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Predictors of Intent to Receive the COVID-19 Vaccination Among the Population in the Kingdom of Saudi Arabia: A Survey Study

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Background: The COVID-19 pandemic had a significant economic and social impact on the Kingdom of Saudi Arabia. This study explored various factors influencing the COVID-19 vaccination intention and the applicability of the health belief model (HBM) to explore vaccination intention among the population of Saudi Arabia.

Methods: This is an online survey conducted between January 6, 2021, and January 19, 2021, using a Google™ form questionnaire among Saudi population. The questionnaire aimed to assess the factors that influence the intent to receive the vaccine, by evaluating demographic details, COVID-19 experience and health self-assessment, acceptability of COVID-19 vaccination and preferences and health belief regarding COVID-19 illness and vaccination.

Results: The survey generated a total of 1333 responses from all over the 13 provinces of the Kingdom. The participants had mixed perceptions regarding the susceptibility and severity of COVID-19. A total of 959 (71.9%) subjects responded positively to COVID-19 vaccine intent. Those with >15,000 SR per month income, no past exposure to COVID-19, and comorbidities reported significantly higher intention to take vaccination ($p<0.05$). Among the HBM variables, the perceived susceptibility construct (OR=3.82, 95% CI 1.64–8.94) and perceived benefit construct (OR=7.59, CI 1.65–34.86) were important facilitators for a definite intention to vaccinate. The perceived barriers construct (safety [OR= 0.062, CI 0.03–0.15]; side effects of the vaccine [OR=0.31, CI 0.13–0.75]) and cues to action construct (OR=0.32, CI 0.13–0.77) were the significant factors hindering the uptake of COVID-19 vaccine. However, the perceived severity construct did not play an important role in predicting definite intention to receive the COVID-19 vaccine in the Saudi population.

Conclusion: The study has important implications for promoting COVID-19 vaccination uptake among the population of Saudi Arabia.

Keywords: COVID-19 vaccination, intention to vaccinate, Saudi Arabia, health belief model

Introduction

The coronavirus disease 2019 (COVID-19) was initially detected in the wet markets in the city of Wuhan, China in late 2019.[1] COVID-19 was declared as a pandemic by the World Health Organization (WHO) on 11 March 2020.[2] COVID-19 infected more than 90 million people worldwide and caused nearly two million fatalities by January 2021.[3] The first case of COVID-19 in Saudi Arabia was detected on 2 March 2020, and the total number of confirmed cases rose to more than 100,000 within a month, reaching an average of thousand new cases per day.[4]

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COVID-19 infected more than 350,000 people in Saudi Arabia by January 2021 and caused more than 6000 deaths.[3] The maximum number of cases are reported from Makkah Province and the least number of cases are reported from Asir Province. To control the spread of infection, the Kingdom took drastic measures such as lockdown, quarantine, and international travel restrictions, and even canceled the hajj, annual pilgrimage.[5] The pandemic had a significant economic and social impact on the Kingdom.[6]

Since there is no effective medical treatment for COVID-19 at present, the international collaborative efforts are more focused on developing a safe and effective vaccine against COVID-19.[7] At the time of writing this manuscript, there are around five vaccine candidates with evidence from Phase 3 trials (BNT162b2, mRNA-1273, ChAdOx1 nCoV-19, Sputnik V, and BBIBP-CorV).[8] However, the data regarding the efficacy and safety of the vaccines were published only for BNT162b2 and ChAdOx1 nCoV-19.[8] Saudi Arabia started COVID-19 vaccination campaign on December 17 using BNT162b2, the Pfizer-BioNTech vaccine.[9] Till January 18, almost 300,000 people have received the COVID-19 vaccine in Saudi Arabia.[10] The mass campaign was planned in three phases. In the first phase, people at a high risk of infection such as healthcare workers and those at a high risk of complications (age more than 65, those with chronic ailments) will receive the vaccine, and those aged over 50 years in the second, and everyone else in the third phase.[11]

Saudi Arabia has a population of more than 34 million.[12] To achieve herd immunity against COVID-19 infection, a vaccination coverage rate of about 67% is needed.[13] Apart from the scarcity of the vaccine candidate and logistic issues, one of the most important barriers in achieving such a high rate of mass vaccination against COVID-19 would be vaccination hesitancy. Studies have consistently shown that the most important factor influencing the success of a mass vaccination campaign is the intention of the population to take the vaccine against the infectious organism.[14] Vaccine hesitancy, delay in acceptance or refusal of vaccination when it is available, is a significant problem worldwide.[15] Previous reports regarding the hesitancy of parents to immunize their children and influenza vaccination hesitancy in Saudi Arabia indicates that vaccination hesitancy is a major public health challenge in the Kingdom.[16,17] Regarding COVID-19 vaccine hesitancy, studies have reported variable rates of vaccine hesitancy across the world.[18] The population of Jordan was reported to have the highest rate of COVID-19 vaccine hesitancy.[18] There is only a single study evaluating vaccine hesitancy from selected cities of Saudi Arabia which reported only 64.7% of the participants intended to uptake a hypothetical vaccine.[19] To the best of our knowledge, there are no studies evaluating vaccine acceptance after the COVID-19 vaccination campaign started in the Kingdom. News reports of the vaccine-related adverse effects and media debates about the efficacy and safety of the vaccine can also potentially influence the acceptance of the vaccine.[20]

The health belief model (HBM) is a commonly used model to study vaccination beliefs and vaccination intention. It was used extensively in studying perceptions of people regarding disease and vaccination during previous epidemics.[14,21] A recent study from China explored vaccination hesitancy using HBM and found that the perceived benefit construct and the perceived barriers construct had the highest significant odds of a definite willingness to receive the COVID-19 vaccine.[14] There are no studies to date regarding the predictors of COVID-19 vaccination hesitancy among the Saudi population using HBM.

There is a real need for more studies regarding the public perception and acceptance of COVID-19 vaccines in Saudi Arabia, especially after the government kick-started the mass COVID-19 vaccination program. We investigated participant's perceptions of the COVID-19 vaccine and explored the factors that influenced the intention to receive the COVID-19 vaccine. This study was conducted after the COVID-19 vaccine was introduced to Saudi Arabia. The information gained from our study will be useful for healthcare workers and policymakers for planning targeted education activities and vaccination awareness campaigns.

Methods

Study Design and Participants

The online survey (snowball technique) using Google™ forms was conducted between January 6, 2021 and January 19, 2021. The study was approved by the institutional ethical committee (Institutional Review Board) with approval number 160/IRB/2021 (University of Jeddah). The questionnaire consisted of questions in English alongside its Arabic translation. The forward and backward translations were done by independent bilingual experts followed by a cognitive interview among 20 participants as a pilot study. The link of the questionnaire was

circulated through social media contacts throughout the Kingdom of Saudi Arabia (questionnaire in Supplementary File 1). Each recipient was asked to share the link with 5 other contacts. The questions started with consent for voluntary participation and a declaration affirming age more than 16-years and not vaccinated for COVID-19 previously. Both Saudi and non-Saudi citizens living in the 13 different provinces of Saudi Arabia were included in this survey.

Instrument

The questionnaire was categorized into 4 groups.

Demographics: personal details collected included age, gender, nationality, marital status, education, monthly income, occupation, and residential information. The questionnaire particularly addressed whether the participant belonged to the healthcare or educational sector.

COVID-19 experience and health self-assessment: this included questions regarding previous COVID-19 illness to the self or close family members as well as a self-assessment about one's health status and pre-existing chronic illnesses.

Acceptability of COVID-19 vaccination and preferences: The intention to receive vaccination was assessed using a direct leading question with a four-point scale (definitely no, probably no, probably yes, definitely yes) while preferences regarding local or imported vaccines were rated using another four-point scale (completely confident to completely non-confident).

Health belief regarding COVID-19 illness and vaccination: Health belief model derived questions were used to enquire about perceived susceptibility and severity of the illness, perceived benefits and barriers of vaccination, and cues to action. This construct includes six main domains that influence health behavior; perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action and self-efficacy.[21] A four-point scale of strongly agree, agree, disagree, and strongly disagree was used for rating the responses.

Statistical Analysis

The data were analyzed using Statistical Package for Social Sciences (SPSS Inc., Chicago, IL, version 26.0 for Windows) software. To describe the study population characteristics, frequencies, percentages, averages and standard deviations were used. Univariate analysis using chi-square tests was used to assess relationships between variables. To determine the most relevant and significant determinants of COVID-19 vaccination intent in terms of HBM constructs, binary logistic regression was performed including all factors showing significance ($p<0.05$). The intention to receive a COVID-19 vaccine was used as the dependent variable, where the original four categories variable (a scale from 1–4; 1 - definitely no, 4 - definitely yes), was transformed to a binary variable (1 - intends to get vaccinated, 0 - does not intend to get vaccinated). The model fit of logistic regression analysis was assessed using the Hosmer-Lemeshow goodness-of-fit test. Odds ratios (OR) and 95% confidence intervals (95% CI) were calculated for each independent variable. All statistical tests were two-sided and performed at a significance level of $p < 0.05$.

Results

Demographics

The survey generated a total of 1333 responses from participants spread all over the 13 provinces of the Kingdom. Table 1 shows the demographic pattern of the subjects. The age of the study participants was in the range of 16 to 75 years, with a mean age of 35.04±11.67. Males comprised 55.2% of the study participants 59.7% were married and 89% were Saudi nationals. Of these, 59.6% had a bachelor's degree and 19.5% had postgraduate qualifications. Most of the respondents were from urban (94.2%) than rural (5.8%) areas. Among the respondents, 32.5% were working in a government setting and 21.3% were working in a private setting. Regarding the nature of the job, 21.5% of the participants were working in the educational sector whereas 27.5% in the healthcare sector. The survey captured all income groups almost proportionately. The study showed less representation from the northern and southern regions of the Kingdom compared to the western region to where the researcher's institute belonged and showed an over-representation in the study. We received high responses from the three provinces which had a higher number of confirmed cases. Regarding exposure to COVID-19,183 participants (13.7%) reported a history of COVID-19 infection in the past and 602 participants (45.2%) reported a history of COVID-19 infection in a family member. Of the participants, 22.8% had co-morbid medical illnesses and 57.4% rated their current health as very good.

Health Beliefs

The subjects had a mixed perception of susceptibility to COVID-19. The majority disagreed to have a high chance

Table 1 Socio-Demographic Variables

Variables	Response	n (%)
Gender	Male Female	736(55.2) 597(44.8)
Nationality	Saudi Non-Saudi	1187(89) 146(11)
Education	High school and below Bachelor Masters/PhD	279(20.9) 794(59.6) 260(19.5)
Marital status (n=1332)	Married Widow Single	795(59.7) 59(4.4) 478(35.9)
Provinces	Central Eastern Western Southern Northern	260(19.5) 165(12.4) 822(61.7) 55(4.1) 31(2.3)
Working in healthcare sector	Yes No	366(27.5) 967(72.5)
Working in education sector	Yes No	287(21.5) 1046(78.5)
Monthly income	<5000 5001–10,000 10,001–15,000 >15,000	386(29) 280(21) 275(20.6) 392(29.4)
Residence	Urban Rural	1256(94.2) 77(5.8)
History of COVID-19 infection	Yes No	183(13.7) 1150(86.3)
Family member infected with COVID-19	Yes No	602(45.2) 731(54.8)
Co-morbid illnesses	Yes No	304(22.8) 1029(77.2)
Rating of health status	Very good Good Fair Poor Very poor	765(57.4) 479(35.9) 80(6) 8(0.6) 1(0.1)

Notes: Data showing socio-demographic and health status of study population; Frequencies mentioned in number (n) with percentages in parentheses.

of contracting COVID-19 in the next few months (60.0%). However, 51.9% agreed that they were worried about the likelihood of getting COVID-19 and 72.2% agreed that getting COVID-19 was a possibility for them. The respondents had a mixed perception about the severity of COVID-19 illness. The majority agreed (77.1%) that the complications of COVID-19 were serious, while 62.9% reported that they were afraid of getting COVID-19. However, 65.1% disagreed about themselves being very sick if they get COVID-19 in the future. The participants had high perceptions about the benefits of the COVID-19 vaccination. The majority agreed that vaccination was a good idea to prevent COVID-19 (74.3%) and 83.9% believed that vaccination would decrease their chance of contracting COVID-19 or developing its complications. Regarding the perceived barriers of COVID-19 vaccination, 42.6% expressed concerns over the possible side effects of vaccination, 50% over the efficacy, and 48.1% over the safety of the COVID-19 vaccine, while 45.2% over the faulty/fake COVID-19 vaccine. Regarding cues to action, 82.1% agreed that they would take the vaccine only if they were given enough information regarding it and 67.1% were ready to receive the vaccine only if many in the public also would take the vaccine. The findings are summarized in Table 2.

The Confidence in Domestic and Foreign-Made COVID-19 Vaccines and Preferences

The vast majority of the subjects were confident or completely confident in domestically made (67.1%) or foreign-made/imported (65%) COVID-19 vaccines. There was a preference for the domestically made vaccine by 24.5% of the participants while 22.3% had a preference for foreign-made COVID-19 vaccines. However, 53.2% reported no preference. There is a significant association between vaccine preference and confidence in the local vaccine (399.19, *df* 6, p<0.001), with a higher number of participants who showed confidence in local vaccine preferring locally manufactured vaccine. Males (21.05, *df* 2, p<0.001), non-Saudi nationals (9.01, *df* 2, p=0.01), those who studied masters and above (60.06, *df* 4, p=0.00), those working in healthcare settings (40.78, *df* 2, p<0.001), those with monthly income more than 15,000 SR (48.77, *df* 6, p<0.001) reported a significantly higher preference for the foreign-made vaccine. The findings are summarized in Table 3.

COVID-19 Vaccination Intent

A total of 959 (71.9%) subjects responded positively to COVID-19 vaccine intent, while only 374 (28.1%) responded in the negative. Of those who responded

Table 2 Frequency Table for Health-Belief Model Variables

Variable	Response	n (%)
Perceived susceptibility of contracting COVID-19		
My chance of getting COVID-19 in the next few months is great	Strongly Agree Agree Disagree Strongly Disagree	85(6.4) 448(33.6) 611(45.8) 189(14.2)
I am worried about the likelihood of getting COVID-19	Strongly Agree Agree Disagree Strongly Disagree	187(14) 505(37.9) 450(33.8) 191(14.3)
Getting COVID-19 is currently a possibility for me	Strongly Agree Agree Disagree Strongly Disagree	180(13.5) 782(58.7) 282(21.2) 89(6.7)
Perceived Severity		
Complications from COVID-19 are serious	Strongly Agree Agree Disagree Strongly Disagree	390(29.3) 638(47.9) 250(18.8) 55(4.1)
I will be very sick if I get COVID-19	Strongly Agree Agree Disagree Strongly Disagree	101(7.6) 364(27.3) 723(54.2) 145(10.9)
I am afraid of getting COVID-19	Strongly Agree Agree Disagree Strongly Disagree	271(20.3) 567(42.5) 353(26.5) 142(10.7)
Perceived benefits of COVID-19 vaccination		
Vaccination is a good idea because I feel less worried about catching COVID-19	Strongly Agree Agree Disagree Strongly Disagree	390(29.3) 601(45.1) 239(17.9) 103(7.7)
Vaccination decreases my chance of getting COVID-19 or its complications	Strongly Agree Agree Disagree Strongly Disagree	499(37.4) 619(46.4) 147(11) 68(5.1)
Perceived barriers of COVID-19 vaccination		
Worry that possible side-effects of COVID-19 vaccination would interfere with my usual activities	Strongly Agree Agree Disagree Strongly Disagree	164(12.3) 404(30.3) 559(41.9) 206(15.5)
I am concerned about the efficacy of the COVID-19 vaccination	Strongly Agree Agree Disagree Strongly Disagree	232(17.4) 434(32.6) 483(36.2) 184(13.8)
I am concerned about the safety of the COVID-19 vaccination	Strongly Agree Agree Disagree Strongly Disagree	249(18.7) 392(29.4) 434(32.6) 258(19.4)
I am concerned of the faulty/fake COVID-19 vaccine	Strongly Agree Agree Disagree Strongly Disagree	246(18.5) 357(26.8) 438(32.9) 292(21.9)
Cues to action		
I will only take the COVID-19 vaccine if I was given adequate information about it	Strongly Agree Agree Disagree Strongly Disagree	481(36.1) 613(46) 166(12.5) 73(5.5)
I will only take the COVID-19 vaccine if the vaccine is taken by many in the public	Strongly Agree Agree Disagree Strongly Disagree	372(27.9) 523(39.2) 310(23.3) 128(9.6)

Note: Frequencies mentioned in number (n) with percentages in parentheses.

positively, the majority responded definitely yes (41.3%) followed by probably yes (30.6%). Only 10.5% responded definitely no and 17.6% reported probably no.

Males (47.8%) expressed a definite intention to get vaccinated than females (33.3%); however, the association was not found significant in the regression analysis. By monthly income level category, high-income groups (>15,000 SR per month) expressed a definite intent to receive the vaccine (51%, 30.36, *df* 9, p<0.001). A significantly higher proportion of subjects who had no history of COVID-19 infection expressed a definite intention to vaccination than those with a history of COVID-19 infection (41.9% vs 37.7%; 11.9, *df* 3, p=0.008). Those who had co-morbid medical conditions reported a definite intention to vaccination than those without any comorbid illnesses (46.4% vs 39.8%; 9.8, *df* 3, p=0.020). Participants who rated higher confidence in local as well as foreign vaccine reported significantly higher intention to take the vaccination. Most of the constructs in the HBM model were significantly associated with having a definite intention for COVID-19 vaccination in the univariate analysis. The findings are summarized in Table 4.

In logistic regression analysis, perception of worry about the likelihood of getting COVID-19 infection under the perceived susceptibility construct (OR=3.82,

Table 3 Association Between Vaccine Preferences and Socio-Demographic Variables

Variable	Response	Vaccine Preference			p-value
		Local	Foreign-Made	No Preference	
Gender	Male Female	154(11.6%) 173(13%)	194(14.6%) 103(7.7%)	388(29.1%) 321(24.1%)	**<0.001**
Nationality	Saudi Non-Saudi	300(22.5%) 27(2%)	251(18.8%) 46(3.5%)	636(47.7%) 73(5.5%)	**0.011**
Education	High school Bachelor Masters/PhD	91(6.8%) 191(14.3%) 45(3.4%)	32(2.4%) 167(12.5%) 98(7.4%)	156(11.7%) 436(32.7%) 117(8.8%)	**<0.001**
Working in health care	Yes No	68(5.1%) 259(19.4%)	124(9.3%) 173(13%)	174(13.1%) 535(40.1%)	**<0.001**
Monthly income	Less than 5000 5001–10,000 10,001–15,000 >15,000	117(8.8%) 73(5.5%) 65(4.9%) 72(5.4%)	67(5%) 40(3%) 60(4.5%) 130(9.8%)	202(15.2%) 167(12.5%) 150(11.3%) 190(14.3%)	**<0.001**

Notes: Frequencies mentioned in number (n) with percentages in parentheses; Significant p values ($p<0.05$) are mentioned in bold letters.

95% CI 1.64–8.94) and the perception that vaccination is a good idea to reduce the worry about catching COVID-19 under the perceived benefit construct (OR=7.59, CI 1.65–34.86) were the strongest predictors for a definite intention to vaccinate. Being concerned with the safety (OR= 0.062, CI 0.03–0.15) and side effects of the vaccine (OR=0.31, CI 0.13–0.75) under the perceived barriers construct and willingness to get vaccinated only if the vaccine was taken by many in the public (OR=0.32, CI 0.13–0.77) under the cue to action construct were among the strongest significant predictors of having no definite intention to take COVID-19 vaccination. The findings are summarized in Table 5.

Discussion

Increasing COVID-19 vaccine uptake among a larger section of the population is an important public health priority at the moment as many vaccine candidates approved for use have shown efficacy in preventing COVID-19 infection and associated complications.[22] This study explored factors associated with COVID-19 vaccination intention and the applicability of the HBM to explore vaccination intention among the population of Saudi Arabia. The findings of this study have shown that among the HBM variables, perceived susceptibility construct and perceived benefit construct were important facilitators for a definite intention to vaccinate. The perceived barriers construct and cues to action construct were significant factors hindering the uptake of COVID-19 vaccination. However, the perceived severity construct did not play an important role in predicting definite intention for COVID-19 vaccination in the Saudi population. A recent study from China also found that the perceived benefit construct in HBM was a significant predictor of a definite intention for COVID-19 vaccination.[14] Contrary to our study, they found that the perceived severity construct as a significant predictor and the perceived susceptibility construct as an insignificant predictor of a definite intention for COVID-19 vaccination. However, similar to our study, cues to action were also found to be important in predicting intention for COVID-19 vaccination. Similarly, another recent study from Malaysia also found high perceived susceptibility of getting a COVID-19, high perception of benefits, and low perceived barriers to receiving the COVID-19 vaccine were important in predicting a definite intention of COVID-19 vaccination.[23] Hence, public health information-education-communication programs to promote COVID-19 vaccination uptake in Saudi Arabia should focus more on providing transparent and adequate information regarding the safety and efficacy of the vaccines to the public, along with promoting the benefits of vaccination, and also should educate the public regarding their susceptibility to COVID-19 infection. Extensive media coverage of the COVID-19 vaccination campaign highlighting the number of people getting vaccinated, along with testimonials can also serve as a cue to get vaccinated.[14]

Table 4 Association Between Health-Belief-Model (HBM) Variables and COVID-19 Vaccination Intention

Variable	Response	COVID-19 Vaccination Intention		p-value
		Definitely Yes	Probably Yes/Probably No/Definitely No	
Perceived susceptibility of contracting COVID-19				
My chance of getting COVID-19 in the next few months is great	Strongly Agree/Agree Disagree/Strongly Disagree	260(19.5%) 291(21.8%)	273(20.5%) 509(38.2%)	**<0.001**
I am worried about the likelihood of getting COVID-19	Strongly Agree/Agree Disagree/Strongly Disagree	351(26.4%) 200(15.1%)	341(25.6%) 441(32.9%)	**<0.001**
Getting COVID-19 is currently a possibility for me	Strongly Agree/Agree Disagree/Strongly Disagree	431(32.3%) 120(9%)	531(39.8%) 251(18.9%)	**<0.001**
Perceived Severity				
Complications from COVID-19 are serious	Strongly Agree/Agree Disagree/Strongly Disagree	478(35.9%) 73(5.5%)	550(41.3%) 232(17.4%)	**<0.001**
I will be very sick if I get COVID-19	Strongly Agree/Agree Disagree/Strongly Disagree	220(16.5%) 331(29%)	245(18.4%) 537(40.3%)	**0.002**
I am afraid of getting COVID-19	Strongly Agree/Agree Disagree/Strongly Disagree	396(29.7%) 155(11.7%)	442(33.2%) 340(25.5%)	**<0.001**
Perceived benefits of COVID-19 vaccination				
Vaccination is a good idea because I feel less worried about catching COVID-19	Strongly Agree/Agree Disagree/Strongly Disagree	513(38.5%) 38(2.9%)	478(35.9%) 304(22.9%)	**<0.001**
Vaccination decreases my chance of getting COVID-19 or its complications	Strongly Agree/Agree Disagree/Strongly Disagree	539(40.5%) 12(0.9%)	579(43.5%) 203(15.2%)	**<0.001**
Perceived barriers of COVID-19 vaccination				
Worry that possible side-effects of COVID-19 vaccination would interfere with my usual activities	Strongly Agree/Agree Disagree/Strongly Disagree	101(7.6%) 450(33.8%)	467(35.1%) 315(23.7%)	**<0.001**
I am concerned about the efficacy of the COVID-19 vaccination	Strongly Agree/Agree Disagree/Strongly Disagree	148(11.1%) 403(30.2%)	518(38.9%) 264(19.8%)	**<0.001**
I am concerned about the safety of the COVID-19 vaccination	Strongly Agree/Agree Disagree/Strongly Disagree	86(6.4%) 465(34.9%)	555(41.7%) 227(17.1%)	**<0.001**
I am concerned of the faulty/fake COVID-19 vaccine	Strongly Agree/Agree Disagree/Strongly Disagree	119(8.9%) 432(32.4%)	484(36.4%) 298(22.3%)	**<0.001**
Cues to action				
I will only take the COVID-19 vaccine if I was given adequate information about it	Strongly Agree/Agree Disagree/Strongly Disagree	496(37.2%) 55(4.1%)	598(44.9%) 184(13.8%)	**<0.001**
I will only take the COVID-19 vaccine if the vaccine is taken by many in the public	Strongly Agree/Agree Disagree/Strongly Disagree	367(27.6%) 184(13.9%)	528(39.7%) 254(19.1%)	0.452

Notes: Frequencies mentioned in number (n) with percentages in parentheses; Significant p values ($p<0.05$) are mentioned in bold letters.

The survey results also showed that the studied population had a mixed level of perception regarding the perceived susceptibility for COVID-19 infection. Although the majority of the participants agreed that getting COVID-19 infection is currently a possibility for them, most of them disagreed with the chance of getting COVID-19 within the next few months. A recent study from China using the HBM also showed a lower level of

Table 5 Health-Belief-Model (HBM) Predictors of Definite COVID-19 Vaccine Uptake (Binary Logistic Regression Analysis)

Variable	OR (Confidence Interval)	Wald	df	p
Constant	_	39.62	1	<0.001
Perceived susceptibility of contracting COVID-19				
My chance of getting COVID-19 in the next few months is great	1.43(0.549–3.741)	0.54	1	0.463
I am worried about the likelihood of getting COVID-19	3.82(1.635–8.942)	9.57	1	**0.002**
Getting COVID-19 is currently a possibility for me	1.47(0.540–4.093)	0.59	1	0.443
Perceived Severity				
Complications from COVID-19 are serious	2.50(0.682–9.171)	1.91	1	0.167
I will be very sick if I get COVID-19	1.05(0.449–2.466)	0.014	1	0.907
I am afraid of getting COVID-19	1.55(0.617–3.872)	0.866	1	0.352
Perceived benefits of COVID-19 vaccination				
Vaccination is a good idea because I feel less worried about catching COVID-19	7.59(1.651–34.863)	6.78	1	**0.009**
Vaccination decreases my chance of getting COVID-19 or its complications	1.42(0.221–9.081)	0.136	1	0.712
Perceived barriers of COVID-19 vaccination				
Worry that possible side-effects of COVID-19 vaccination would interfere with my usual activities	0.31(0.132–0.746)	6.88	1	**0.009**
I am concerned about the efficacy of the COVID-19 vaccination	0.65(0.272–1.566)	0.92	1	0.339
I am concerned about the safety of the COVID-19 vaccination	0.06(0.025–0.152)	36.66	1	**<0.001**
I am concerned of the faulty/fake COVID-19 vaccine	0.60(0.286–1.269)	1.78	1	0.182
Cues to action				
I will only take the COVID-19 vaccine if I was given adequate information about it	1.27(0.376–4.302)	0.15	1	0.698
I will only take the COVID-19 vaccine if the vaccine is taken by many in the public	0.32(0.130–0.768)	6.47	1	**0.011**

Note: Significant p values (p<0.05) are mentioned in bold letters.

perceived susceptibility for COVID-19 infection among the Chinese population.[14] Personal adherence decisions regarding safety measures against the transmission of COVID-19 are essential for the control of the pandemic, and high perceived susceptibility for infection is an important factor influencing personal decision-making regarding the practice of preventive action, as reported by previous studies.[14,24] Considering the increasing trend in COVID-19 infection in Saudi Arabia, our study results highlight the importance of public engagements to educate the population regarding the dangers of underestimating the risks of COVID-19 infection and the potential resurgence of the infection so that the people continue to practice safety measures such as social distancing and wearing of masks more effectively.

Our study found that overall 71.9% reported their intention to receive the COVID-19 vaccine, and 41.3% responded with a definite intention for receiving the vaccination. Our results are similar to a recent Malaysian study, where 48.2% of the respondents reported a definite intention to receive the COVID-19 vaccine.[23] A nationwide survey study from China among 3,541 participants found that 54.6% reported probable willingness to take COVID-19 vaccination, and only 28.7% reported a definite intention to receive COVID-19 vaccine.[14] A global survey on potential acceptance of the COVID-19 vaccine conducted in June 2020, among 13,426 participants from 19 countries found that 71.5% of the participants would be very or somewhat likely to take a COVID-19 vaccine. However, the responses between the countries were very heterogeneous. China reported the highest acceptance rate (90%), while Russia reported the least (55%).[25] Another systematic review done on December 25, 2020, exploring COVID-19 vaccination acceptance rate from 33 countries, found the highest acceptance rate in Ecuador (97.0%), Malaysia (94.3%), Indonesia (93.3%) and China (91.3%), and lowest acceptance rate in Kuwait (23.6%), Jordan (28.4%), Italy (53.7), Russia (54.9%), Poland (56.3%), US (56.9%), and France (58.9%).[18] Similar to our study, this systematic review

found ≥70% acceptance rate in the majority of the studies among the general public. Compared to other countries in the region, the COVID-19 vaccination acceptance rate is significantly higher in the Kingdom. A previous study from Saudi Arabia (before the Saudi government approved COVID-19 vaccine) also highlighted that 64.7% of the respondents reported their intention to receive a hypothetical COVID-19 vaccine.[19] Our study indicates that the COVID-19 vaccine acceptance rate improved in Saudi Arabia after the introduction of the vaccine.

This study also showed significantly higher definite intent to vaccination among males and respondents belonging to the high-income category, which is consistent with past studies. Paul et al explored attitudes towards COVID-19 vaccine uptake among a large sample of UK adults and found lower annual income and female gender as predictors of COVID-19 vaccine uncertainty and refusal.[26] Higher definite intent to vaccination for COVID-19 was also expressed by respondents with no history of COVID-19 infection, and those suffering from co-morbid illnesses, showing their awareness of susceptibility and higher risks associated with COVID-19 infection, respectively.

It is important to recognize a few limitations of this survey study. It was an online cross-sectional survey where data were collected using an online questionnaire with the help of social media platforms. There is a possibility of selection bias with such a study design, as reflected in the overrepresentation of responses from the western province in our study. We received responses from all the provinces, but not in a representative manner. Moreover, the study population does not include a significant number of the rural or non-Saudi citizens. Furthermore, more than half of the study participants were graduates, and 19.5% had post-graduate qualifications. Hence, the sample may not be representing the population of Saudi Arabia as a whole.

Conclusions

To conclude, this study shows that among the HBM variables, perceived susceptibility construct and perceived benefit construct were important facilitators for a definite intention to vaccinate among Saudi population. The perceived barriers construct and cues to action construct were also found to be significant factors hindering the uptake of COVID-19 vaccination. This study results has important implications for promoting COVID-19 vaccination uptake among the population of Saudi Arabia. It is recommended that HBM variables predicting a definite intention to take COVID-19 vaccination should be considered in the design of public health interventions to promote COVID-19 vaccination uptake at the community level.

Abbreviations

COVID −19, Corona Virus Disease- 19; HBM, Health Belief Model; WHO, World Health Organisation.

Data Sharing Statement

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Ethics Approval and Consent to Participate

The project was approved by the institutional ethical committee (Institutional Review Board) with approval number 160/IRB/2021 (University of Jeddah). The participants received information about the purpose of the survey, and that participants under the age of 18 years were approved by the University of Jeddah IRB to provide informed consent on their own behalf. Consent to participate was obtained from all the participants.

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Author Contributions

SA made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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