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RESEARCH ARTICLE

Acceptance of COVID-19 Vaccine in Saudi Arabia: A Systematic Review

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ABSTRACT

Mass vaccination against COVID-19 infection is an essential strategy for countries to limit the spread of the virus and reduce pandemic-related morbidity and mortality. However, the success of vaccination programs is closely associated with vaccine acceptance among potential beneficiaries. The current study estimated the COVID-19 vaccine acceptance rate in Saudi Arabia using a systematic review of primary studies. Specific keyword searches were conducted in two databases (PubMed and Embase) from January 1, 2021, to October 23, 2022, to identify articles about vaccine acceptance or hesitancy. Twenty articles with a total sample size of 32,768 people were included in the study. The pooled acceptance rate in the 20 studies included in this systematic review is 57.7%. Eighteen of the included studies reported separate vaccine hesitancy rates, averaging 26.9%. This review, which showed a moderate level of COVID-19 vaccine acceptance, should help the authorities to take precautions while planning for special vaccination campaigns. Future research is needed to understand the hesitancy and acceptance of various vaccine initiatives and the effectiveness of vaccine promotion campaigns in Saudi Arabia.

INTRODUCTION

After the World Health Organization (WHO) declared the COVID-19 infection outbreak a global pandemic on March 11, 2020, all WHO member countries were advised to implement strategic preparedness and response actions to control the epidemic. Likewise, the Kingdom of Saudi Arabia (KSA), which reported its first case on March 20, 2020, took several steps to reduce transmission (Medicine, 2023). The response of the Saudi authorities included the early establishment of mechanisms to monitor the pandemic situation, screen the population, trace contacts, and raise awareness (Ministry of Health, 2021). KSA implemented several measures, including travel restrictions and social distancing measures such as closing schools, universities, and public places. It ramped up testing for COVID-19 and implemented contact tracing measures.

Vaccination against COVID-19 infections has been one of the key strategies for pandemic containment worldwide and in KSA. In fact, vaccination has been considered the most crucial instrument for pandemic containment (Assiri et al., 2021). KSA was at the forefront of rolling out an extensive vaccination program soon after introducing the vaccines globally. Extensive arrangements for a mass vaccination

campaign have been made by the public health authorities in KSA to vaccinate the entire population of KSA by the end of 2020. With a population of over 30 million and significant urban and rural distribution, the authorities had to address many issues related to a mass vaccination campaign, such as ensuring a robust supply chain, deploying digital applications for operations, managing vaccine side effects, clinical care, community mobilization, and quality assurance.

The specific initiatives of the Ministry of Health included the initiation of the COVID-19 Vaccination Operation Program (VOP) and other vaccine-related efforts, such as the development of the Tawakkalna mobile application for managing vaccination appointments and compliance, the establishment of vaccine stations, and the implementation of policies for work and public places that require vaccination (Assiri et al., 2021; **?** , 2021; Alkhalifah et al., 2022). Most importantly, several social media campaigns and public education efforts were initiated to improve vaccine acceptance.

Previous experience shows that public health authorities with strong political support can create resilient supply-side systems for ensuring the efficiency of vaccination programs (Chen and Orenstein, 1996). However, as the authors of the cited studies point out, the real challenge is creating a healthy demand-side response, which is essential for successful vaccination campaigns. This means overcoming vaccine hesitancy, the reluctance or refusal to get vaccinated. Vaccine hesitancy can be due to various factors, including misinformation about vaccines, fear of side effects, and religious beliefs (Kumar et al., 2016).

LITERATURE REVIEW

A literature review shows that factors from both the demand and supply sides can affect mass vaccination initiatives. One of the key demand-side factors for a vaccination campaign is probable vaccine hesitancy. The perceived susceptibility to the disease and the perception of vaccine safety and effectiveness are among the most common influencing factors in vaccine acceptance (Daley et al., 2018). Vaccinations are also considered essential for health and part of routine procedures to maintain one's health. The motivation of parents to vaccinate their children is driven by such beliefs (Wilson et al., 2008). Other studies on vaccine acceptance reported that the previous vaccination experience strongly influences individuals' vaccine acceptance (Qureshi et al., 2023; Varghese et al., 2013). Streefland et al. (1999) noted the importance of a continuous positive perception of the vaccination process for high vaccination coverage and the sustenance of national-level vaccination programs.

In addition to the demand-side factors mentioned above, trust in the healthcare system or health workers and the messages spread by the media can all affect the acceptability or hesitancy of vaccination programs (Bish et al., 2011; De Freitas et al., 2021). Previous studies have shown that vaccination hesitancy is likely to set in faster during special vaccination campaigns than it affects routine vaccination programs (Varghese et al., 2014). Special campaigns for vaccinations can distort the relationship between health workers and beneficiaries of vaccination and result in a loss of trust in the system. Thiede (2005) reported the significance of the relationship between service providers and beneficiaries of vaccines, which is important for creating confidence in vaccine information.

A literature review also helps to identify the factors contributing to an increase in vaccine hesitancy. Poorly performing health systems are fertile ground for generating vaccine hesitancy (Reiter et al., 2009; Azhar et al., 2022). People are more likely to be hesitant about vaccines if they have had negative experiences with the healthcare system. This could include long wait times, a lack of access to care, or poor quality of care. Lack of trust in healthcare systems or health workers can also create suitable conditions for the propagation of vaccine hesitancy (Renne, 2006). Likewise, Das and Das (2003) noted that the previous success of immunization programs can critically influence the generation of vaccine hesitancy. This can be a problem, especially in countries where immunization programs have yet to reduce disease incidence.

A commonly used theoretical model to explain vaccine acceptance and hesitancy is the Health Belief Model (HBM). The theory explains health-related behavior, especially related to using services such as vaccination (Kumar et al., 2016). The model suggests that people

are more likely to take action if they believe that they are susceptible to the disease, that the disease is serious, and that the benefits outweigh the risks. People's vaccination intention can be explained by assessing their perceived severity and susceptibility to the disease and the perceived benefits and risks of the vaccine (Zampetakis and Melas, 2021).

COVID-19 vaccination acceptance in KSA has been studied and reported in several previous studies. However, most of these studies were based on smaller sample sizes or among specific population subgroups, such as health workers or parents. Saudi Arabia is a large country with a diverse population; to our knowledge, a large-scale study with a representative sample has yet to be conducted. This limitation can be addressed by pooling the results of all the relevant previous primary studies on COVID-19 vaccine acceptance in Saudi Arabia. This study aimed to determine the level of acceptance of the COVID-19 vaccine among the general population of KSA and to identify the possible predictors associated with COVID-19 vaccine acceptance and hesitancy using a systematic review approach. A systematic review, which involves collecting and analyzing all the relevant research evidence on a particular topic, is the gold standard for evidence-based action, as it provides a comprehensive overview of the available research and allows for identifying patterns and trends.

METHODS

This systematic review followed the PRISMA checklist (PRISMA, 2023/) to design this study. The checklist helped to ensure that systematic reviews were conducted in a transparent and reproducible manner. Two health-related databases (PubMed and Embase) were searched to identify relevant articles on October 23, 2022. The review used the following search terms: "Covid-19 OR "Coronavirus" OR SARS-COV-2 OR Cov-19) AND vaccin* AND Saudi OR KSA AND accept* OR willing* OR intent* OR attitud* OR perception* OR hesitan* OR refus* OR reluct* OR reject* OR resist* OR declin*. Two researchers (JV and AM) screened the articles by title and abstract. After excluding duplicate records, the same researchers reviewed the full texts of the remaining articles to identify eligible studies. A hand search was conducted in the shortlisted articles' references to identify additional articles. The research protocol was not registered with PROSPORO or any other database.

The studies that reported COVID-19 vaccine acceptance and/or hesitancy rates and were conducted on the general population were included for final review. The review excluded studies focusing only on subpopulations such as health workers, parents, students, and older people. The studies that calculated vaccine acceptance or hesitancy using indirect methods or reported vaccine acceptance in the region without details about the KSA part of the study were also excluded. Two researchers (JV and AM) independently selected articles, and differences of opinion were referred to a third person (MA) for the final decision. Four researchers extracted the information into an Excel sheet (FK, AJ, WR, and SQ). The researchers extracted the following information from the identified articles: full reference; study period; location of the study; research design; sampling method; sample size with gender-wise number; vaccination acceptance and hesitancy in percentage; and all predictors of vaccine acceptance and hesitancy that are reported as statistically significant. Any other features of the articles relevant to the systematic review were also noted as comments. To assess the quality of the included articles, the methodology assessment part of the STROBE statement was used (Von Elm et al., 2008). The statement, which provides guidelines for reporting observational studies, has 13 benchmarks for the quality of the methodology. One of the researchers (SM) scored each article by assigning one point for each of the 13 benchmarks that were satisfied. Since the review is based on published articles, an ethics review from an institutional review board was not required.

FINDINGS

The initial Boolean search yielded 205 articles. After filtering at multiple steps, 20 articles were included in the meta-analysis (Figure 1).

Initial screening based on the review of the title and abstract removed 146 articles. At the next level, after reading the full text of 37 articles, 17 were excluded for one or more of the following reasons:

- Did not report vaccine acceptance or hesitancy.
- Used indirect methods to calculate vaccine

acceptance or hesitancy.

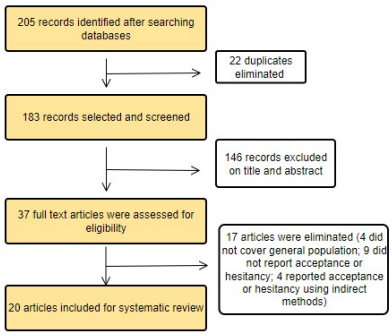

Figure 1: Flowchart of study selection

The remaining 20 articles were included in the meta-analysis.

All studies included in the review were conducted as online cross-sectional studies. None of the studies used any form of proportional sampling to recruit study participants. The total number of study participants across 20 different studies was 32,768, with an average study participation of 1,684.7. The sample size in the included studies ranged from 391 to 8,056 participants. Although 9 out of the 20 studies had more female participants than male participants, around 55.15% were female.

All 20 studies included in the meta-analysis reported an acceptance rate. However, two studies did not report a separate vaccine hesitancy rate. Table 1 shows the distribution of acceptance and hesitancy rates of the COVID-19 vaccine, as reported in the studies.

Table 1: Descriptive summary of studies included in the systematic review

S. No.	Study articles included in the review	Period of study	Region	Sample size	Male	Female	Acceptance rate	Hesitancy rate	Comments
Less than 40% acceptance									
1	(Mahmud et al., 2021)	February to March 2021	National	1387	848	539	27.30%	15.60%	Acceptability measured on 4 point Likert scale
Acceptance between 40% to 50%									
2	(Alobaidi, 2021)	January 2021	National	1333	736	597	41.30%	10.50%	Vaccine acceptability measured on 4 point Likert scale
3	(Alfageeh et al., 2021)	December 2020	National	2137	1227	910	48.40%	51.60%	Vaccine acceptance measured as dichotomous variable; yes or no
4	(Narapureddy et al., 2021)	April to June 2021	National	796	506	276	44.5%	10.4%	Vaccine acceptance measured on 4 point Likert scale; absolutely yes, may be yes, may be no, absolutely no
5	(Alqathami and Mohamed, 2021)	November 2020	National	1345	744	601	48.20%	33.20%	Vaccine acceptance measured on 3 point scale; yes, no or not sure
6	(Magadmi and Kamel, 2021)	May 2020	National	3101	1294	1807	44.70%	55.30%	Vaccine acceptance measured as dichotomous variable; yes or no
Vaccine acceptance between 50 to 60%									
7	(Al-Mohaithef et al., 2021)	January to March 2021	National	658	346	312	53.35%	Did not report	Vaccine acceptance measured on 3 point scale; yes, no or not sure
8	(Fayed et al., 2021)	January to March 2021	National	1537	636	901	59.50%	Did not report	Vaccine acceptance was measured on a five-point Likert scale and likely and very likely are considered as acceptance
9	(Alzahrani et al., 2021)	December 2020 to February 2021	National	3048	1189	1859	52.90%	20.30%	Vaccine acceptance measured on 3 point scale; yes, no or not sure
10	(Noushad et al., 2021)	February to March 2021	National	879	271	608	56.20%	12.20%	Vaccine acceptance measured on 5 point Likert scale; strongly agree to strongly disagree

Cont.....

S. No.	Study articles included in the review	Period of study	Region	Sample size	Male	Female	Acceptance rate	Hesitancy rate	Comments
11	(Altulahi et al., 2021)	November to December 2020	National -5 regions	8736	4368	13104	52.40%	47.60%	Vaccine acceptance measured as dichotomous variable; yes or no
12	(Alqahtani, 2022)	No information	South-western region	391	270	121	57.29%	42.71%	Vaccine acceptance measured as dichotomous variable; yes or no
Vaccine acceptance between 60% to 70%									
13	(Alshahrani et al., 2021)	January 2021	National	758	458	300	63.80%	36.20%	Vaccine acceptance measured as dichotomous variable; yes or no
14	(Yahia et al., 2021)	January to March 2021	National	531	317	214	61.80%	38.20%	Vaccine acceptance measured as dichotomous variable; yes or no
15	(El Hassan et al., 2022)	March to June 2021	National	2199	700	1499	68.50%	14.10%	Vaccine acceptance measured on 3 point scale; yes, no or I do not know
16	(Alamri et al., 2021)	Not reported	National	2227	663	1564	60.10%	21.80%	Vaccine acceptance measured on 3 point scale; agree; disagree or neutral
17	(El-Gamal et al., 2022)	Not reported	Regional - Jeddah	518	170	348	68.71%	31.27%	Vaccine acceptance measured as dichotomous variable; yes or no
Vaccine acceptance more than 70%									
18	(Fadhel, 2021)	July 2021	National	558	300	258	71.30%	17.20%	Vaccine acceptance measured on 3 point scale; yes, no or unsure
19	(Othman et al., 2022)	June 2021	National	504	136	368	94.60%	5.40%	Vaccine acceptance measured as dichotomous variable; yes or no
20	(Zahid and Alsayb, 2021)	March to April 2021	National	819	198	621	79.24%	20.76%	Vaccine acceptance measured as dichotomous variable; yes or no

A large variation in the acceptance rate was found in the included studies, ranging from 27.3% to 94.6%. The average and median for COVID-19 vaccine acceptance were 57.7% and 60.9%, respectively. Likewise, the highest and lowest reported rates for vaccine hesitancy were 55.3% and 5.4% (average: 26.9%; median: 21.8%). The studies included in this review used different tools to calculate vaccine acceptability and hesitancy. Most studies (9) assessed vaccine acceptance and hesitancy as dichotomous binary variables. Six studies reported an additional category of participants who were 'unsure' of receiving the vaccination, apart from those who responded with a definite 'yes' or 'no.' The rest of the studies used four or more point scales to collect information on vaccine acceptability.

There was also heterogeneity in the questions asked to identify vaccine acceptance or hesitancy in different studies. While some studies assessed acceptance as conditional on free vaccine availability by the government, other studies did not specify such conditions.

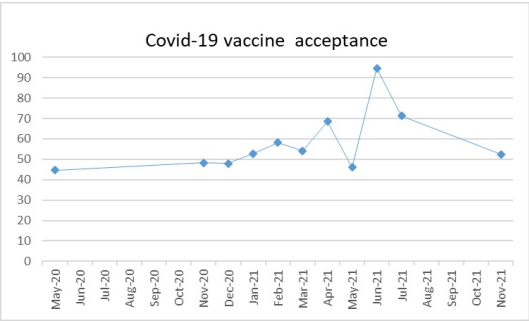

Figure 2: Trends in vaccine acceptance

A graph of vaccine acceptance against the 19 months of data collected for different studies was plotted. For those studies that involved multiple months to collect data, the median month was selected as the month of data collection. The graph shows that the studies conducted before introducing the mass COVID-19 vaccination program in Saudi Arabia reported lower acceptance; vaccine acceptance among the general population increased with the introduction of vaccination.

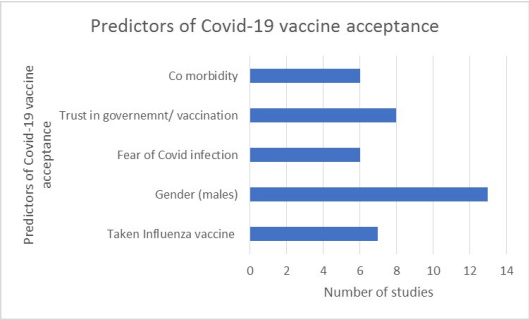

Figure 3: Predictors of Covid-19 vaccine acceptance

The frequencies of the predictors of COVID-19 vaccine acceptance are shown in Figure 3. Thirteen studies found an association between the gender of the study participants and vaccine acceptance. All these studies reported that male participants showed significantly higher acceptance of the COVID-19 vaccine than females. Eight studies reported that trust in government health systems or vaccines was significantly associated with vaccine acceptance.

DISCUSSION

This study systematically reviewed 20 articles to synthesize the information on COVID-19 vaccine acceptance in Saudi Arabia. The vaccine acceptance rate is highly dynamic and changes over time, location, and other contextual factors. The pooled estimate of Covid-19 vaccine acceptance is 57.7%, which shows that a significant section of the population covered in these studies is either hesitant to get vaccinated or is still unsure about receiving the vaccine.

Our results can be compared with several other international estimates from systematic reviews. These systematic reviews reported higher vaccine acceptance rates than the acceptance rate of KSA found in our review. A systematic review of 81 studies (including 5 studies from Saudi Arabia) categorized KSA among countries with lower acceptance rates of 50% to 60% (Shakeel et al., 2022). Another systematic review and meta-analysis of 68 studies covering 38 countries, including six studies from Saudi Arabia, revealed a prevalence of COVID-19 vaccine acceptance of 64.9%. In this review, the lowest prevalence of COVID-19 vaccine acceptance rate (60.8%) was reported in the Eastern Mediterranean Region, in which Saudi Arabia is located (Mengistu and Demu, 2022). A third systematic review of 38 articles reported a pooled global COVID-19 vaccine acceptance rate of 73.31%. However, no studies from Saudi Arabia were part of this systematic review (Wang et al., 2021). Even though this study shows a less-than-optimal vaccine acceptance rate in Saudi Arabia, the current data on actual COVID-19 vaccination coverage, which compares different countries, counts KSA among countries with higher coverage (Economics, 2023; Ramizulhasan et al., 2021). This suggests that there may be a disconnect between vaccine acceptance reported in this review and actual vaccination rates. There are several possible explanations for this disconnect. One possibility is that people who are hesitant to get vaccinated may still get vaccinated if they feel it is necessary, such as if they are required to get vaccinated for work or school. Another possibility is that people may be more likely to get vaccinated if they see their friends and family getting vaccinated and having no negative side effects. Further research is needed to understand vaccine acceptance and hesitancy in the context of mandatory vaccine policies and the changing pandemic scenario in KSA.

The predictors of the vaccine acceptance matrix

display the factors that influence the behavioral decision to accept, delay, or reject vaccines. Our review, which showed lower acceptance of COVID-19 vaccination among those who have not taken the flu vaccine, suggests the possibility of lower acceptance towards special vaccination initiatives in Saudi Arabia among this segment of population. This is in contrast to other studies, which have observed increased levels of vaccine hesitancy only against specific vaccine initiatives (Varghese et al., 2014).

Theoretical implications of the study

Vaccine hesitancy and acceptance are closely connected to three interconnected Cs: confidence, complacency, and convenience (World Health Organization, n.d.). Confidence refers to trust in the safety and effectiveness of the vaccine; complacency refers to the perception of diminished disease risk; and convenience refers to the availability, accessibility, affordability, and quality of vaccination services. The key predictors of COVID-19 vaccine acceptance identified in this systematic review suggest that confidence and complacency are two key factors that influence COVID-19 vaccine acceptance. Interventions that target these factors may be effective in increasing vaccine acceptance.

The key predictors of vaccine hesitancy identified in this systematic review can be analyzed using the epidemiologic triad of environmental, agent, and host factors (Kumar et al., 2016). This helps to move beyond the anti-vaccine or pro-vaccine binary narrative. Environmental factors are those that are outside of the individual, such as the government's health system and the availability of vaccines. Agent factors are related to the vaccine, such as its safety, efficacy, and cost. Host factors are related to the individual, such as age, health status, and vaccine beliefs.

The trust in the healthcare system, which is driving vaccination against COVID-19, is an environmental or external factor associated with vaccine hesitancy. Trust in vaccines, which reflects the perception of vaccine efficacy and safety, is an agent factor. All the other factors (comorbidity, fear of COVID-19 infection, gender, and history of previous flu vaccine) commonly reported as predictors of COVID-19 vaccine hesitancy in the included study are host factors. The findings of this systematic review suggest that the interventions targeting environmental, agent, and host factors may be effective in increasing vaccine acceptance.

Practical Implications of the Study

The results of this systematic review will further enlighten healthcare professionals and policymakers to address people's beliefs and concerns regarding COVID-19 vaccination. This review, which showed a moderate level of COVID-19 vaccine acceptance, should help the authorities to take precautions while planning for special vaccination campaigns.

Conspiracy theories or misinformation that target vaccination programs may affect the acceptance of new vaccines (Alamri et al., 2021). Analysis of the predictors of vaccine hesitancy shows that some people may be hesitant to get vaccinated because they do not trust the vaccines. This may be due to the negative information they have heard about vaccines. A previous study on COVID- 19 vaccination in Saudi Arabia that identified the role of trust in government and healthcare system for building trust in vaccines is relevant here (Almalki et al., 2021). . There is a lot of misinformation about vaccines circulating online and in the media. This misinformation can lead people to believe vaccines are dangerous or ineffective (Blume, 2006). Other studies have shown that people who believe vaccines are important for protecting themselves and others from the disease are more likely to get vaccinated (Daley et al., 2018; Streefland et al., 1999).

Personal beliefs can positively influence people's decisions to get vaccinated. For example, one of the predictors of COVID-19 vaccine acceptance is fear of COVID-19 infection. Studies have shown that fear of infection can increase vaccine acceptance in several ways (Wilson et al., 2008; Zampetakis and Melas, 2021). First, fear can make people more receptive to information about vaccines. People are more likely to pay attention to messages relevant to their fears. This is because fear can motivate people to take action to protect themselves from the virus. Second, fear can make people more willing to take risks. People are more likely to believe that the benefits of vaccination outweigh the risks if they are afraid of the virus.

To improve COVID-19 vaccine uptake, health education targeting different socio-demographic groups should be prioritized. It is important to respect the personal beliefs of those hesitant to get

vaccinated. However, it is also important to provide them with accurate information about the risks and benefits of vaccines so that they can make an informed decision. The current widespread public awareness campaigns in Saudi Arabia on the benefits of vaccination against COVID-19, should also include special and innovative strategies to assure the safety of vaccines. Misinformation about vaccines can be countered by providing accurate information through trusted sources, such as healthcare providers and government websites. The successful use of the media or promotions using prominent personalities can go a long way in reassuring apprehensions against COVID-19 vaccines in the community (Serah et al., 2020). Besides mass media campaigns, the authorities should incentivize healthcare providers to deal with vaccine hesitancy.

CONCLUSION

There are several Saudi and international studies on COVID-19 vaccine hesitancy. However, our systematic review is the first attempt to provide a pooled estimate of COVID-19 vaccination acceptance in Saudi Arabia. One of the limitations of this study is that the pooled estimate presented here is based on cross-sectional studies conducted at different points in time. The non-probability sampling methods used in the included studies did not ensure representativeness. Therefore, a nationally representative sample survey is recommended to assess vaccine acceptance in Saudi Arabia. Public health authorities can develop strategies to increase vaccine acceptance and coverage by understanding the factors that can contribute to vaccine hesitancy.

By addressing the factors that contribute to vaccine hesitancy, Saudi Arabia can increase vaccine acceptance and protect its people from the COVID-19 virus. It is important to provide accurate information about vaccines clearly and concisely and to address people's concerns about vaccines. This can be done by listening to their concerns, providing accurate information, and addressing their fears. It is important to overcome people's fear of side effects by providing accurate information about the risks and benefits of vaccines. It is also important to emphasize that the benefits of vaccines outweigh the risks.

Authors' Contributions

"Conceptualization of the review was done by JV, WR, AM, and FK; methodology was developed by MA and JV; database search and shortlisting of articles were done by JV, WR, AM, and MA; data extracted and analyzed by AJ, SQ, and FK; validation was done by SM; and writing—review, and editing—were done by JV and WR. All authors have read and agreed to the final version of the manuscript."

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