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ORIGINAL RESEARCH

# Determinants of Intention to Uptake COVID-19 Vaccination Among Saudi Adults: Application of the Health Belief Model

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**Introduction:** The pandemic caused by COVID-19 has had a profound effect on global health. Due to its potential impact on the efficacy of pandemic control measures, vaccine hesitancy (VH) in relation to COVID-19 has emerged as a significant concern. The attainment of herd immunity is contingent on the rate of COVID-19 vaccine adoption. Despite this, there have been reports of reluctance toward the COVID-19 vaccine. This study seeks to investigate the effect of constructs that influence adults' intentions to receive COVID-19 vaccination using the Health Belief Model (HBM).

**Methods:** A cross-sectional study was conducted by recruiting Saudi Arabian adults as participants. Using Structural Equation Modeling (SEM), the proposed HBM model was evaluated. A total of 505 individuals replied to the survey.

**Results:** The suggested HBM model explained 68% of the variation in intention to get COVID-19 immunization. I found all HBM variables namely perceived susceptibility, greater levels of perceived behavioral control, severity, benefits, and barriers to be significant predictors of vaccination intentions. Among demographic variables, only married status had a significant relationship with the intention to obtain COVID-19 immunization.

**Discussion:** The findings of this study indicate that the HBM can be utilized effectively to obtain insight into the factors that influence COVID-19 prevention measure adherence. Understanding and recognizing individuals' perceived health beliefs and practices is essential for the development of effective COVID-19 intervention strategies.

**Keywords:** immunization, COVID-19, health belief model, vaccine hesitancy, structural equation modeling, Saudi Arabia

## Introduction

The COVID-19 pandemic has posed and is still considered a significant challenge to the whole world.[1,2] The burden of the disease has impacted nearly all government sectors and systems such as healthcare, education, quality of life, and the economy.[3] More importantly, the implication of the disease is expected to linger for a long time and reach future generations in the coming years.[4] As of July 2023, there have been 768 million confirmed COVID-19 cases, 6 million deaths, and 13 billion vaccine doses have been administered.[5] However, due to the collaborative effort to control the disease and the high percentage of vaccinated people globally, the severity and spread of the disease have decreased significantly. Despite the diminished spread of the disease, the virus is still considered a threat, especially to persons with low immunity such as older adults, children, and people with underlying comorbidity, and due to the virus's rapid mutation ability to develop several variants.[6]

Most governments attempted early in the pandemic to mitigate the widespread impact of the disease by implementing serious measures such as social distancing, masking, and handwashing.[7] Despite the effectiveness of such measures, the most effective method was aiming for herd immunity by mandating the uptake of the COVID-19 vaccine.[8] However, the willingness and acceptability to take the vaccine and its booster doses are decreasing among the public enabling the reemergence of the spread of the disease.[6] Such a decrease in COVID-19 vaccine uptake has been examined by researchers to assess what influences people's intention to get vaccinated.[9] Early COVID-19 pandemic difficulties

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included an excessive number of patient samples being sent to labs for testing and the possibility of sample cross-contamination as a result of inadequate facilities and overworked personnel.[10] Additionally, The potential for immune evasion and detection challenges of COVID-19 has increased due to the Introduction of variants, impeding monitoring efforts.[11]

Understanding the contextual factors that influence people's decision to take the vaccine is an essential step to reaching a high uptake rate. Theoretical models are one effective method used to predict and understand what drives people's intention to get vaccinated.[12] The Health Belief Model (HBM) is one of the widely applied and largely tested to explain the difference in people's decisions in terms of adopting preventive health behaviors in general and getting vaccinated.[13,14] The HBM posits that an individual's level of involvement in health-promoting behavior can be explained by their beliefs regarding the health issue, perceptions of the benefits of taking action, and obstacles to taking action. More specifically, the HBM suggests that the decision to obtain a COVID-19 vaccine is determined by perceived susceptibility to COVID-19, beliefs about the severity of COVID-19, perceived benefits of the vaccine in preventing COVID-19, and perceived barriers to getting vaccinated.

Saudi Arabia implemented proactive measures in the early stages of the COVID-19 pandemic in accordance with international guidelines, with the aim of mitigating the spread of the virus. The employed measures included the implementation of lockdowns, enforcement of social distancing measures, suspension of public transportation, closure of educational institutions, restriction of large religious gatherings, and implementation of contact tracing protocols for travelers exhibiting symptoms of COVID-19 infection.[15] In addition, the government has undertaken initiatives to bolster its capabilities in detecting and managing various facets of the COVID-19 pandemic. The implementation encompassed the creation of walk-in respiratory clinics, such as the Tatamman clinic, which were furnished with proficient healthcare personnel and diagnostic apparatus throughout the nation. These clinics were specifically designed to attend to individuals who were manifesting symptoms indicative of COVID-19.[16] Several national studies have examined the knowledge, attitudes, perceptions, and hesitancy toward COVID-19 vaccination among the general public and healthcare workers. For instance, a study with 2022 participants from various regions of Saudi Arabia found that 76.0% had satisfactory knowledge, 72.4% had positive attitudes, and 71.3% had positive perceptions regarding the use of COVID-19 vaccines.[17] Another study involving 1599 participants reported an overall vaccine acceptance rate of 79.2%. Key factors motivating individuals to receive the vaccine were confidence in government decisions (54.8%) and a personal sense of responsibility to control the pandemic (48.7%).[18] Despite the researchers' effort to understand people's behavior to get vaccinated, to our knowledge, no study has examined adults' behavior towards vaccination against COVID-19 using the HBM at the early stages of the COVID-19 pandemic.

This study aims to investigate the predictors of COVID-19 vaccination behavior among adults in Saudi Arabia by employing the HBM. I hypothesize that the four components of the HBM, susceptibility, severity, benefits, and barriers, have the ability to predict individuals' intention to receive the COVID-19 vaccine. Additionally, I hypothesize that various demographic variables, such as sex, age, marital status, and income, exert an influence on individuals' perceptions of susceptibility, severity, benefits, and barriers.

# Methods

## Participants and Data Collection

The research utilized a cross-sectional, web-based anonymous survey, study design during the period of January 3 to 14, 2021. At that time, the COVID-19 pandemic was widespread globally, and the COVID-19 vaccination campaign was starting in Saudi Arabia. The study's inclusion criteria included individuals who were residents of Saudi Arabia and who were aged 18 years or older. Convenient sampling was utilized to recruit the participants of the study via Email invitations. The initial Email invitation originally went out to graduate and undergraduate students enrolled at a public university in Saudi Arabia on January 3rd, followed by a subsequent reminder sent one week later to encourage participants' engagement and improve the response rate. The questions were provided in a bilingual format, with English and Arabic languages being used. The reliability of the questionnaire was examined by the author and independent reviewer. The invitation included comprehensive details pertaining to the study's contextual framework, aims,

methodologies, the anticipated duration for survey completion, the researcher's contact information, assurances regarding privacy and confidentiality, as well as an explicit statement outlining the option to withdraw participation. The sample size was calculated using a margin of error of 5%, a confidence level of 95%, a response rate of 50%, and a previous estimate rate of COVID-19 vaccine intention of 80%, giving a minimum sample size of 402.[19] In order to participate in the survey, participants were required to provide informed consent on the introductory webpage. Consent was obtained from study participants prior to study commencement; no incentives were provided to the Participants and personally identifiable information was not collected. An 86% response rate was achieved, with a total of 505 responses received out of the 588 questionnaires distributed. The study protocol was approved by the Saudi Electronic University Research Ethics Committee prior to commencing the study and complies with the declaration of Helsinki.

## Measures

The questionnaire contained three distinct sections. Firstly, the demographic variables were age, gender, marital status, employment status, educational attainment, and monthly household income. Second, the intention to receive the COVID-19 vaccination. Third, HBM constructs were incorporated into the model and were composed of indicators assessed as questions in a survey. The intention and HBM constructs were derived from the existing body of literature on the Health Belief Model,[9,20–23] and were measured using 5-point Likert scales ranging from "strongly disagree" to "strongly agree". Table 1 illustrates Cronbach's α coefficients, factor loadings, Average Variance Extracted (AVE), and Composite reliability (CR) for the constructs of the HBM and their measurement items. The final version of the questionnaire was determined after a comprehensive evaluation of the face and content validity conducted by two experts in the field of public health.

## Statistical Analysis

The characteristics of the participants were analyzed using descriptive statistics, such as means, standard deviations, and frequencies using the Statistical Package for the Social Sciences (SPSS). Pearson correlation coefficients were utilized to examine the relationships between each pair of constructs included in the model and to understand the zero-order associations among the variables being studied.

To evaluate the explanatory power of the HBM in predicting the intention to obtain COVID-19 vaccination, Structural Equation Modeling (SEM) was utilized. Initially, a priori power analysis was conducted to determine the least sufficient sample size needed for SEM. The results indicated that at least 179 participants would be necessary to employ SEM for the study. The SEM was performed utilizing AMOS Version 20 software to assess HBM predictors of COVID-19 vaccination. The study hypothesized that perceived susceptibility, perceived severity, perceived benefits, and perceived barriers were potential predictors of both COVID-19 and the intention to acquire COVID-19 vaccination, as illustrated in Figure 1.

Confirmatory factor analysis (CFA) was used to assess construct validity, thereby verifying the alignment of the items with the intended construct. The latent variables in this model were constructed using the items specified in the Measures section. The reliability coefficients, factor loadings, and average variance extracted statistics of the measuring instruments were determined (Table 1). The evaluation of the overall SEM model's adequacy was conducted using established fit indices, including the comparative fit index (CFI) with a threshold of 0.95, Tucker-Lewis's index (TLI) with a threshold of 0.95, root mean square error of approximation (RMSEA) with a threshold below 0.08, and standardized root-mean-square residual with a threshold below 0.08.

# Results

In total, the study had 505 participants. As indicated in Table 2, the sample had a greater number of males (n = 275; 54.5%) compared to females, a relatively young age distribution, with 88% of participants falling within the 18 to 30 age range. The overwhelming majority of participants (96%) possessed a bachelor's degree. A minority of the participants (13%) were found to be married during the period in which the survey was conducted. All the participants in the study were found to be free of any prior COVID-19 infection when the survey was administered.

**Table 1** Items for Study Measures with Descriptive Statistics, Confirmatory Factor Analysis, Reliability Coefficients, Factor Loadings, Composite Reliability, and Average Variance Extracted Statistics (n = 505)

| Construct Items | Measurement Item | Factor Loading (λ) | Cronbach Alpha (α) | Average Variance Extracted (AVE) | Composite Reliability (CR) | Mean (Range 1–6) | SD |
|---|---|---|---|---|---|---|---|
| Intention | I intend to get vaccinated against COVID-19 | 0.91 | 0.90 | 0.75 | 0.90 | 4.41 | 1.48 |
| | I want to get vaccinated against COVID-19 | 0.94 | | | | 4.38 | 1.46 |
| | I expect to get vaccinated against COVID-19 | 0.74 | | | | 4.57 | 1.35 |
| Perceived susceptibility | My chance of getting COVID-19 in the next few months is great | 0.67 | 0.81 | 0.72 | 0.83 | 2.91 | 1.38 |
| | I am worried about getting COVID-19 in the next few months | 0.86 | | | | 2.91 | 1.63 |
| | Getting COVID-19 is currently a possibility for me. | 0.75 | | | | 3.04 | 1.44 |
| Perceived severity | COVID-19 is a serious illness for someone my age | 0.68 | 0.78 | 0.71 | 0.79 | 2.88 | 1.45 |
| | COVID-19 is a serious illness for children | 0.66 | | | | 3.77 | 1.57 |
| | COVID-19 is a serious illness for the elderly | 0.68 | | | | 5.37 | 0.89 |
| | COVID-19 may cause serious health problems. | 0.68 | | | | 4.85 | 1.15 |
| | Even if I am infected by COVID-19, I can sufficiently recover naturally without medical treatment. | 0.75 | | | | 3.95 | 1.45 |
| | Even if I will be infected with COVID-19 I do not think it will cause me significant suffering or complications | 0.69 | | | | 4.03 | 1.32 |
| Perceived benefits | COVID-19 vaccination will prevent me from getting COVID-19 | 0.75 | 0.83 | 0.73 | 0.82 | 4.07 | 1.31 |
| | COVID-19 vaccination will prevent the spreading of the disease to people close to me | 0.80 | | | | 4.60 | 1.16 |
| | COVID-19 vaccination can relieve COVID-19 symptoms and complications | 0.81 | | | | 4.57 | 1.19 |
| | COVID-19 vaccination will make me feel less worried about being infected with COVID-19 | 0.83 | | | | 4.34 | 1.31 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Perceived barriers | Getting the COVID-19 vaccination can be painful | 0.72 | 0.91 | 0.76 | 0.85 | 3.15 | 1.62 |
| | There are too many risks in getting the COVID-19 vaccination | 0.61 | | | | 3.28 | 1.47 |
| | I am concerned about having a bad reaction to the COVID-19 vaccination | 0.73 | | | | 3.24 | 1.38 |
| | People often get sick from COVID-19 vaccination | 0.64 | | | | 3.91 | 1.58 |
| | *Access barriers* | | | | | | |
| | Clinics that give the COVID-19 vaccination are hard to reach | 0.69 | | | | 2.52 | 1.67 |
| | It is difficult for me to find the time to get a COVID-19 vaccination | 0.76 | | | | 3.04 | 1.53 |
| | *Belief barriers* | | | | | | |
| | COVID-19 vaccination are unnecessary | 0.89 | | | | 2.26 | 1.35 |
| | Healthy people do not need to get a COVID-19 vaccination | 0.72 | | | | 2.49 | 1.51 |
| | I am concerned about the efficacy of the COVID-19 vaccination | 0.72 | | | | 3.08 | 1.641 |
| | I am concerned about the safety of the COVID-19 vaccination | 0.64 | | | | 3.11 | 1.64 |
| | *Mistrust* | | | | | | |
| | I do not trust a doctor's advice to get COVID-19 vaccination | 0.86 | | | | 3.10 | 1.52 |
| | I do not have all the information on the COVID-19 vaccination I need | 0.77 | | | | 3.38 | 1.61 |

**Abbreviations**: λ, Standardized factor loading from structural equation model; α, Cronbach's alpha reliability coefficient; CR, Composite reliability; AVE, Average variance extracted from structural equation model.


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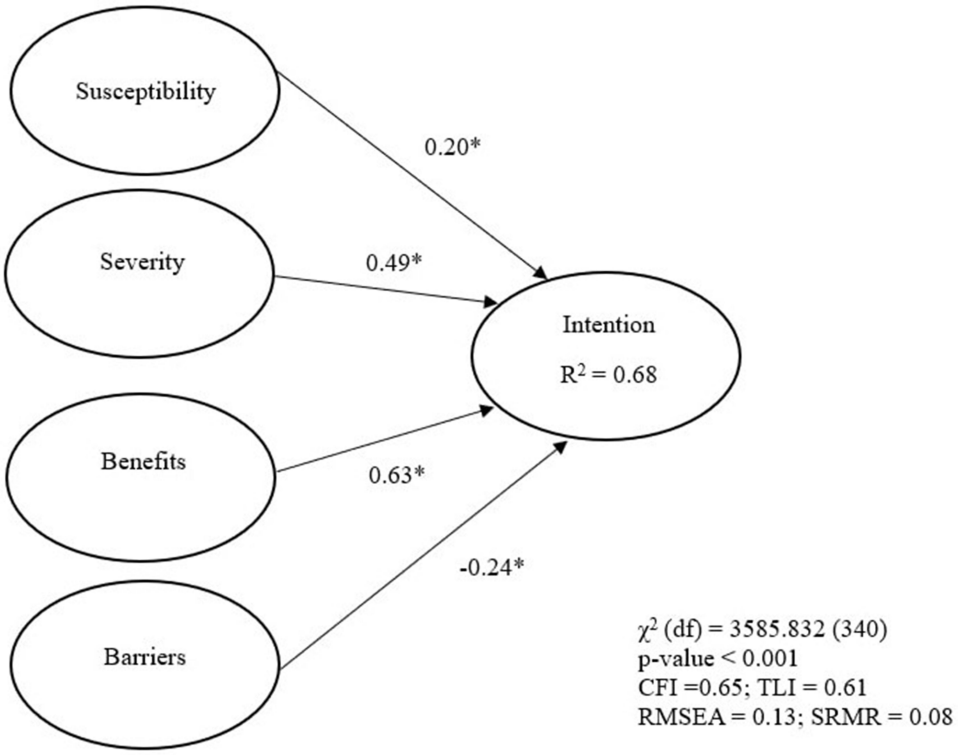


**Figure 1** The structural equation modeling results of the proposed HBM model.
**Note**: *P < 0.001.

To assess common method bias in the CFA, a latent variable approach was employed as the initial process.[24] A supplementary variable was incorporated into a subsequent confirmatory factor analysis (CFA) model, wherein all the measures were utilized as indicators. Subsequently, the standardized regression weights for all loadings across the two

**Table 2** Characteristics of Study Participants (n = 505)

| Variable | % |
|---|---|
| Sex | |
| Male | 54.5 |
| Female | 45.5 |
| Age group (years) | |
| 18–30 | 88.09 |
| 31–90 | 7.91 |
| ≥ 40 | 1.00 |
| Social status | |
| Married | 12.92 |
| Single | 87.08 |

(*Continued*)

**Table 2** (Continued).

| Variable | % |
|---|---|
| Education level | |
| Ungraduated level | 96.12 |
| Graduate level | 3.88 |
| Monthly Income | |
| <5000 SAR | 88.24 |
| 5001–10,000 SAR | 8.82 |
| > 10,000 SAR | 1.04 |

**Table 3** The Correlations of the Theory of Planned Behavior Variables

| SD | Mean | Range | 5 | 4 | 3 | 2 | 1 | |
|---|---|---|---|---|---|---|---|---|
| 3.93 | 13.36 | 3–18 | − 0.27* | 0.62* | 0.25* | 0.32* | 1 | 1. Intention |
| 3.79 | 8.86 | 3–18 | 0.25* | 0.36* | 0.24* | 1 | – | 2. Perceived susceptibility |
| 4.55 | 24.86 | 13–36 | − 0.17* | 0.31 | 1 | – | – | 3 Perceived benefits |
| 4.03 | 17.58 | 4–24 | − 0.14* | 1 | – | – | – | 4. Perceived benefits |
| 12.88 | 36.54 | 12–70 | 1 | – | – | – | – | 5. Perceived barriers |

**Note**: *P < 0.01.

models were compared. No significant differences were observed that would indicate the existence of common method bias.

The standardized factor loading for each measurement item of the CFA models is presented in Table 3. The item factors of the proposed model exhibit significant factor loadings, with values ranging from 0.67 to 0.86 for perceived susceptibility, 0.66 to 0.75 for perceived severity, 0.76 to 0.83 for perceived benefits, 0.61 to 0.89 for perceived barriers, and 0.74 to 0.94 for intentions. The reliability coefficients (α) varied between 0.78 and 0.91, while the Average Variance Extracted (AVE) ranged from 0.71 to 0.76. The Composite Reliability (CR) also showed variation, ranging from 0.79 to 0.90.

The HBM framework that was proposed demonstrated adherence to all five assumptions of SEM. The CFI, GFI, and TLI all exhibited values exceeding 0.80, thereby suggesting an acceptable level of fit despite the significance of the $\chi 2$ test. As depicted in Figure 1, CFI yielded a value of 0.65, the TLI yielded a value of 0.61, and the GFI yielded a value of 0.66. Additionally, the RMSEA yielded a value of 0.13, with a 90% confidence interval ranging from 0.134 to 0.142. The SRMR yielded a value of 0.08. The statistical significance of the $\chi 2$ test is commonly observed in studies with large sample sizes and complex models. Additionally, it is worth mentioning that both the RMSEA and the TLI rely heavily on the $\chi 2/df$ ratio, which further supports their adequacy as model fit indicators. Additionally, Table 3 illustrates the range, mean, and standard deviation for each factor; also, the table shows the bivariate correlations observed in the study which were found to be statistically significant ($p < 0.01$) and ranging from −0.27 to 0.62.

Overall, the models show all HBM factors had a significant impact on the intention to obtain the COVID-19 vaccination. Figure 1 shows the standardized parameters estimated for the hypothesized model. The strongest association was observed between Perceived Benefits and intention, while the weakest association was observed between Perceived Susceptibility and intention. In examining the association between demographic characteristics and adults' intention to

receive the COVID-19 vaccination, only married status (standardized B= 0.11, p 0.05) had a significant relationship with the intention to obtain COVID-19 immunization.

The squared multiple correlations ($R^2$) value was 0.68 ($p < 0.001$) suggesting that the predictors of the HBM model utilized in this study account for approximately 68% of the variation in an individual's intention to receive the COVID-19 vaccine. The intention to receive the COVID-19 vaccination is significantly associated with marital status (standardized $B = 0.11$, $p < 0.05$), while no significant associations were found with other demographic factors such as age, income, and gender.

## Discussion

This research aimed to investigate the influence of the HBM constructs on the vaccination intentions of adult individuals residing in Saudi Arabia, specifically during the initial phase of COVID-19 vaccine approval and public availability. The HBM model showed a statistically significant effect between each variable in the HBM and individuals' intention to receive the COVID-19 vaccination. Specifically, I observed a positive correlation between individuals' intention for vaccination and their beliefs regarding their susceptibility to COVID-19, the severity of illness upon infection, the benefits of receiving the vaccine, and their ability to overcome obstacles associated with vaccine uptake. The findings demonstrated the effectiveness of the constructs of the HBM in understanding people's intentions, a proxy to the uptake of COVID-19 vaccinations. Previous research investigating the significance of HBM constructs has yielded inconclusive findings. In Saudi Arabia, a large sample was examined to investigate the preventive practices related to COVID-19 using the HBM.[25] The findings in my study indicated that there was no statistically significant association between perceived severity and susceptibility to adopting preventive practices against COVID-19. Similarly, other studies found no significance for various HBM components in predicting the adoption of healthy behaviors such as condom usage and breast self-examination.[26,27] On the other hand, several studies have shown the significance of each HBM component in predicting the uptake of COVID-19 vaccination.[28–30] The association between HBM constructions and the uptake of COVID-19 vaccination must thus be confirmed in more research with robust study designs. This will enable the government to plan and create successful campaigns for widespread immunization of the general population. These Results can be utilized to help inform health initiatives aimed at enhancing acceptance and utilization of the COVID-19 vaccine within the population.

Overall, participants in this research reported a very high intent to be vaccinated against COVID-19, with an average score of 13.36 on a scale from 3 to 18. (75% on the scale of intention). Upon analyzing the variation in intention across different demographic characteristics of the participants, no statistically significant differences were found. Another study was conducted to investigate the extent of intention within a large sample of Saudi individuals.[31] The findings revealed elevated levels of intention, particularly among older adults (80% as opposed to 65% in young adults) and males (70% in comparison to 62% in females). Globally, a study found that 69% of participants in the United States expressed an intention to receive a COVID-19 vaccine.[30] Additionally, another study observed an intention rate of 75% among individuals seeking to receive the COVID-19 vaccination.[32] Nevertheless, the intent to receive the vaccine does not automatically result in the actual uptake of the vaccine. According to a national longitudinal study, it was found that 81% of individuals who expressed an intention to receive the COVID-19 vaccine ultimately followed through and received it.[33] Therefore, it is crucial to conduct additional research to gain a deeper understanding of the factors that influence the actual adoption of the vaccine. This can be achieved by leveraging high-quality data obtained from reliable public health agencies and organizations.

The findings of the study indicate that, within the HBM framework, the susceptibility and severity of the components related to COVID-19 significantly influenced individuals' intention to receive the vaccine when compared to the barriers construct. This highlights the positive correlation between the perceived severity and susceptibility of COVID-19 and an individual's inclination to receive the vaccine, thereby reducing the potential risks associated with exposure to the virus. Similar results have been shown in the literature.[28] Another study provided an additional explanation regarding the substantial correlation, attributing it to the potential impact of "hypochondriac concerns" encompassing apprehension about contracting the disease and transmitting it to one's family, as well as the ensuing panic stemming from the perceived difficulty in managing the disease.[34] Therefore, the presence of protective measures beliefs in relation to the

safety of others leads to a decrease in self-interest behaviors among individuals, resulting in an increase in vaccine uptake. Additionally, from a psychological aspect, individuals participate in health-promoting actions when they believe the potential impact is severe.[35] However, it was noted that there was no significant correlation between perceived susceptibility and vaccine willingness.[21] Other research also has indicated a lack of association between the perception of susceptibility and severity and the intention to receive the COVID-19 vaccine.[36] Given the considerations above, implementing outreach programs and public education initiatives aimed at informing the public about the enduring threat of COVID-19 after lifting protective measures could be considered an essential strategy alternative. Hence, health promotion and disease prevention programs that emphasize one's susceptibility to the disease and employ fear-inducing messages through mass media platforms raise public consciousness regarding the severity of the coronavirus, which eventually could increase the adoption of the COVID-19 vaccine. This was also observed in other diseases, such as the Human papillomavirus (HPV).[37] Additionally, the results of the study support the use of health communications that emphasize a heightened susceptibility to diseases, as they have been shown to effectively influence individuals' behavior towards vaccination.[38]

The findings of our study also indicated that people's perceived benefits of COVID-19 vaccination exerted the most significant influence on their intention to seek vaccination. In conducting an analysis of the effects of benefits and barriers, our research revealed that only the perceived benefit exhibited a positive impact on the intention of obtaining the COVID-19 vaccine. In examining the components of the benefits and barriers constructs, the participants in the study placed a high value on the benefit of protecting their loved ones from infection, as they held the belief that vaccines were highly effective in preventing the disease for both themselves and their families. The primary obstacles identified among the various barriers were the fear of experiencing sickness and other side effects after receiving the vaccination and the efficacy of the vaccine. These findings were corroborated by other studies.[39,40] Additionally, the elements that cause post-vaccination responses to diminish, that raise the possibility of breakthrough infections by accumulating virus mutations, and that are unique to each patient, including age, sex, socioeconomic position, and comorbidities.[41,42] Therefore, the implementation of a successful promotion strategy that focuses on fostering trust between the public as a whole and health governing bodies, distributing accurate information, and maintaining transparency in the vaccine approval process may serve as a viable approach to enhance vaccine adoption. In addition, it is imperative for public health government agencies to disseminate information to the general population regarding anticipated symptoms following vaccination, alongside emphasizing the infrequency of significant adverse reactions. Other studies found that the proliferation of conspiracy theories surrounding the COVID-19 pandemic has had a pervasive impact, leading individuals to reject precautionary measures such as vaccination.[30] Thus, the implications of these results suggest that prevention initiatives have the potential to mitigate negative perceptions surrounding the vaccine. Such initiatives can achieve this by addressing and countering prevailing conspiracies and views, including the belief that the vaccine is ineffective or conflicts with religious principles.

The HBM proposed in this study demonstrates a strong explanatory capacity, as it accounts for 68% of the variability in participants' intention to update their COVID-19 vaccine. This suggests that the constructs of the HBM play a significant role in understanding individuals' vaccination intentions. Research findings have indicated a considerable range in the percentage of intention accounted for, with the lowest value observed at 28% and the highest value recorded at 66.8%.[30,43] Therefore, our research indicates that the HBM framework is a valuable tool for identifying the underlying determinants that influence vaccine decision-making and for developing intervention strategies aimed at enhancing the acceptance of COVID-19 vaccines.

The current study showed only married status (standardized $B$= 0.11, p 0.05) had a significant relationship with the intention to obtain COVID-19 immunization among participants' demographics (age, income, gender). Several studies have yielded inconclusive results regarding the influence of demographic variables on individuals' intentions. Our study did not identify a statistically significant relationship between the age of participants and their intention to receive the COVID-19 vaccination. One potential explanation for this is that a majority of the participants were of a young age group. Multiple studies have documented a notable positive association between age and the inclination to receive a vaccine.[44,45] Specifically, older individuals have exhibited a greater propensity to accept the COVID-19 vaccine compared to their younger counterparts. The identification of a higher intention towards vaccination among respondents

in this particular age group can be deemed reasonable, given their inclusion within the high-risk category for COVID-19. Income has been identified as a significant mediating variable between intention and the constructs of the HBM.[28] The implications of these results are disconcerting as individuals with lower socioeconomic status face greater challenges in accessing the COVID-19 vaccine in comparison to their higher-income counterparts.

The gender of the participants did not have a statistically significant impact on their intention to receive the COVID-19 vaccination. This observation diverges from previous research that repeatedly demonstrated higher levels of COVID-19 vaccine acceptance among women.[46] A study from the United States revealed a notable disparity in COVID-19 vaccination rates between genders, with a higher proportion of women receiving the vaccines compared to men.[47] This trend persists despite the fact that a greater number of men succumb to the disease. Nevertheless, research conducted in India has revealed that the dissemination of inaccurate information and the presence of obstacles in accessing vaccines have exacerbated disparities in distribution across several states in India.[48] Another study revealed that females exhibited a lower perception of severity compared to males, resulting in a correspondingly lower intention.[28]

## Limitations

There are several Limitations associated with our study that could potentially be addressed in further investigations. First, the study was subject to potential information and recall bias due to the self-reporting method used by participants regarding their intention to receive the COVID-19 vaccine and other variables. Second, the methodology employed in this study involved the use of a cross-sectional survey that relied on self-reported data. As a result, it is important to note that establishing causality from these findings is challenging. Third, due to the scarcity of resources and the urgent nature of the COVID-19 pandemic, we employed a convenient sampling technique that may not accurately reflect the broader population. Fourth, the scope of our study was restricted. The composition of our sample was evidently biased towards individuals who were young and possessed higher levels of education, thereby constraining the extent to which our findings can be extrapolated to the broader population. Fifth, the inclusion of factors that influence individuals' intention to receive the COVID-19 vaccine in the model resulted in a substantial enhancement of the model's explanatory power. However, a significant portion of the variability in the data still remained unaccounted for.

This research holds significant importance by examining the underlying determinants influencing individuals' choices to receive a COVID-19 vaccination as there exists a subset of individuals who exhibit hesitancy towards embracing vaccination despite its proven efficacy in mitigating the impact of COVID-19. Additionally, the results will enhance the availability of scientific evidence to policymakers, enabling them to formulate effective regulations and implement suitable interventions for the promotion of vaccines throughout epidemics.

# Conclusion

The study's findings offer evidence-based recommendations for the implementation of vaccination strategies designed to increase vaccine acceptance during the COVID-19 pandemic. The data demonstrate that effectively disseminating information pertaining to our susceptibility to contracting COVID-19, the severity of the disease, the benefit of vaccination, and strategies for overcoming barriers is crucial for enhancing the adoption of accessible COVID-19 vaccines. These findings are valuable for evaluating the inclination of adults in Saudi Arabia toward acquiring the COVID-19 vaccination and the various factors that may influence their decision to get vaccinated. This information can serve as a foundation for developing future immunization strategies that prioritize the dissemination of precise information regarding the health consequences of COVID-19 and the advantages of receiving the vaccine. Enhancing individuals' self-assurance in their capacity to overcome obstacles to vaccination, as well as engaging family members and influential figures within social or religious circles, will contribute to a higher rate of COVID-19 vaccine acceptance among the population. In order to gain a deeper understanding of the factors that influence vaccination uptake and to facilitate the development of effective health policies and communication strategies aimed at improving vaccine acceptance and uptake among the population, it is recommended that future research integrate actual real-world vaccine behavior into the existing models. Furthermore, future investigations should aim to investigate the influence of information on individuals' decision-making processes regarding the administration of the COVID-19 vaccine. Additionally, there is a necessity to increase vaccination rates, especially in communities that are more susceptible. Emphasize that

immunization has been shown to be successful in lowering the risk of protracted COVID-19 syndrome, a serious side effect of an acute COVID-19 infection.[49]

## Disclosure

The author reports no conflicts of interest in this work.

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