al.<sup>48</sup> reported the lowest

hesitancy rate (17%), as most participants (81%) had registered to receive the vaccine or had already received it. Interestingly, the vaccine hesitancy rate significantly increased over time as the policy regarding protective measures was relaxed.<sup>46</sup> Males, younger adults, and those who had positive behavior regarding the influenza vaccine or vaccinations in general were more willing to receive the vaccine.<sup>29-46-50</sup> On the contrary, those who were married or had children, nonsmokers, and those concerned about vaccine safety and effectiveness were more hesitant to receive the vaccine.<sup>29-46-50</sup> Most participants considered social media their primary source for vaccine-related information (69%).<sup>49</sup> Noteworthy, about one-third of respondents (32%) attributed their hesitancy to social media posts by physicians doubting the effectiveness of the COVID-19 vaccine.<sup>49</sup> Similarly, Sallam et al.,<sup>29</sup> who evaluated the negative impacts of belief in conspiracy theories, demonstrated significantly higher rates of vaccine hesitancy among those who believed in conspiracy theories and indicated social media as their primary source of information.

### United Arab Emirates

Six studies assessed vaccine hesitancy in the UAE.<sup>51-56</sup> Two of these were conducted before vaccine approval in the country and reported a hesitancy rate of 40% and 78%.<sup>51,54</sup> The most



**Table 3.** COVID-19 vaccine hesitancy and acceptance rates and their associated variables per GCC country.

Author (survey period)	Reference no.	No. of participants	Hesitancy rate*	Factors associated with hesitancy**	Factors associated with acceptance**
Saudi Arabia (Dec 2020)	14	592 ↓↓	70% ↑	<ul style="list-style-type: none"> <li>● Married</li> <li>● History of COVID-19 infection</li> <li>● Lower monthly income (&lt;\$1000)</li> </ul>	<ul style="list-style-type: none"> <li>● Males ↓</li> <li>● Having a medical degree ↓</li> <li>● Positive behavior regarding the flu vaccine ↓</li> <li>● Scoring high on COVID-19 fear score ↓</li> <li>● Higher risk perception of contracting COVID-19 ↓</li> </ul>
AlFageeh (Dec 2020)	15	2,137	52%	<ul style="list-style-type: none"> <li>● Low-moderate perceived severity of COVID-19</li> <li>● Negative behavior regarding vaccines in general</li> </ul>	<ul style="list-style-type: none"> <li>● Males</li> <li>● Residents of the southern region</li> <li>● Perceived risk of contracting COVID-19</li> <li>● Positive behavior regarding vaccination in general</li> <li>● History of COVID-19 infection</li> <li>● Support for compulsory vaccination</li> <li>● Vaccine made mandatory ↓</li> <li>● If provided with information on effectiveness and safety ↓</li> <li>● If most of the public gets vaccinated ↓</li> </ul>
Almaghaslah (Jan–Feb 2021)	16	862	80% ↑	<ul style="list-style-type: none"> <li>● Concerns about vaccine safety because of news on social media ↓</li> <li>● Concerns about vaccine effectiveness ↓</li> <li>● Not knowing whether they were eligible or how to register ↓</li> <li>● Natural immunity is sufficient ↓</li> <li>● Lower educational level ↓</li> <li>● Concerns about vaccine effectiveness ↓</li> </ul>	<ul style="list-style-type: none"> <li>● Married</li> <li>● High trust in the healthcare system and its role in controlling the pandemic</li> </ul>
Al-Mohaithef (Jan–Mar 2021)	17	658	47%	<ul style="list-style-type: none"> <li>● Married</li> </ul>	<ul style="list-style-type: none"> <li>● Males</li> <li>● Younger age ↓</li> <li>● High risk perception of contracting COVID-19</li> <li>● Frequent travel</li> </ul>
N. Alshahrani (Feb–Mar 2021)	18	2,236	15% ↑	<ul style="list-style-type: none"> <li>● Married</li> </ul>	<ul style="list-style-type: none"> <li>● Males</li> <li>● Younger age ↓</li> <li>● High risk perception of contracting COVID-19</li> <li>● Frequent travel</li> </ul>
S. Alshahrani (Jan 2021)	19	758	36%	<ul style="list-style-type: none"> <li>● Obtaining COVID-19 information from other sources, such as social media, besides MOH official accounts</li> <li>● Concerns about vaccine effectiveness</li> <li>● Higher educational level (postgraduates)</li> <li>● Low perceived severity of COVID-19</li> <li>● Vaccines have not been tested sufficiently</li> <li>● Concerns about vaccine safety</li> </ul>	<ul style="list-style-type: none"> <li>● Positive behavior regarding the flu vaccine</li> <li>● If vaccination is mandatory for international travel</li> </ul>
Alzahrani (Dec 2020–Feb 2021)	20	3,048	47% ↑	<ul style="list-style-type: none"> <li>● Concerns about vaccine safety</li> <li>● N/A</li> </ul>	<ul style="list-style-type: none"> <li>● Males</li> <li>● Residents of the western region</li> <li>● Positive behavior regarding vaccines in general ↓</li> </ul>
Fayed (Jan–Mar 2021)	21	1,539	41% ↑	<ul style="list-style-type: none"> <li>● Concerns about vaccine safety</li> <li>● N/A</li> </ul>	<ul style="list-style-type: none"> <li>● Males</li> <li>● Current or former smokers</li> <li>● Higher risk perception of contracting COVID-19</li> </ul>
Magadmi (May 2020)	22	3,101	55%	<ul style="list-style-type: none"> <li>● Concerns about vaccine safety ↓</li> <li>● Concerns about vaccine effectiveness ↓</li> <li>● Belief in conspiracy theories ↓</li> </ul>	<ul style="list-style-type: none"> <li>● Males</li> <li>● Education (high school and undergraduates)</li> <li>● Higher risk perception of contracting COVID-19 ↓</li> <li>● Positive behavior regarding the flu vaccine</li> <li>● Positive beliefs about the COVID-19 vaccine</li> <li>● Older age (≥50 years old)</li> <li>● HCWs</li> <li>● Positive behavior regarding the flu vaccine</li> <li>● Obtaining complete vaccine-related information</li> <li>● When the vaccine uptake becomes more common amongst the public</li> </ul>
Mahmud (Jan–Mar 2021)	23	1,387	73% ↑	<ul style="list-style-type: none"> <li>● Concerns about vaccine effectiveness</li> <li>● Concerns about vaccine safety</li> <li>● Religious/cultural convictions</li> <li>● Residents of Riyadh</li> </ul>	<ul style="list-style-type: none"> <li>● Males</li> <li>● Younger age (&lt;30 years old)</li> <li>● Education (high school and undergraduates)</li> <li>● Higher risk perception of contracting COVID-19 ↓</li> <li>● Positive behavior regarding the flu vaccine</li> <li>● Positive beliefs about the COVID-19 vaccine</li> <li>● Older age (≥50 years old)</li> <li>● HCWs</li> <li>● Positive behavior regarding the flu vaccine</li> <li>● Obtaining complete vaccine-related information</li> <li>● When the vaccine uptake becomes more common amongst the public</li> </ul>
Yahia (Jan–Mar 2021)	24	531	38%	<ul style="list-style-type: none"> <li>● Concerns about vaccine safety ↓</li> <li>● Vaccines have not been tested sufficiently ↓</li> <li>● Concerns about vaccine effectiveness ↓</li> </ul>	<ul style="list-style-type: none"> <li>● Males</li> <li>● Younger age (&lt;34 years old)</li> <li>● Protect oneself and others ↓</li> <li>● Trust in the Saudi health authorities ↓</li> </ul>

(Continued)

Table 3. (Continued).

Author (survey period)	Reference no.	No. of participants	Hesitancy rate*	Factors associated with hesitancy**	Factors associated with acceptance**
Zahid (Mar–Apr 2021)	25	1,599	21%	<ul style="list-style-type: none"> <li>Concerns about vaccine safety</li> <li>There is no need for a vaccine</li> <li>Vaccines have not been tested sufficiently ↓</li> </ul>	<ul style="list-style-type: none"> <li>Saudis</li> <li>Males</li> <li>Trust in the Saudi government's decisions ↓</li> <li>Feeling responsible for ending the pandemic ↓</li> <li>Higher perceived risk/severity of COVID-19 ↓</li> <li>Positive behavior regarding the flu vaccine</li> <li>Trust in the Saudi government's decisions ↓</li> <li>Trust in the Saudi healthcare system ↓</li> <li>Older age (&gt;45 years old)</li> <li>Married</li> <li>Trust in the Saudi healthcare system</li> <li>Perceived risk of contracting COVID-19</li> </ul>
Almalki (Jan–May 2021)	26	407	6%	<ul style="list-style-type: none"> <li>Concerns about vaccine safety ↓</li> <li>Vaccines have not been tested sufficiently ↓</li> </ul>	<ul style="list-style-type: none"> <li>Older age (≥50 years old)</li> <li>Married</li> <li>Trust in the Saudi healthcare system</li> <li>Perceived risk of contracting COVID-19</li> </ul>
Al-Mohaithef and Padhi (Unspecified)	27	992	35% ↑	N/A	<ul style="list-style-type: none"> <li>Older age (≥50 years old)</li> <li>Males</li> <li>History of a chronic illness</li> <li>Compliance with protective measures</li> <li>Higher risk perception of contracting COVID-19</li> <li>High perceived severity of COVID-19</li> </ul>
Noushad (Feb–Mar 2021)	28	879	44% ↑	<ul style="list-style-type: none"> <li>History of COVID-19 infection ↓</li> <li>Lower level of knowledge about the COVID-19 vaccine ↓</li> </ul>	<ul style="list-style-type: none"> <li>Saudis</li> <li>Older age (≥50 years old)</li> <li>Males</li> <li>History of a chronic illness</li> <li>Compliance with protective measures</li> <li>Higher risk perception of contracting COVID-19</li> <li>High perceived severity of COVID-19</li> <li>Males</li> <li>History of a chronic illness</li> <li>Positive behavior regarding vaccines in general</li> <li>COVID-19 is of natural origin</li> <li>COVID-19 is not man-made to force people to get the vaccine</li> </ul>
Sallam (Dec 2020)	29	154 ↓	68%	<ul style="list-style-type: none"> <li>Lower educational level ↓</li> <li>Concerns about vaccine safety ↓</li> </ul>	N/A
Alduwayghiri and Khan (Jan 2021)	30	1,713	45%	<ul style="list-style-type: none"> <li>Concerns about vaccine effectiveness</li> <li>Concerns about vaccine safety</li> <li>Natural immunity is sufficient</li> <li>Vaccines have not been tested sufficiently</li> <li>Other preventive measures are enough</li> <li>Fear of injections</li> <li>Saudis</li> <li>Younger age</li> <li>Higher monthly income (&gt;18,000 SR)</li> <li>History of a chronic illness</li> <li>Lower level of knowledge about COVID-19</li> <li>Concerns about vaccine safety ↓</li> <li>Vaccines have not been tested sufficiently ↓</li> <li>Mistrust in pharmaceutical companies ↓</li> </ul>	N/A
Al-Mansour (Feb–Apr 2021)	31	1935	31% ↑	<ul style="list-style-type: none"> <li>Saudis</li> <li>Younger age</li> <li>Higher monthly income (&gt;18,000 SR)</li> <li>History of a chronic illness</li> <li>Lower level of knowledge about COVID-19</li> <li>Concerns about vaccine safety ↓</li> <li>Vaccines have not been tested sufficiently ↓</li> <li>Mistrust in pharmaceutical companies ↓</li> </ul>	N/A
Al-Zalfawi (Mar–Apr 2021)	32	2,022	36%	N/A	<ul style="list-style-type: none"> <li>Being 18–59 years of age</li> <li>Females</li> <li>Positive behavior regarding the flu vaccine</li> <li>Trust in the health system</li> <li>Males</li> </ul>
Alamer (July 2021)	33	655	33%	<ul style="list-style-type: none"> <li>Concerns about vaccine effectiveness ↓</li> </ul>	<ul style="list-style-type: none"> <li>Being 18–59 years of age</li> <li>Females</li> <li>Positive behavior regarding the flu vaccine</li> <li>Trust in the health system</li> <li>Males</li> </ul>
Almalki (May 2020)	34	597	15%	N/A	<ul style="list-style-type: none"> <li>Higher monthly income</li> <li>Private sector employees</li> <li>Higher monthly income (&gt; 15,000 SR)</li> <li>No history of COVID-19 infection</li> <li>History of a chronic illness</li> <li>High risk perception of contracting COVID-19</li> </ul>
Almoayad (Jan 2021)	35	487	53%	<ul style="list-style-type: none"> <li>Bachelor's degree holders</li> </ul>	<ul style="list-style-type: none"> <li>Higher monthly income</li> <li>Private sector employees</li> <li>Higher monthly income (&gt; 15,000 SR)</li> <li>No history of COVID-19 infection</li> <li>History of a chronic illness</li> <li>High risk perception of contracting COVID-19</li> </ul>
Alobaidi (Jan 2021)	36	1,333	28%	<ul style="list-style-type: none"> <li>Concerns about vaccine safety</li> <li>Willingness to get vaccinated only if the vaccine is accepted by a lot of the population</li> <li>Concerns about vaccine effectiveness ↓</li> </ul>	<ul style="list-style-type: none"> <li>Higher monthly income</li> <li>Private sector employees</li> <li>Higher monthly income (&gt; 15,000 SR)</li> <li>No history of COVID-19 infection</li> <li>History of a chronic illness</li> <li>High risk perception of contracting COVID-19</li> </ul>

(Continued)



Table 3. (Continued).

Author (survey period)	Reference no.	No. of participants	Hesitancy rate*	Factors associated with hesitancy**	Factors associated with acceptance**
Alqahtani (Unspecified)	37	391	43%	N/A	<ul style="list-style-type: none"> <li>Higher perceived risk of contracting COVID-19</li> <li>Positive behavior regarding the flu vaccine</li> <li>Trust in the healthcare system</li> <li>Higher perceived risk of contracting COVID-19 ↓</li> </ul>
Alrajeh (Unspecified)	38	401	82%	<ul style="list-style-type: none"> <li>Concerns about vaccine safety</li> <li>Concerns about vaccine effectiveness</li> </ul>	<ul style="list-style-type: none"> <li>Young adults</li> <li>Males</li> </ul>
Altulahi (Nov–Dec 2020)	39	8,056	48%	<ul style="list-style-type: none"> <li>Concerns about vaccine side effects and safety</li> <li>Natural immunity is sufficient</li> <li>Concerns about vaccine effectiveness ↓</li> <li>Belief in conspiracy theories</li> </ul>	<ul style="list-style-type: none"> <li>Having less than or a high school degree</li> <li>Smokers</li> <li>History of a chronic illness</li> </ul>
Fadhel (Jul 2021)	40	558	21%	<ul style="list-style-type: none"> <li>Females</li> <li>Younger age (18–37-year-olds)</li> <li>Belief in conspiracy theories</li> <li>Psychosocial factors</li> <li>Concerns about vaccine safety ↓</li> <li>Concerns about vaccine effectiveness ↓</li> <li>Lower level of knowledge about the COVID-19 vaccine ↓</li> </ul>	<ul style="list-style-type: none"> <li>Positive behavior regarding the flu vaccine</li> <li>Older age group (48–65-year-olds)</li> <li>Married</li> </ul>
Jan (Unspecified)	41	756	22%	<ul style="list-style-type: none"> <li>Perceived barrier, including concerns about vaccine safety</li> <li>Concerns about vaccine effectiveness ↓</li> <li>Self-efficacy</li> </ul>	NA
Khalafalla (Mar–Aug 2021)	42	1,039	16%	<ul style="list-style-type: none"> <li>Lower level of knowledge about COVID-19 ↓</li> <li>Concerns about vaccine safety</li> <li>Concerns about vaccine effectiveness ↓</li> <li>Young and middle-age groups (&lt;20 and 40–59 years of age)</li> <li>Fear of injections</li> <li>Concerns about vaccine safety</li> <li>Concerns about vaccine effectiveness</li> <li>Exercising other precautionary measures</li> <li>Concerns about vaccine safety</li> <li>Vaccines have not been tested sufficiently</li> <li>Concerns about vaccine effectiveness</li> <li>History of a chronic illness</li> </ul>	<ul style="list-style-type: none"> <li>Older age</li> <li>Perceived risk/severity of COVID-19 infection</li> <li>Cues to action, including positive behavior regarding vaccines in general</li> <li>Perception of the vaccine as safe</li> <li>Trust in the health system</li> </ul>
Mubarak (Mar–May 2021)	43	332	16%	<ul style="list-style-type: none"> <li>Lower level of knowledge about COVID-19 ↓</li> <li>Concerns about vaccine safety</li> <li>Concerns about vaccine effectiveness ↓</li> <li>Young and middle-age groups (&lt;20 and 40–59 years of age)</li> <li>Fear of injections</li> <li>Concerns about vaccine safety</li> <li>Concerns about vaccine effectiveness</li> <li>Exercising other precautionary measures</li> <li>Concerns about vaccine safety</li> <li>Vaccines have not been tested sufficiently</li> <li>Concerns about vaccine effectiveness</li> <li>History of a chronic illness</li> </ul>	<ul style="list-style-type: none"> <li>Males ↓</li> </ul>
Narapureddy (Apr–Jun 2021)	44	782	34%	<ul style="list-style-type: none"> <li>Lower educational level ↓</li> <li>Concerns about vaccine safety ↓</li> </ul>	N/A
Othman (Jun 2021)	45	504	5%	<ul style="list-style-type: none"> <li>Lower educational level ↓</li> <li>Concerns about vaccine safety ↓</li> </ul>	N/A
Kuwait Sallam (Dec 2020)	29	771 ↓↓	76% ↑	<ul style="list-style-type: none"> <li>Lower educational level ↓</li> <li>Concerns about vaccine safety ↓</li> </ul>	<ul style="list-style-type: none"> <li>Males</li> <li>History of a chronic illness</li> <li>Positive behavior regarding vaccines in general</li> <li>COVID-19 is of natural origin</li> <li>COVID-19 is not man-made to force people to get the vaccine</li> </ul>

(Continued)

Table 3. (Continued).

Author (survey period)	Reference no.	No. of participants	Hesitancy rate*	Factors associated with hesitancy**	Factors associated with acceptance**
AlAwadhi (May–Sep 2020)	46	7,241	33%	<ul style="list-style-type: none"> <li>• Older age</li> <li>• Females</li> <li>• Married ↓</li> <li>• History of COVID-19 infection ↓</li> <li>• Lower level of knowledge about COVID-19 ↓</li> <li>• Knowing others with a history of COVID-19 infection ↓</li> <li>• Having children ↓</li> <li>• Negative behavior regarding the flu vaccine</li> <li>• Protective measures are exaggerated</li> </ul>	<ul style="list-style-type: none"> <li>• Younger age (&lt;30 years old)</li> <li>• Males</li> <li>• HCWs</li> <li>• Residential area</li> <li>• Lower educational level</li> <li>• Lower monthly income</li> <li>• Informing oneself about COVID-19</li> <li>• Protecting oneself</li> <li>• High or very high trust in the MOH, hospitals, doctors, and social media</li> <li>• Knowledge of and compliance with protective measures</li> <li>• Strong agreement with containment policies</li> <li>• Higher probability of convincing others about protective measures</li> <li>• Higher risk perception of contracting COVID-19</li> <li>• Higher risk perception of contracting the flu</li> <li>• Non-Kuwaitis</li> <li>• Males</li> <li>• Young adults (aged 21–24 years old)</li> <li>• Farwaniya residents</li> <li>• Physicians</li> <li>• Former cigarette smokers</li> <li>• Abnormal weight (underweight, overweight, and obese)</li> <li>• Perception of the vaccine as effective</li> <li>• Positive behavior regarding the flu vaccine</li> <li>• Lower self-perceived overall health</li> <li>• High risk perception of contracting COVID-19</li> <li>• High perceived severity of COVID-19</li> <li>• The vaccine-conferred immunity is superior to that developed after contracting COVID-19</li> <li>• Fewer vaccine-related concerns</li> <li>• Feeling responsible for ending the pandemic ↓</li> <li>• Protecting oneself ↓</li> <li>• Asthmatic ↓</li> <li>• HCWs ↓</li> <li>• Positive behavior regarding vaccines in general ↓</li> <li>• Males ↓</li> <li>• Higher risk perception of contracting COVID-19 ↓</li> <li>• Positive behavior regarding the flu vaccine and vaccines in general ↓</li> </ul>
Alqudeimat (Aug 2020)	47	2,368	73% ↑	<ul style="list-style-type: none"> <li>• Concerns about vaccine safety ↓</li> <li>• Concerns about vaccine effectiveness ↓</li> <li>• Lack of vaccine-related information ↓</li> </ul>	
Burhamah (Mar–Apr 2020)	48	2,345	17%	<ul style="list-style-type: none"> <li>• Married</li> <li>• History of COVID-19 infection</li> <li>• History of ICU admission</li> <li>• Concerns about vaccine safety ↓</li> <li>• Concerns about vaccine effectiveness ↓</li> <li>• Aged 30–64</li> <li>• Married or divorced</li> <li>• Residential area</li> <li>• Lower monthly income (≤1000 KD)</li> <li>• Nonsmokers</li> <li>• Lack of knowledge of their family members' COVID-19-related health statuses</li> <li>• Low confidence in Kuwait health system's ability to control the spread of COVID-19</li> <li>• Lack of adequate COVID-19 vaccine-related information from authorities or HCWs</li> <li>• Exposure to COVID-19 is safer</li> <li>• Family members' hesitancy</li> <li>• Concerns about commercial profiteering</li> <li>• Concerns about vaccine effectiveness</li> <li>• Concerns about vaccine safety ↓</li> <li>• Vaccines have not been tested sufficiently ↓</li> </ul>	
AlIbrahim and Awad (Mar–Apr 2021)	49	4,147	26%		

(Continued)



Table 3. (Continued).

Author (survey period)	Reference no.	No. of participants	Hesitancy rate*	Factors associated with hesitancy**	Factors associated with acceptance**
Al-Ayyadhi (Jan 2021)	50	6,943	74%	<ul style="list-style-type: none"> <li>Lower educational level ↓</li> <li>Concerns about vaccine safety ↓</li> <li>Concerns about vaccine effectiveness ↓</li> </ul>	<ul style="list-style-type: none"> <li>Non-Kuwaitis</li> <li>Younger age</li> <li>Males</li> <li>HCWs</li> <li>Positive behavior regarding the flu vaccine</li> <li>Private sector employees</li> </ul>
<b>UAE</b> Albahri (Sep 2020)	51	2,705	40%	<ul style="list-style-type: none"> <li>Unemployment</li> <li>Perception that COVID-19 is not serious</li> <li>Authorities are not tackling the pandemic appropriately</li> <li>Concerns about vaccine effectiveness</li> <li>Concerns about vaccine safety</li> <li>Natural immunity is sufficient</li> </ul>	<ul style="list-style-type: none"> <li>Non-Emiratis</li> <li>Males</li> <li>Younger age (&lt;55 years old) ↓</li> <li>Residents of Sharjah and the Northern Emirates</li> <li>Lower educational level (undergraduate or less)</li> <li>High or very high perceived severity of COVID-19</li> <li>High or very high risk perception of contracting COVID-19</li> <li>Positive behavior regarding the flu vaccine ↓</li> <li>Protecting oneself and close relatives ↓</li> <li>Approval of vaccine safety ↓</li> </ul>
Ahamed (Unspecified)	52	1,003	N/A	<ul style="list-style-type: none"> <li>Concerns about vaccine safety ↓</li> <li>Concerns about vaccine effectiveness ↓</li> <li>Concerns about vaccine effectiveness ↓</li> <li>Concerns about vaccine safety ↓</li> <li>Non-Emiratis</li> <li>Lower educational level ↓</li> <li>Religious/cultural convictions</li> <li>Concerns about vaccine safety</li> <li>History of unpleasant experiences with vaccination</li> <li>Cost</li> </ul>	N/A
Saeed (Jan–Apr 2021)	53	1,080	23%	<ul style="list-style-type: none"> <li>Lower educational level ↓</li> <li>Religious/cultural convictions</li> <li>Concerns about vaccine safety</li> <li>History of unpleasant experiences with vaccination</li> <li>Cost</li> </ul>	<ul style="list-style-type: none"> <li>Higher monthly income</li> <li>Younger age ↓</li> <li>Gender</li> <li>Emirate of residence</li> <li>Perception of vaccine importance</li> <li>Positive behavior regarding vaccines in general ↓</li> </ul>
Niankara (Jul–Aug 2020)	54	1,109	78% ↑↑	<ul style="list-style-type: none"> <li>A need to travel to receive the vaccine</li> <li>Low risk perception of contracting COVID-19</li> <li>Concerns about vaccine safety</li> </ul>	<ul style="list-style-type: none"> <li>Non-Emiratis</li> <li>Clinically vulnerable</li> <li>High risk perception of contracting COVID-19</li> <li>Trusting pharmaceutical companies</li> <li>Country of the vaccine manufacturer</li> </ul>
Alzubaidi (Feb 2021)	55	669	32%	<ul style="list-style-type: none"> <li>Concerns about vaccine safety</li> <li>Concerns about vaccine effectiveness</li> <li>Natural immunity is sufficient</li> </ul>	<ul style="list-style-type: none"> <li>Males ↓</li> <li>Younger age (≤65 years old) ↓</li> <li>Immigrants of working age</li> <li>Positive behavior regarding the flu vaccine ↓</li> <li>Long-term medication ↓</li> <li>Perception of the vaccine as safe and protective ↓</li> </ul>
Shahwan (Mar–Aug 2021)	56	467	44%	<ul style="list-style-type: none"> <li>Qataris</li> <li>Single</li> <li>Self-employment</li> <li>Non-HCWs</li> <li>Vaccines have not been tested sufficiently</li> <li>Authorities are motivated by financial benefits</li> <li>Exposure to COVID-19 is safer than the vaccine</li> <li>Concerns about vaccine safety</li> <li>Concerns about vaccine effectiveness ↓</li> <li>Lower educational level ↓</li> <li>Vaccines have not been sufficiently tested ↓</li> <li>Concerns about vaccine safety ↓</li> <li>Concerns about vaccine effectiveness ↓</li> </ul>	<ul style="list-style-type: none"> <li>Non-Qataris</li> <li>Males</li> <li>Employment</li> <li>Older age (≥45 years old)</li> <li>Students at schools of health sciences</li> <li>Positive behavior regarding the flu vaccine</li> <li>Males ↓</li> <li>Trust in the measures taken to tackle the pandemic</li> <li>Higher perceived risk of contracting COVID-19 ↓</li> </ul>
<b>Qatar</b> Alabdulla (Oct–Nov 2020)	57	7,821	40% ↑	<ul style="list-style-type: none"> <li>Concerns about vaccine safety</li> <li>Concerns about vaccine effectiveness</li> <li>Natural immunity is sufficient</li> </ul>	<ul style="list-style-type: none"> <li>Non-Emiratis</li> <li>Clinically vulnerable</li> <li>High risk perception of contracting COVID-19</li> <li>Trusting pharmaceutical companies</li> <li>Country of the vaccine manufacturer</li> </ul>
Al-Mulla (Feb 2021)	58	462 ↓↓↓	37%	<ul style="list-style-type: none"> <li>Arab ethnicity</li> <li>Migrants</li> <li>Concerns about vaccine safety</li> </ul>	<ul style="list-style-type: none"> <li>Non-Qataris</li> <li>Males</li> <li>Employment</li> <li>Older age (≥45 years old)</li> <li>Students at schools of health sciences</li> <li>Positive behavior regarding the flu vaccine</li> <li>Males ↓</li> <li>Trust in the measures taken to tackle the pandemic</li> <li>Higher perceived risk of contracting COVID-19 ↓</li> </ul>
Khaled (Dec 2020–Jan 2021)	59	1,038	57% ↑↑	<ul style="list-style-type: none"> <li>Arab ethnicity</li> <li>Migrants</li> <li>Concerns about vaccine safety</li> </ul>	<ul style="list-style-type: none"> <li>Non-Qataris</li> <li>Males</li> <li>Employment</li> <li>Older age (≥45 years old)</li> <li>Students at schools of health sciences</li> <li>Positive behavior regarding the flu vaccine</li> <li>Males ↓</li> <li>Trust in the measures taken to tackle the pandemic</li> <li>Higher perceived risk of contracting COVID-19 ↓</li> </ul>

(Continued)



**Table 3.** (Continued).

Author (survey period)	Reference no.	No. of participants	Hesitancy rate*	Factors associated with hesitancy**	Factors associated with acceptance**
Hafizh (Unspecified)	<sup>60</sup>	175	N/A	<ul style="list-style-type: none"> <li>● Religious/cultural convictions</li> <li>● Lower educational level ↓</li> </ul>	<ul style="list-style-type: none"> <li>● Seeing public figures or heads of state get vaccinated</li> <li>● Positive behavior regarding vaccines in general ↓</li> </ul>
<b>Oman</b> Al-Marshoudi (Dec 2020)	<sup>61</sup>	3,000	43%	<ul style="list-style-type: none"> <li>● Pregnancy</li> </ul>	<ul style="list-style-type: none"> <li>● Omanis</li> <li>● Males</li> <li>● Employment</li> <li>● Perception of the vaccine as safe</li> <li>● Illiteracy</li> <li>● History of chronic illness</li> <li>● Hearing about the vaccine from friends</li> </ul>

N/A: not applicable, HCWs: healthcare workers.

\*Rounded to whole numbers.

\*\*Reported as statistically significant (P < 0.05).

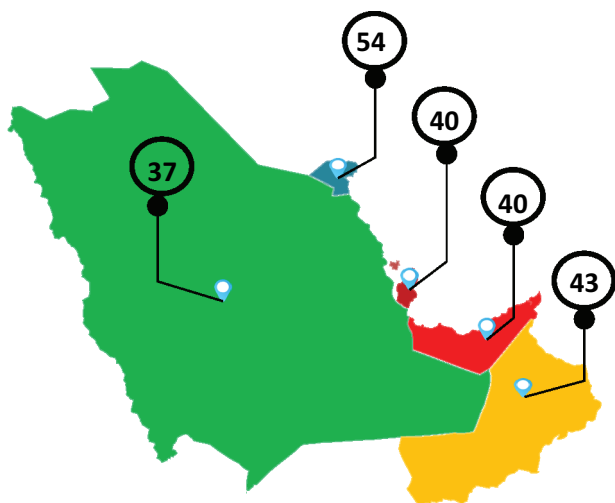
↑ After considering those who were unsure about receiving the vaccine as vaccine hesitant.

↑↑ After considering those who were vaccine resistant as vaccine hesitant.

↓ Not tested for significance.

↓↓ Significance testing was based on the answers of the total study participants from the different countries (2,925 participants [25] and 3,414 participants [40]).

↓↓↓ 454 participants answered questions related to their willingness to receive the vaccine.



**Figure 2.** Medians of vaccine hesitancy rates (%) in each GCC country.

frequently reported factors associated with COVID-19 vaccine hesitancy were concerns about vaccine safety and effectiveness, as well as the low risk perception of contracting COVID-19.<sup>51–56</sup> Some participants were interested in developing immunity naturally through exposure rather than vaccination.<sup>51,56</sup> In one study, more than half of the participants reported cost as a factor contributing to hesitancy. Religious or cultural convictions (11%) were reported as contributing factors in the study conducted by Niankara et al.<sup>54</sup> Official government websites were seen to be the most trustworthy source of vaccine-related information.<sup>54</sup> General internet websites were also commonly used as informative references.<sup>54</sup> The main driver of receiving the vaccine among participants from the UAE was the intention to protect oneself and close relatives.

### **Qatar**

The overall COVID-19 vaccine hesitancy rate in Qatar was 37%–57%, with a median of 40%.<sup>57–60</sup> Only one study was conducted before the vaccine rollout in Qatar.<sup>57</sup> Males were more likely to be willing to receive the vaccine.<sup>57–59</sup> Similar to in other GCC countries, those who had positive behavior regarding the influenza vaccine were more likely to accept the COVID-19 vaccine.<sup>57,58,60</sup> The most common reasons attributed to vaccine hesitancy were safety concerns and the belief that natural immunity conferred by contracting COVID-19 is safer.<sup>57–59</sup> In the study by Hafizh et al., respondents claimed that seeing public figures or heads of state accept the vaccine would encourage them to receive the vaccine.<sup>60</sup> The local Ministry of Health (MOH), the WHO, and healthcare providers were deemed the primary sources for vaccine-related information.<sup>58,59</sup>

### **Oman**

Only one study focused on Oman and explored hesitancy toward the COVID-19 vaccine in December 2020, before the vaccine was introduced for use in the country.<sup>61</sup> In a cross-sectional, mobile-based survey conducted among 3,000 participants from the public, the overall vaccine hesitancy rate was 43%. The major concern raised by participants was the perception that the vaccine might be unsafe (23%). Interestingly, only

0.2% expressed religious convictions as a reason. Furthermore, among female participants, pregnant women were significantly more likely to be hesitant regarding the vaccine. Most participants referred to social media (67%) and mass media sources (56%) for vaccine-related information.

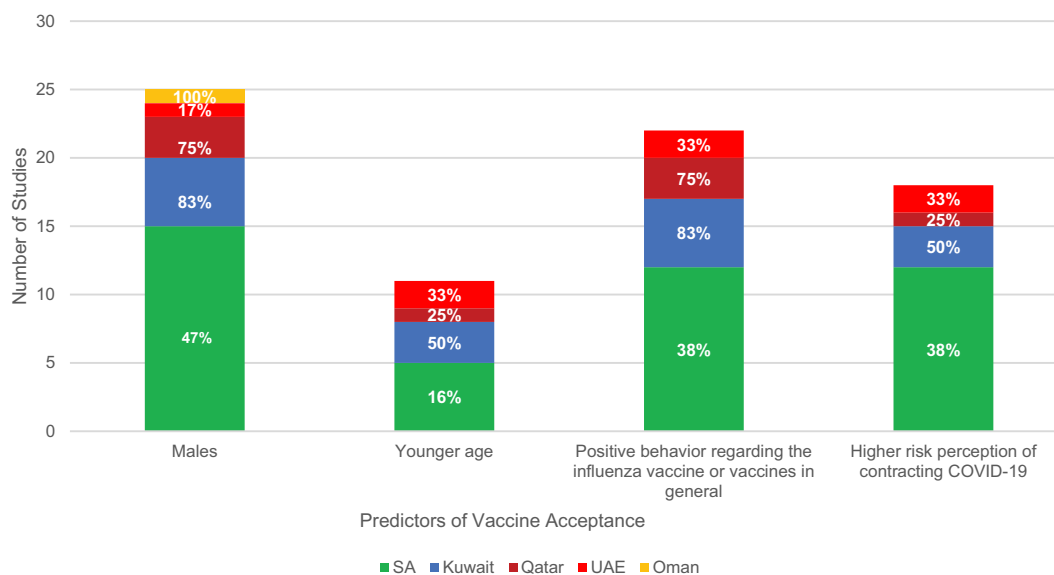
### **Discussion**

This review summarizes COVID-19 vaccine hesitancy data from 49 papers across the GCC countries. Hesitancy rates ranged widely, from as low as 5% to as high as 82%. As shown in Figure 2, the median overall vaccine hesitancy rates in each country were 54%, 43%, 40%, and 37% for Kuwait, Oman, both the UAE and Qatar, and Saudi Arabia, respectively, with an average of 43%. This value is higher than that reported by Arce et al.<sup>62</sup> among low- and middle-income countries (a median rate of 22%) and similar to that given for the United States (a median rate of 35%).<sup>62</sup> Sallam et al.<sup>10</sup> reported lower COVID-19 vaccine acceptance in Kuwait compared to other countries, which is inconsistent with our findings. This is probably because more studies from Kuwait were published at a later stage and included in our review; hence, the collective findings from all the studies published to date on Kuwait could be more reflective of the recent situation there.

The median hesitancy rate in individual countries ranged between 37–54%. Although the variation between the countries was not very wide, there might have been multiple factors contributing to this. The number of studies evaluated from individual countries varied widely from 32 in Saudi Arabia and only one in Oman. The timing of the individual studies varied between the countries as before and after the vaccine rollout. Furthermore, even after the introduction of vaccines for public use, the specific time of the study could have had an influence on the vaccine hesitancy rate depending on multiple factors. At the same time, inherently or genuinely the vaccine hesitancy rate might have varied between the countries depending on multiple factors including the trust of the people from each country in their health care system, their general belief and perception of vaccines, kind of information that is spread among the public, educational level, as well as other demographics of the participants.

Efforts taken by the individual countries' regulatory bodies and health departments in tackling vaccine hesitancy might be different. This could differ in the way of sharing direct information among the public to improve vaccine acceptance through mass media and other means, addressing the concerns and rumors among the public on COVID-19 vaccine and measures taken to control infodemics including inaccurate information spread through social media and other means.

The included studies attempted to assess various factors likely influencing the willingness/unwillingness of the public to receive the COVID-19 vaccine. Although a specific and accurate interpretation of such findings cannot be obtained as there was no uniformity in the assessed/enquired-about factors, a general overview can be provided based on the results of the studies. The most frequently reported factors associated with COVID-19 vaccine acceptance across the GCC countries included being male ( $n = 25$ ), positive behavior regarding the influenza vaccine or vaccines in general ( $n = 22$ ), a higher risk



**Figure 3.** Predictors of COVID-19 vaccine acceptance. The percentages are presented based on the total number of studies from each country (i.e., SA: 32, Kuwait: 6, UAE: 6, Qatar: 4, and Oman: 1). Not all the findings reported in this figure were tested for significance.

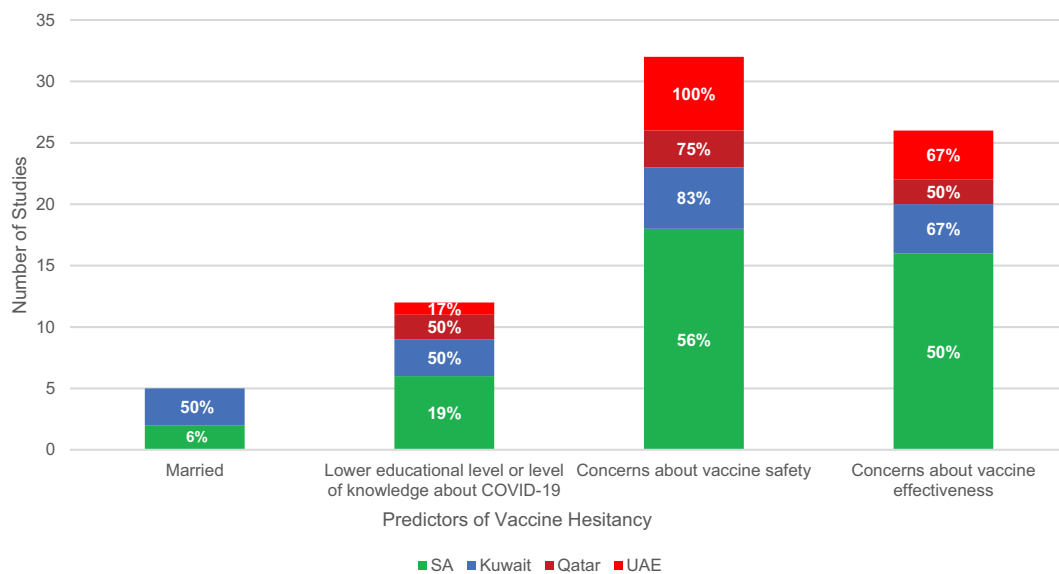
perception of contracting COVID-19 ( $n = 18$ ), and a younger age ( $n = 11$ ). On the other hand, concerns about vaccine safety ( $n = 32$ ) and vaccine effectiveness ( $n = 26$ ), lower educational levels or levels of knowledge about COVID-19 ( $n = 12$ ), and being married ( $n = 5$ ) were frequently identified as factors associated with COVID-19 vaccine hesitancy. Other factors that contributed to hesitancy included the notion that the vaccines have not been tested sufficiently ( $n = 10$ ), the idea that natural immunity is safer or sufficient ( $n = 6$ ), and belief in conspiracy theories ( $n = 5$ ). Figures 3 and 4 show the most common predictors of COVID-19 vaccine acceptance and hesitancy in each GCC country, respectively. Arce et al.<sup>62</sup> reported similar predictors in low- and middle-income countries. In their study, concerns about vaccine safety were the most common predictor of hesitancy. Our results are also consistent with those reported by Sallam et al.,<sup>10</sup> who conducted a systematic review to assess COVID-19 vaccine acceptance worldwide and reported higher COVID-19 vaccine acceptance among males. The association of gender and concerns about vaccine safety and effectiveness with vaccine hesitancy/acceptance was reported in other countries as well.<sup>63,64</sup>

While the source of vaccine information has been evaluated as a predictor for vaccine hesitancy in some studies, a correlation was not established. Social media and mass media sources were most commonly considered as the primary source of vaccine-related information, though official government websites and healthcare professionals were often referred to as well. Unlike traditional media, social media platforms do not undergo editorial curation or scientific evaluation. Such platforms allow users to create and share content and opinions quite rapidly, which may result in the fast spread of misinformation regarding COVID-19 vaccines. Such a process creates a major public health concern, which may be associated with lower vaccine acceptance among the general population.<sup>65</sup>

### Implications and recommendations

Targeting factors associated with vaccine hesitancy might be the best place to start when aiming to increase vaccination rates. The WHO's SAGE working group proposes three Cs to address when tackling vaccine hesitancy: confidence (i.e., trust in the vaccine, in the healthcare system, and in the policy makers), complacency (i.e., a low perception of risk regarding the disease), and convenience (i.e., the availability, accessibility, and affordability of the vaccine).<sup>9</sup> Most of the GCC countries have targeted these three Cs in their efforts to enhance vaccine acceptance. Confidence in the vaccine and complacency were addressed by creating and distributing clear and continually updated resources in multiple languages. These resources included information about the heightened risk of the disease and its complications, methods for contracting and transmitting the disease, and the risk associated with not getting vaccinated. This information was widely disseminated via traditional channels (e.g., on television and street billboards) and social media. Additionally, some GCC governments created infographics and videos with information on COVID-19 vaccines in an effort to encourage the public to receive the vaccine. Quick hot lines were created by the MOH in each country to address any questions consumers might have regarding the vaccine or the virus. Important public figures, including the crown prince of Saudi Arabia, were vaccinated in public, and this was aired via different channels, again as a strategy to enhance confidence and trust in the vaccine and the healthcare system. Another method used to address complacency was the reporting of the number of cases, including those in critical condition, and death rates on a daily basis to increase awareness of the gravity of this disease.

The vaccination process in GCC countries was made easy and free of charge. At first, vaccination required downloading an application to a smart phone, being triaged according to one's risk status, and traveling to a center that had the capacity



**Figure 4.** Predictors of COVID-19 vaccine hesitancy. The percentages are presented based on the total number of studies from each country (i.e., SA: 32, Kuwait: 6, UAE: 6, and Qatar: 4). Not all the findings reported in this figure were tested for significance.

to freeze the vaccines at very cold temperatures. As GCC countries acquired more doses, more and more vaccination centers were able to offer the vaccine with minimal waiting times. This made the process quite convenient and accessible. Finally, once individual countries had enough vaccine supplies for all their residents, a vaccine mandate was put in place in many of the countries. This mandate requires citizens and residents to demonstrate they have been vaccinated with two doses to be able to go pretty much anywhere: stores, universities, workplaces, movie theaters, airports, etc.

#### Potential future approaches

The following are additional recommendations that can be considered. One involves encouraging educational institutions (schools, colleges, and universities) to include classes/lectures on the pandemic disease, its dangers, and the benefits of the vaccine, as well as providing evidence on the effectiveness of vaccines throughout history. Furthermore, basic education on the drug development process, including the methods employed in assessing the efficacy and safety of medications, as well as vaccines, before their introduction for general use, could be considered. This could probably improve the trust of the public in terms of the drug/vaccine approval process and its efficacy and safety. The media (such as TV or radio) may host recovered COVID-19 patients or the relatives of individuals suffering from COVID-19 in order to emotionally influence people to get vaccinated to protect themselves and their loved ones.

#### Limitations

We believe this is the first review to summarize the data on COVID-19 vaccine hesitancy and acceptance among the public in the GCC countries. Nonetheless, this review

has some limitations. First, all the included studies were cross-sectional, which means that our results cannot be generalized. Second, given that most of the included studies were from Saudi Arabia (32/49) and that no studies reported the situation in Bahrain, the distribution of the included studies is skewed, which makes our calculated average of vaccine hesitancy and the comparisons between GCC countries less reliable. Third, the included studies used different scales to assess vaccine hesitancy (e.g., some used a binary approach of yes/no questions, while others used a scale ranging from definitely/probably to unsure or from strongly agree to strongly disagree). Fourth, all the included studies utilized social media to distribute their web-based surveys. While this method allows for a larger reach of participants, it may be coupled with reliability and validity problems as part of the general population may not have access to such platforms or may need guidance while filling out the questionnaires.<sup>66</sup> Fifth, although some studies did not consider those that were unsure/indecisive about receiving the vaccine as vaccine hesitant, we classified such individuals as hesitant as they fall under the WHO's definition of a form of delaying the vaccination process.<sup>9</sup> Sixth, as the included studies administered their surveys at different times, this could have been a confounder with regard to accurately mirroring vaccine hesitancy rates, especially with the fluctuations in the level of protective measures and/or in governmental/other organizations' encouragement of vaccination over time. Lastly, one study included vaccinated individuals as study participants as the primary aim of the study was to assess vaccine safety.<sup>53</sup> Lower vaccine hesitancy rates were reported, which is likely biased due to the fact that it included vaccinated individuals as study participants, who had obviously overcome their initial hesitancy, if

any existed in the first place. The inclusion of this study might have affected the reflections on vaccine hesitancy in the respective country.

## Conclusion

COVID-19 vaccine hesitancy is a common phenomenon among the public globally and in the GCC countries specifically, with concerns about vaccine safety and effectiveness being the most reported factors. This warrants collaborative efforts of governments, academic bodies, and the media to provide evidence on vaccines' effectiveness throughout history and to strictly manage the spread of the vaccine safety-related rumors. Improving the health literacy of the public in general will also be beneficial. Such an approach is vital considering the potential emergence of similar situations in the future for which all stakeholders should be better prepared.

## Disclosure statement

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