Public acceptability of COVID-19 vaccines and its predictors in Middle Eastern/North African (MENA) countries: a systematic review

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\section*{ABSTRACT}

\textbf{Introduction:} COVID-19 vaccines emerged as a worldwide hope to contain the pandemic. However, many people are still hesitant to receive these vaccines. We aimed to systematically review the public knowledge, perception, and acceptability of COVID-19 vaccines in the Middle East and North Africa (MENA) countries and the predictors of vaccine acceptability in this region.

\textbf{Methods:} We systematically searched databases of PubMed, Scopus, Web of Science, and Cochrane and retrieved all relevant studies by 5 August 2021.

\textbf{Results:} There was a considerable variation in the COVID-19 vaccine acceptance rates, from 12% in a study from Israel to 83.3% in Kuwait, although two other studies from Israel mentioned 75% and 82.2% acceptability rates. Concerns about the side effects and safety of the vaccine were the main reasons for the lack of acceptability of taking the vaccine, which was reported in 19 studies.

\textbf{Conclusion:} Several factors, such as age, gender, education level, and comorbidities, are worthy of attention as they could expand vaccine coverage in the target population.

\section*{Introduction}

Coronavirus 2019 (COVID-19) emerged as a pandemic and a serious threat to the public health in 2020.\textsuperscript{1-4} Many countries have accelerated vaccine research and developed vaccination programs against COVID-19.\textsuperscript{5-7} With emerging variants that exhibit more transmissibility or disease severity, such as delta and omicron variants, the worldwide hope relies on higher vaccination rates to decrease the disabilities and deaths related to the COVID-19.\textsuperscript{3,8,9} Although vaccine research has progressed rapidly, public acceptance and negative attitudes toward COVID-19 vaccines are significant challenges. The willingness to receive the COVID-19 vaccine is recognized as a key issue in predicting the success of a vaccination program.\textsuperscript{10}

The acceptability of the vaccines and people’s attitude toward them determine the rates of vaccinations and serves an important role in containing the pandemic. Several factors were suggested to affect the vaccine acceptability among the general population, such as the previous experience of vaccine, level of education and knowledge, risk perception and trust, perception of vaccine effectiveness, having underlying diseases, mental and cultural norms, religious and moral beliefs, etc.\textsuperscript{11-13} Understanding the severity and risks of the COVID-19 is also associated with public awareness of the dangers and encourages people to be more involved in disease prevention.\textsuperscript{12,14,15} Nevertheless, such factors are not extensively reviewed by the previous studies. The current global acceptance of the COVID-19 vaccines varies from 35% to 98% across countries, indicating that policymakers need to understand the public attitude to assist the large-scale vaccination programs.\textsuperscript{16-18}

The Middle East and North Africa (MENA) region was affected early in the COVID-19 epidemic, and there were a large number of cases in some countries (e.g., Iran).\textsuperscript{19} The first COVID-19 confirmed cases in MENA date back to February 2020 and have been reported in the UAE, Iran, and Egypt.\textsuperscript{20} Although some original studies on vaccine acceptability exist that measure the public perception toward vaccination in the countries of the region, no systematic reviews are available to summarize the findings for this region. Furthermore, the causes of vaccine hesitation and lack of acceptability are not studied in details for the region. Bearing these facts in mind, this study aimed to systematically review the public knowledge, perception, and acceptability of COVID-19 vaccines in the MENA countries and the predictors of vaccine acceptability in this region, as making policies revolving around such factors may increase the willingness of the people to receive the COVID-19 vaccines.


Methods

Overview

We systematically searched the online databases of PubMed, Scopus, Web of Science, and Cochrane and retrieved the relevant studies by 5th August 2021. The retrieved records were downloaded into the EndNote 20 program for study selection. The study selection process consisted of two steps; first, the records underwent a title/abstract screening process. Then, studies selected in the title/abstract screening were included in the full-text screening, and the eligible articles were included in the final review.

Search strategy

We searched for the keywords related to "COVID-19", "vaccination", and "MENA and its countries". The detailed keywords and search strategy be found in Supplementary material 1.

Study selection

We included the original studies that evaluated public attitude, perception, and acceptability of COVID-19 vaccines in the MENA region. The exclusion criteria were as follows:

1. Reviews, systematic review, meta-analyses, and any other studies without original data
2. Case reports
3. Abstracts or other studies lacking available full texts
4. Studies from the world regions other than MENA
5. Non-English studies

Data extraction

We summarized the included publications into a word table (Table 1) that represents the year and country of study, study design (e.g., cross-sectional study), sample size, patient’s mean age, gender, comorbidity, history of influenza vaccination (%), participants’ education and occupation, acceptability rate of COVID-19 vaccine (%), reasons for lack of acceptability, respondents’ attitudes toward vaccination, reasons and predictors of acceptability, and a summary of findings. Three independent researchers undertook this process, and a final investigator reviewed the extracted data and addressed any possible discrepancies between the researchers.

Results

A total of 45 cross-sectional studies were included in this review (Figure 1). All studies were conducted using phone interview or a self-reported online questionnaire. Most of the studies were from Saudi Arabia, Jordan, and Israel, with 11, 7, and 5 studies, respectively. The majority of studies had a high number of participants; 15 of them polled 1000–3000 participants, 12 polled over 3000 participants, and 18 had less than 1000 participants.

There has been a considerable variation in COVID-19 vaccine acceptance between the studies. The highest acceptance rate was reported in a survey conducted in Kuwait (83.3%); while, the lowest rate of acceptance was reported in a survey conducted in Israel with an acceptance rate of 12%. Some countries had higher acceptance: one study in Kuwait (83%), two studies in Israel (82.2% and 75%), and one study in Saudi Arabia (70.7%). The acceptance rate was not reported in six studies. Concerns related to the side effects and safety of the vaccine were the main reasons for the lack of acceptability of the vaccines reported in 19 studies.

A considerably wide variety of acceptability rates have been reported across the studies included in this review. Depending on the demographic characteristics of the participants, such as age, gender, education, and region. Elgendy and Abdelrahim, Fares et al., and Temsah et al. reported that the safety and efficacy of the currently available COVID-19 vaccines against severe complications is another predictor of high vaccine acceptability.\(^{21,22,25}\) The type of vaccine, side effects, and its manufacturing company has also played a pivotal role in people’s willingness to receive vaccines.\(^{22,26}\) Interestingly, other studies conducted on younger than 25-year-old participants have also shown a high rate of vaccine acceptability.\(^{29}\) In contrast, studies with a wider range of participants that included middle-aged adults demonstrated lower vaccine acceptability rates than the groups mentioned above.\(^{25,30,31}\)

Individuals who have received their influenza vaccine appeared to be more willing to get vaccinated against the COVID-19.\(^{27,28,32–35}\) Nevertheless, Baghdad et al. did not find correlations between intentions for accepting influenza vaccinations and the COVID-19 vaccines’ acceptability.\(^{37}\) While Dror et al. reported influenza vaccine acceptance as the most significant predictor of willingness to the COVID-19 vaccines.\(^{44}\)

Males tended to have higher acceptability rates compared to the women.\(^{36–38,40–43}\) Patients with underlying conditions that found themselves at higher risk of severe COVID-19 had better acceptability for the COVID-19 vaccines.\(^{44}\) Participants involved in healthcare services tend to have a higher vaccine acceptability rate compared to other groups. In a group of 628 medical students and nursing students in Israel, the acceptability rate was 82.2%.\(^{45}\) However, the acceptability rate among 2133 Egyptian medicine, nursing, dentistry, and pharmacy students reported to be 34.9%.\(^{39}\) Temsah et al. also reported a relatively low acceptability rate (20.9–24.4%) in a sample of 15,124 physicians, nurses, and health care providers in Saudi Arabia.\(^{22}\) Those with non-medical but higher degrees are more likely to find their desired information about the vaccines and understand the arguments supporting vaccination.

Discussion

In this study, we reviewed the acceptability rate and influencing factors of COVID-19 vaccinations such as age, sex, education level, and comorbidities of the participants. The reasons and rationale leading to higher or lower acceptability rates are discussed here to enhance the awareness of vaccine acceptability and influencing factors. Whether subjective or objective, various factors were shown to contribute to a high vaccine acceptability rate among subjects. Being concerned about the risk of contracting COVID-19
| ID | Author                           | Country and number | Mean age and male (% | Comorbidity | Previous influenza vaccination | Education level and occupation | Acceptability rate | Attitudes towards vaccination | Reasons for lack of acceptance | Reason and predictors of positive acceptability | Summary of findings |
|----|---------------------------------|-------------------|----------------------|-------------|-------------------------------|--------------------------------|---------------------|-----------------------------|---------------------------------|------------------------------------------------|------------------|
| 1  | Almaaytah, Salama A.            | Jordan            | 44                   | N/A         | N/A                           | No education at all: 3.2% Less than high school degree: 6.8%, High school degree: 8.7%, Some college: 64.7%, College degree: 16.6% | N/A                 | A strong correlation between the participants’ unwillingness to get vaccinated and the perceived potential harms of the vaccine | Perceived stigma, Perceived severity, the Perceived likelihood of infection in the future, Knowledge, Protective behaviors, Perceived potential harms of vaccine, Perceived effectiveness of the vaccine | – Being free of charge - The availability of COVID-19 vaccines | Jordanians are still hesitant about getting vaccinated against COVID-19, which could be mainly attributed to their perceived uncertainty of the vaccines’ efficacy and toxicity |
| 2  | Alobaidi S.                     | Saudi Arabia      | 35.04 ± 11.67        | 22.8%       | N/A                           | High school and below: 279 (20.9), Bachelor: 794 (59.6), Masters/ PhD: 260 (19.5) | N/A                 | 67.1% Perceived susceptibility construct and perceived benefit construct were important facilitators for a definite intention to vaccinate among the Jordanians | Being concerned with the safety and side effects of the vaccine under the perceived barriers construct and willingness to get vaccinated | Participants who rated higher confidence in local as well as foreign vaccine reported significantly higher intention to take the vaccination, perception of worry about the likelihood of getting COVID-19 infection | N/A |
| 3  | Aloweidi A.                     | Jordan            | 28.2 ± 10.8 26.2%    | N/A         | 37 (10.3%)                    | Elementary school: 20 (3.1%), High school: 55 (8.5%), Diploma: 55 (8.5%), Bachelor: 429 (66.4%), Masters: 69 (10.7%), Doctor of Philosophy (PhD): 18 (2.8%) | N/A                 | 35% Rumors They Received via Social Media, The Rumors That They Believed in, Side Effects They Heard about | Most Encouraging Factors for Vaccination, Most Influencing Social Media Tools to Encourage Vaccination | Reading a scientific article about the available vaccines showed a significant increase in the rate of willingness to take the vaccines | N/A |
| 4  | Alzahrani SH                    | Saudi Arabia      | N/A                  | 81% Chronic disease | 58.9%                         | Secondary education: 42 (1.4%), Secondary: 302 (9.9%), University: 2104 (69%), Postgraduate: 600 (19.7%) | N/A                 | 24.4% About half of Saudis are unwilling or undecided about getting the COVID-19 vaccine | Short clinical testing period, vaccine side effects, preference for acquired immunity via contracting the COVID-19 infection. | Males, Saudis, individuals with less than secondary education, residence in the southern region, and individuals with perceived risks of COVID-19, Participants who had received the influenza vaccine within the past year were Perceived susceptibility, Perceived severity, Perceived self-efficacy, Perceived response efficacy, intention | About half of Saudis are unwilling or undecided about getting the COVID-19 vaccine, representing a significant public health threat and impediment to the goal of attaining herd immunity. |
| 5  | Ansari-Moghaddam A.             | Iran              | 37.73 ± 12.27 46.2%  | N/A         | N/A                           | University degree: 83.7%, Undergraduate degree: 47.3%, Graduate degree: 36.4% | N/A                 | N/A | N/A | The PMT constructs are useful in predicting COVID-19 vaccination intention | (Continued) |
| ID | Author | Country and number | Mean age and male (%) | Comorbidity | Previous influenza vaccination | Education level and occupation | Acceptability rate | Attitudes towards vaccination | Reasons for lack of acceptability | Reason and predictors of positive acceptability | Summary of findings |
|----|--------|-------------------|-----------------------|-------------|-----------------------------|-----------------------------|-------------------|-----------------------------|---------------------------------|---------------------------------|-------------------|
| 6  | Asadi-Faezi, N. | Iran 1880 | N/A 45.85% | 13% | N/A | High school: 95 (5.05%), Diploma: 231 (12.29%), Bachelor: 506 (26.91%), MSc: 529 (28.14%), Doctorate: 519 (27.61%) | 66.81% | Individuals with higher education believe that India, the USA, the UK, and Europe produce the best vaccine, while healthcare workers think of China, India, Russia, and Cuba. | Concerned about the reports of post-vaccination mortality, the earlier preparation of the vaccine, the side effects of vaccines, believed rumors such as changes in the human genome in the vaccine. | Vaccination can help control the recent epidemic, to effectively reduce mortality from COVID-19 disease. | A multifaceted approach to facilitate vaccine uptake that includes vaccine education, behavioral change strategies, and health promotion. |
| 7  | AlAwadi EA | Kuwait 7241 | 38.08 27.3% | 25.1% Chronic illness | No formal education: 29, High school or less: 9.11, University: 71.87, Post-graduate: 18.73 | 67% | Knowledge of COVID-19, the perception of being prepared to protect oneself, taking protective measures, informing oneself about the coronavirus, having high confidence in the media, doctors, hospitals, or the Ministry of Health | Increased age, being female, an increased belief that the measures are taken is greatly exaggerated, and not taking the seasonal influenza vaccine in 2019 | To take the COVID-19 vaccine if it was available and recommended in the country. Informing oneself about the coronavirus and perceiving the probability of getting infected with seasonal influenza | This increase in vaccine hesitancy reveals a challenge in achieving high inoculation levels and the need for effective vaccine-promotion campaigns and increased health education in the country. |
| 8  | Baghdadi, L. R | Saudi Arabia 329 | N/A 48.2% | 19.8% Chronic diseases | Physician: 44.6%, Nurse: 19.4%, Others: 36.0% | 70.7% | Vaccine acceptors had greater odds about the belief that COVID-19 is a bad disease and is dangerous for patients, and the vaccine would be beneficial | The vaccine rejecters believed that HCWs must have the freedom of choice to accept or reject the vaccine. | Perceived susceptibility to the COVID-19 infection, Encouragement from close family and friends, colleagues, and supervisors | Most of the HCWs were willing to accept the COVID-19 vaccine. The intention of accepting the vaccine was not associated with previous exposure to the influenza vaccine. |
| 9  | Burhamah, W. | Kuwait 2345 | 29 41% | Diabetes, Hypertension, Heart attack, Asthma, Hypothyroidism, Depression, Cancer, Inflammatory bowel disease | N/A | High school: 481 (20%), College diploma: 323 (14%), Bachelor's degree: 1,290 (55%), Master's degree/PhD: 251 (11%) | 83% | Most people were not opposed to the vaccine and agreed to Use it | Waiting for the vaccine to work for others, lack of complete protection against the virus, This is a conspiracy, The vaccine is harmful and unsafe, The vaccine gives the person the virus. | The pandemic ends faster, and life returns to normal, Protection against the virus, wanted to be able to travel in the future. | Vaccine hesitancy could jeopardize the efforts to overcome this pandemic; therefore, intensifying nationwide education and dismissal of falsified information is an essential step toward addressing vaccine hesitancy. |

(Continued)
Table 1. (Continued).

| ID | Author | Country and number | Mean age and male (%) | Comorbidity | Previous influenza vaccination | Education level and occupation | Acceptability rate | Attitudes towards vaccination | Reasons for lack of acceptability | Reason and predictors of positive acceptability | Summary of findings |
|----|--------|-------------------|-----------------------|-------------|-------------------------------|-------------------------------|------------------|-----------------------------|---------------------------------|---------------------------------|---------------------|
| 10 | Dror, A. A<sup>18,29</sup> | Israel 1112 | N/A N/A | N/A | N/A | Doctors: 338, Nurse: 211, Others: 563 | 75% | N/A | Quality control, Side effect, Associated of covid, Wait until tested by other, Wait for next year, Pregnancy, Doubled efficiency, Covid symptoms are mostly mild, Physiological immunity is better | The most significant positive predictor for people to accept a potential COVID-19 vaccine is their current influenza vaccination status. | The majority of the responders' concerns, both among healthcare workers and non-healthcare workers alike, are due to public uncertainty of the COVID-19 vaccine's rapid development. |
| 11 | El-Bimat, T<sup>27,35</sup> | Jordan 3100 | 29 32.6% | 13.4% Chronic diseases | School education: 269 (8.7), Undergraduate: 2,169 (69.9), Postgraduate: 662 (21.4) | 37.4% | COVID-19 vaccines made in Europe or America are safer than those made in other world countries, Most people will refuse to take the COVID-19 vaccine once licensed in Jordan, The government makes the vaccine available for all citizens for free | Concerned that the COVID-19 pandemic is a conspiracy, Not trust any information. | Participants who believed that the COVID-19 pandemic is a conspiracy and those who did not trust any information were less acceptable for the vaccine. | Jordan is one of the lowest eligible countries for the COVID-19 vaccine. Vaccines have raised safety and cost concerns with the refusal. |
| 12 | Elgendy, M. O<sup>13,37</sup> | Egypt 871 | N/A 46.6% | 22.9% Chronic diseases | Colleague student:15.5%, Bachelor: 63.8%, Master/PhD: 20.7% | N/A | A person can be infected with coronavirus more than one time, Herd immunity is enough to protect everyone from the coronavirus | Believed that the vaccine itself may infect them with coronavirus. | The vaccine is the best way to protect against coronavirus and its complications. Necessary to take the coronavirus vaccine even if the person has already been infected with the coronavirus. | Participants were satisfied in terms of acceptance of the vaccine, there are some concerns about it due to insufficient clinical trials and fear of its side effects. |
| 13 | Rana Abu-Farha<sup>10,36</sup> | Jordan-Iraq-Saudi Arabia-Lebanon 2,925 | 27 ± 16.0 37.6% | 13.5% Chronic disease | School level or below 7.2%, Diploma 11.9%, bachelor or graduated degree 80.9%, biomedical degree 45.8% Monthly income < $500 (49.7%), $501 - $1,000 (26.4%), >$1,000 (21%) | 25% | 32.6% hesitate and 42.5% denied the willingness to take vaccine. | Being female, previous infection of COVID-19 | Predictors: Living in Saudi Arabia and Iraq, being unmarried, having a monthly income more than $1,000, having a medical degree, having high fear from COVID-19 and feeling of being at risk of being infected, and the previous injection of Influenza vaccine. | Of those participants who were willing to receive the vaccine, 60% were ready to pay for the vaccine in case not covered by the government. Also, 50% of acceptors preferred to receive American vaccines and 30% of them were unsure about the best vaccine. Also, 11% stated that any vaccine is good. |
| ID | Author                  | Country and number | Mean age and male (%) | Comorbidity                          | Previous influenza vaccination | Education level and occupation | Acceptability rate | Attitudes towards vaccination | Reasons for lack of acceptability | Reason and predictors of positive acceptability | Summary of findings           |
|----|-------------------------|--------------------|-----------------------|--------------------------------------|------------------------------|-------------------------------|----------------------|-----------------------------|---------------------------------|----------------------------------|---------------------------------|
| 14 | Rana K Abu-Farha        | Jordan 1,207       | 30.1 ± 9.7 53%        | 9.2% Chronic disease                 | School-level or lower (30.6%), University or higher (69.4%), biomedical degree (13.1%) | 57.4%                          | 36.1%                | 18.1% were willing to allow their children to receive the vaccine. 16.2% had fear of COVID-19. | Not wanting to be challenged by the virus (54.7%), fear (40.7%), lack of time (40.4%), and mistrust in pharmaceutical companies (38.9%) | Being female and being married were significantly associated with lower odds of agreeing with vaccination. | Higher education was associated with lower willingness. |
| 15 | Carina Kasrine Al Halabi| Lebanon 579        | 24.94 ± 9.45 23.8%   | 30.7% Pregnant or chronic disease   | Complementary or less (6%), secondary (14.5%), university (79.4%) | 40.4%                          | 21.4%                | 40.9% refused to receive vaccine. |                                  |                                  | N/A                             |
| 16 | Sabria Al-Marshoudi     | Oman 3000          | 38.2 ± 10.45 76%     | 16.3% Chronic disease 16.3%         | N/A                           | Illiterate 8% pre-secondary school 54.64%, post-secondary and higher 37.32%, Employed 71.39% | 56.8%                | 59.3% had a concern about the vaccine, 34% had concerns because of doubts about the efficacy and safety of the vaccine, and 56.8% would advise others to take the vaccine. | Uncertainty about the vaccine safety (22.6%), belief in the non-effectiveness of vaccine (1.9%), COVID-19 is not a serious disease (1.1%), fear from injection (1.1%), no time (3.7%), religious reasons (2.2%) | Being male and being non-Omani, having a chronic disease, especially diabetes mellitus, being illiterate, and being employed were predictors of being willing to be vaccinated. | Pregnant women were less likely to be vaccinated. Those who heard about the benefits of vaccines from their friends were more willing to be vaccinated. |
| 17 | Abdel-Hameed Al-Mistareh| Jordan 2,208       | 33.2 ± 13.5 44.3%    | 13.2% Chronic disease               | High school or lower (15%), university degree 85%, Employed 39.4%, unemployed or retired 28%, Being in the medical field, 29.4% | 32%                           | 30.4%                | 36.4% were unwilling, and 31.5% were indecisive about taking the vaccine. 20.1% agreed to vaccinate their children, and 41.7% agreed to encourage the elderly to receive the vaccine. | Concerns about safety and side effects (66.7%), effectiveness, and length of protection of vaccines (33.2%) | Being younger adult and male, being unmarried, do not having children, having a high level of education, being employed or student, being healthcare staff, and the previous receive of flu vaccine. | Perception of COVID-19 risks and benefits of vaccine were predictors. |
| 18 | Mohammed Al-Mohaithef   | Saudi Arabia 992   | ≥18 years old 34.1%   | N/A                                  | N/A                           | Diploma 30%, Graduate 50%, postgraduate 20%, Employed 60%, Not-employed 40%, Diploma/undergraduate 58.4%, postgraduate 41.6% | 64.7%                | N/A                         |                                  | In older age groups, married, non-Saudi, and government employees' willingness to be vaccinated was high. | Being above 45 years old and married were predictors of accepting vaccination. | A knowledge score of 53% was high. Having a higher education level, being non-Qataris, and being an employee were associated with higher rates of vaccine acceptance. |
| 19 | Reem Al-Mulla           | Qatar 462          | ≥18 years old 36.5%   | N/A                                  | University students 50%, employee 50%, Diploma/undergraduate 58.4%, postgraduate 41.6% | 45%                           | 62.6%                | 37.4% were unwilling to take the vaccine. Most of them agreed that being vaccinated is important to end the pandemic. | Concern about safety and effectiveness for themselves and their children. | Participants who were male, 45 years and older, health-related students, or employees showed a higher rate of vaccine acceptance. | (Continued) |
| ID  | Author                      | Country and number | Mean age and male (%) | Comorbidty | Previous influenza vaccination | Education level and occupation | Acceptability rate | Attitudes towards vaccination | Reasons for lack of acceptability | Reason and predictors of positive acceptability | Summary of findings |
|-----|-----------------------------|--------------------|-----------------------|------------|-------------------------------|-----------------------------|------------------|-------------------------------|----------------------------------|-----------------------------------------------|---------------------|
| 20  | Walid A. Al-Qerem          | Jordan 1,144       | ≥18 years old 33.5%   | 15%        | High school and less 6.9%, Diploma 7%, academic education 86.1%. Working or studying in the medical field 47.1%. Monthly income <500$ (26.3%), 500-1000$ (41.2%), and >1000$ (32.5%). | 12.1%                      | 36.8% were unwilling, and 26.4% were unsure of taking the vaccine. Those with low or medium monthly income and those who did not know someone infected with COVID-19 had significantly decreased odds of having high knowledge score about COVID-19. | Concerns about efficacy and newness of vaccine (98.3%), and lack of trust in the vaccine (81%). Only 1.9% believe that there is a cure for COVID-19 | Knowing someone who was infected with COVID-19 and working/studying in the medical field was significantly associated with willingness to take the vaccine. | Those who had a history of COVID-19 infection were significantly more adherent to quarantine procedures. Being female, being married, having children, and having a diploma degree are associated with unwillingness to the vaccine. |
| 21  | Mariam Al-Sanaf            | Kuwait 1,019       | 34 ± 9.7 38.6%        | N/A        | Undergraduate degree 65%, postgraduate degree 35%. All participants were healthcare workers, including 90% in public and 10% in private sectors. | N/A                         | 9% were not willing and 7.7% were not sure about taking the vaccine. 62.6% preferred to take mRNA vaccines and 69.7% preferred to take Pfizer-BioNTech vaccine. | Hesitance about taking vaccines was significantly associated with the embrace of vaccine conspiracy beliefs. Those who received information about the vaccine from social media, TV programs, and the news showed a higher rate of hesitancy. | Participants own understanding of the infection (36.1%) and understanding of the vaccine (43.4%). | Higher rate of unwillingness to take the vaccine was seen in females, those with a lower level of education, nurses, laboratory workers, and private sector employees. |
| 22  | Majid Al-abdulla           | Qatar 7,821        | ≥18 years old 59.4%   | 22.2%      | High school 10.4%, University 76.8%, trade and vocational 12.8%, Employed 82.9%, unemployed or retired 17.1%. Healthcare worker 19.8% | 46.6%                      | 20.2% were unwilling, and 19.8% were unsure about taking the vaccine. 92.1% believed that natural exposure to the virus gave the safest protection. | Concerns about the safety of vaccines (53.8%) and long-term side effects (47.9%). Vaccine hesitancy was significantly associated with the belief of insufficient vaccine testing, financial motivation of authorities, and safe protection of natural exposure to infection. | Participants who had flu vaccines were significantly less likely to be vaccine hesitators. | Citizens of Qatar, older ages, self-employed or retired ones, singles, and females were more hesitant about taking the vaccine. Participants who had flu vaccines were significantly less likely to be vaccine hesitators. |
Table 1. (Continued).

| ID  | Author                  | Country and number | Mean age and male (%) | Comorbidity | Previous influenza vaccination | Education level and occupation | Acceptability rate | Attitudes towards vaccination | Reasons for lack of acceptability | Reason and predictors of positive acceptability | Summary of findings |
|-----|-------------------------|--------------------|-----------------------|-------------|-------------------------------|-------------------------------|--------------------|-------------------------------|---------------------------------|------------------------------------------|-------------------|
| 23  | Eiman Al-Awadi          | Kuwait 7,241       | 38.03 27.3%           | 25%         | 16.6%                         | High school or less 9.4%, University 71.5%, postgraduate 18.8%. Income: $999 KD (30%), $700-2,399 KD (56.2%), >$2,400 (13.8%) | 67%                | Perceived knowledge (5.4/7), real knowledge (6.2/7) | Predictors: Being female, increased age, increased the belief that the measures taken are greatly exaggerated, and not taking the flu vaccine in last year. | Predictors: Being male, ages 18-28 years, an education level of high school or less, a low income, being single. Knowledge of COVID-19, correctly identifying protective measures, having high confidence in the media, doctors, hospitals, believing that the government decisions are fair, and taking the influenza vaccine in 2019. | Various factors affect the vaccination acceptability, positively or negatively, discussed in the columns |
| 24  | Eman Ibrahim Alfageeh   | Saudi Arabia 2,173 | ≥18 years old 57.4%   | 26.1%       | 66.3%                         | High school or below 28%, University 72%, Employed 63.4%, unemployed or retired 23.6%, student 13%, <3,000 SAR (20.2%), 3,000-20,000 (60.8%), ≥20,000 SAR (19%). | 48.4%               | 52% were not willing to take the vaccine. | Predictors: History of vaccine refusal | Predictors: Southern region residency, received the flu vaccine, believe in mandatory COVID-19 vaccination, high level of concern about contracting COVID-19. | Participants who were male, hadan income level ≥30,000 SAR, were residents of the southern region, and previously received the flu vaccine, and had experienced COVID-19 infection were more likely to be vaccinated. Females were less likely to get vaccination due to the lack of data on the effects of the vaccine on the risks of pregnancy. |
| 25  | Elharake, J. A.         | Saudi Arabia 23,582| ≥18 years old 52.4%   | 14.6%       | N/A                           | High school (2.1%), some college (5.7), college (40.2%), Graduate/Professional (51.8%) | 64.9%               | 35.1% were not willing to take the vaccine. | 58.5% reported fear of potential side effects, 34.5% lack of trust for those creating and distributing the vaccine, 6.6% do not believe vaccines work. | Males accept a COVID-19 vaccine more than females. | Females were less likely to get vaccination due to the lack of data on the effects of the vaccine on the risks of pregnancy. |
| 26  | Fares, S.              | Egypt 365          | From 17 to 66 years old 18.70% | N/A         | N/A                           | Baccalaureate degree (40%), Professional diploma (9.09%), Master’s degree (29.87%), and MD degree (17.40%) | 21%                | The majority of participants did not decide yet (51%), and 28% percent were not likely to get vaccinated. | Lack of enough clinical trials (92.4%), and fear of vaccine’s side effects (91.4%) | Risks of Covid-19 (93%), the safety of the vaccine (57.5%), the effectiveness of the vaccine (56.25%), and travel facilitation (43.75%). | There is a high level of concern for vaccine safety. Males accept vaccination more than females. |
| 27  | Fayed, A.A.            | Saudi Arabia 1539  | ≥18 years old 41.4%   | 19.5%       | N/A                           | Minimal schooling 20.2%, University 65%, and higher education 14.8% | 59.5%               | 39% of the participants were vaccine-hesitant | Vaccine safety, efficacy, and misleading information about the pandemic | N/A | Older participants and males were more likely to get vaccinated than younger adults and females. | (Continued) |
| ID | Author          | Country          | Sample Size | Mean age (±SD) | Comorbidity | Education level and accessability | Previous and current year influenza vaccination | Reasons of positive vaccine acceptance | Reasons of vaccine hesitancy | Other vaccine hesitancy predictors | Summary of findings with [less vaccine hesitancy] |
|----|----------------|-----------------|-------------|----------------|-------------|----------------------------------|-----------------------------------------------|----------------------------------------|---------------------------------|-----------------------------------|------------------------------------------|
| 28 | Green, N.14,20 | Israel          | N/A         | 30 year or older | N/A         | N/A                              | N/A                                           | N/A                                    | N/A                             | N/A                               | Higher education was associated with less vaccine hesitancy. |
| 29 | Heymann, M.15,20 | Egypt           | 967         | 30 year or older | N/A         | N/A                              | N/A                                           | N/A                                    | N/A                             | N/A                               | N/A                                      |
| 30 | Herhan, A.16,20 | Saudi Arabia    | N/A         | ≥18 years old    | N/A         | N/A                              | N/A                                           | N/A                                    | N/A                             | N/A                               | N/A                                      |
| 31 | Mapammi, R.17,20 | Saudi Arabia    | 3101        | ≥18 years old    | N/A         | N/A                              | N/A                                           | N/A                                    | N/A                             | N/A                               | N/A                                      |
| 32 | Maroq, B.21,20 | Tunisia         | 320         | ≥18 years old    | 37.1%       | 37.6%                            | NA                                            | N/A                                    | N/A                             | N/A                               | N/A                                      |
| 33 | Mejri, N.18,20 | Tunisia         | 320         | ≥18 years old    | 37.1%       | 37.6%                            | NA                                            | N/A                                    | N/A                             | N/A                               | N/A                                      |
| 34 | Mohammed, S.22,20 | Jordan         | 3,402       | ≥18 years old    | 37.1%       | 37.6%                            | NA                                            | N/A                                    | N/A                             | N/A                               | N/A                                      |
| 35 | Omar, D.23,20 | Egypt           | 1,011       | ≥18 years old    | 37.1%       | 37.6%                            | NA                                            | N/A                                    | N/A                             | N/A                               | N/A                                      |
| 36 | Voula, P.24,20 | Greece         | 254         | ≥18 years old    | 37.1%       | 37.6%                            | NA                                            | N/A                                    | N/A                             | N/A                               | N/A                                      |

(Continued)
| ID | Author                  | Country and number | Mean age and male (%) | Comorbidity | Previous influenza vaccination | Education level and occupation | Acceptability rate | Attitudes towards vaccination | Reasons for lack of acceptability | Reason and predictors of positive acceptability | Summary of findings |
|----|-------------------------|--------------------|-----------------------|-------------|-------------------------------|-----------------------------|-------------------|-----------------------------|--------------------------------|--------------------------------|-------------------|
| 37 | Ameerah M N Qattan⁷⁹,⁶³  | Saudi Arabia 673   | 18-60< 67.06%         | 79.4% Chronic condition | N/A              | N/A                          | N/A               | N/A                         | Male healthcare worker                | N/A                                      |                   |
|    |                         |                    |                       |              |                               |                             |                   |                             |                                |                              |                   |
| 38 | Qunaibi, E.⁶⁰,⁶⁴        | 21 Arab countries 5708 | 30.6 ± 10 55.6%       | 14% Chronic diseases | 5.6%                         | 67.9% bachelor’s degree or higher | Rate of vaccine hesitancy among Arabic-speaking HCWs 25.8% | The western regions of the Arab world (Egypt, Morocco, Tunisia, and Algeria) had the highest rates of hesitancy | Concerns about side effects and distrust of the expedited vaccine production and healthcare policies. | Age of 30–59, previous or current suspected or confirmed COVID-19, female gender, not knowing the vaccine type authorized in the participant’s country, and not regularly receiving the influenza vaccine. | N/A                                      |
| 39 | Rabi, R.⁶¹,⁶⁵           | Palestine 638      | Under 30 25%, 30–49 55.8%, Above 50 19%, 17% | 28%          | 38.5% Nurse                   | 40% planned to get the vaccine when available | N/A               |                             | Concern about long-term side effects, lack of vaccine knowledge, Vaccine safety, fear of injection, natural immunity preference, media misrepresentation, and getting COVID-19 from the vaccine. | Safety and quality Not tried on others, Low efficiency, Temporary solution, natural immunity is preferable. Female nurses. | N/A                                      |
| 40 | Rosental, H.⁴¹,⁶²        | Israel 628         | Med. S. 28.06 ± 3.33  50%, Nurse, 526.04 ± 3.74 16% | NA           | Med. 81.6% Nurse. 47.6%       | Med. Nurse. 82.2%           | Medical. S expressed higher intentions of getting vaccinated than nursing. S (88.1% vs.76.2%) |                             |                              | N/A                                      | N/A                                      |
| ID | Author       | Country and number | Mean age and male (%) | Comorbidity | Previous influenza vaccination | Acceptability rate | Attitudes towards vaccination | Reasons for lack of acceptability | Reason and predictors of positive acceptability | Summary of findings |
|----|--------------|---------------------|-----------------------|-------------|-------------------------------|-------------------|-------------------------------|---------------------------------|----------------------------------|-------------------|
| 41 | Saied, SM    | Egypt 2133          | 20.24 ± 1.8 34.8%     | NA          | 10.3%                         | 34.9%             | Refusal 19% Hesitant 45.6%. 67.9% of students believed that the way to overcome the COVID-19 pandemic is mass vaccination (56.5%). | adverse effects of the vaccine (96.8%), its ineffectiveness (93.2%) and enough testing (80.2%), safety (54.0%), acquisition of COVID-19 from the vaccine itself 63.3% Insufficient information regarding vaccine 72.8%, its adverse effects (potential 74.2% Unknown 56.3%, financial cost 68%, insufficient trust in the vaccination source 53%, inject microchips into recipients 27.7%/ that the vaccines are related to infertility 23.4% females, lower educational levels, and respondents rely on social media platforms as the main source of information. | N/A                             | Most students were not against vaccination (95.1%) |
| 42 | Sallam, M    | Arab-speaking countries 3414 | 31 32.7% | 34.6% | 30.9% | 75% undergraduate study level | 29.4% | inject microchips into recipients 27.7%/ that the vaccines are related to infertility 23.4% females, lower educational levels, and respondents rely on social media platforms as the main source of information. | N/A                             | A reliance on social media as the main source of information about COVID-19 vaccines was associated with vaccine hesitancy. |
| 43 | Tahir, A      | Iraq 1188           | N/A 47.2%            | 15%         | 22%                           | N/A               | Fear of side effects such as blood clotting (45.03%) (p < .016). 39.9% and 34.01%, were afraid of AstraZeneca and Pfizer (p < .001) 4.63% had fear of Sinopharm | Fear, social media use (51.8%), and losing family members, (previous seasonal influenza vaccine, previous infection, chronic medical diseases) show no relationship. | N/A                             |                                 |
Table 1. (Continued).

| ID | Author          | Country and number | Mean age and male (%) | Comorbidity | Previous influenza vaccination | Education level and occupation | Acceptability rate | Attitudes towards vaccination | Reasons for lack of acceptability | Reason and predictors of positive acceptability | Summary of findings |
|----|-----------------|--------------------|-----------------------|-------------|-------------------------------|-------------------------------|--------------------|-------------------------------|----------------------------------|------------------------------------------|---------------------|
| 44 | Talmy, T.       | Israel, 511        | 21.5 ± 3.6, 63.6%     | N/A         | N/A                           | N/A                           | 77.7%              | Hesitancy remains a concern with only 62.4% | N/A                              | On-site COVID-19 vaccine rollout joined with primary care communication interventions may maximize vaccine uptake within a young-adult community. Highly accessible vaccine sites and engagement of primary care physicians with their communities may increase vaccination rates. |
|    | 45 | Temsah, M.      | Saudi Arabia, 15,124 | 37.28 ± 8.99, 47.6%  | N/A         | Physician 42.1 Nurse 50.1%    | Other healthcare providers (HCPs) 7.8% | 24.4% ChAdOx1 nCoV-19 vaccine, 20.9% RNA BNT162b2 vaccine | 18.3% reported refusing the Ad5- vectored vaccine and 17.9% refused the Gam-COVIDVac vaccine. | N/A                              | Their perceptions of the vaccine’s efficiency in preventing the infection (33%), their personal preference (29%), and the vaccine’s manufacturing country (28.6%) were among the factors that affected the acceptability. |
infection, especially among those with chronic diseases such as diabetes mellitus, contributed significantly to the willingness to get vaccinated.\textsuperscript{30,35,38,40,46} Another contributing factor has been the strong urge to help eradicate the COVID-19 pandemic and recommence everyday life\textsuperscript{21,41,42,48} by achieving herd immunity through vaccination. Moreover, Burmaham et al. and Fares et al. reported a tendency to travel as a critical factor in increasing vaccine acceptability.\textsuperscript{25,41}

Several studies demonstrated that subjects who had previously received influenza vaccine were more likely to accept COVID-19 vaccine injection,\textsuperscript{27,32,35,46,49} which may be the result from observing vaccines’ effectiveness in preventing flu. Two cross-sectional studies in Qatar and another in Syria stated that comprehensive knowledge of vaccines and their function accounts for another factor leading to high vaccine acceptability.\textsuperscript{30,36}

As different studies have reported various vaccine acceptability rates concerning the mean age of participants, it is difficult to make a conclusive deduction. However, generally speaking, as reported by Mejri et al., those with an older age have shown more willingness for receiving the COVID-19 vaccine.\textsuperscript{47} This may stem from the fact that they are at greater risk of being infected and having severe complications due to older age and comorbidities.

The results of included studies imply that generally, women hesitate more for getting vaccinated. Studies with a male percent of more than 40% reported a significantly higher rate of vaccine acceptability than most of the studies involving more women.\textsuperscript{36–38,40–42,43} However, the intriguing point is that some exception studies that, despite involving more women, demonstrated a high rate of acceptability,\textsuperscript{50,51} surprisingly sometimes even higher than other studies.\textsuperscript{52}

Patients at higher risk of COVID-19 infection, particularly diabetic and immunocompromised patients, have more tendency to get their COVID-19 vaccine shot. In a report from Kuwait in which 24% of the participants had at least one medical condition such as diabetes, hypertension, stroke, and asthma, 83% of participants were convinced to take their vaccine.

The impact of one’s education level on vaccine acceptability could not be emphasized enough, as higher education and especially medical education are due to help people understand the cons and pros of vaccines, as well as their mechanism of action and thus make them less afraid of the upcoming complications. The acceptability of vaccines could be diminished by conspiracy beliefs, especially among those with lower education levels.\textsuperscript{31}

Just acceptability and hesitancy themselves, the reasons for them also vary with education level, age, and medical conditions. The uncertainty about the safety and effectiveness of vaccines,\textsuperscript{24,36,44,53} misbeliefs, and conspiracies spread through social media\textsuperscript{27,28,52} are often reported as the reasons for mistrust of COVID-19 vaccines. Some claimed the lack of sufficient clinical trials as the logic of their hesitancy.\textsuperscript{25} Many hesitate the vaccines because they do not have trust in their efficacy. Either not believing the authorities or the clinical trials, these participants tend to protect themselves against COVID-19 through natural exposure to the virus, which is not supported by the same evidence compared to vaccines.\textsuperscript{36}

![Figure 1. The PRISMA flowchart for included articles](image-url)

| Identification of studies via databases and registers | Identification of studies via other methods |
|------------------------------------------------------|------------------------------------------|
| Records identified from: PubMed (n = 109) Scopus (n = 276) Web of Science (n = 136) Cochrane (n = 1) | Records identified from: Websites (n = 0) Organisations (n = 0) Citation searching (n = 0) |
| Records removed before screening: Duplicate records removed (n = 200) | |
| Records screened (n = 322) | Reports sought for retrieval (n = 0) Reports not retrieved (n = 0) |
| Reports sought for retrieval (n = 59) | Reports not retrieved (n = 0) |
| Reports assessed for eligibility (n = 59) | Reports excluded: 5 Not original 5 Not related 2 From other parts of the world 2 Abstract/ no available full-texts |
| Studies included in review (n = 45) | Reports excluded: (n = 0) |
**Conclusion**

The acceptability of COVID-19 vaccines depends on many variables and could not be predicted using only one or a few of them. Age, education level, and comorbidities are the main prognostic factors based on which a higher or lower acceptability rate could be explained. Furthermore, evaluation of the popular reasons leading to lack of acceptability would result in a better understanding of the concerns of the population, which could empower the authorities to plan for better vaccination coverage. Also, approaching each group of people with a coherent strategy and providing them with relevant information will with great chance facilitate the process of vaccination. At last, better control of vaccine information spread through social networks can be helpful in diminishing the conspiracy beliefs leading to mistrusting the vaccination process.

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**Authors’ contributions**

All authors participated in all stages of the manuscript drafting.

**Disclosure statement**

No potential conflict of interest was reported by the author(s).

**Data availability materials**

The authors stated that all information provided in this article could be shared

**Ethics approval and consent to participate**

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