



# Application of Health Belief Model to Assess COVID-19 Vaccine Acceptance: A Population-Based Survey

Marwa B. Awad Allah

<sup>1</sup>Public health Department, Faculty of Medicine, Zagazig University. Egypt

## ABSTRACT

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### Key Words:

COVID-19 Vaccine, Acceptance, Health belief model, Egypt.

**Background:** Acceptance of coronavirus disease 2019 (COVID-19) vaccine is uncertain and uptake of the vaccine may be hampered by the widespread reduction in public trust in immunization. Uptake of 55–82 percent is needed to gain herd immunity against COVID. Thus investigating important Health belief model (HBM) components that impact the COVID-19 vaccination may be critical for interventions designed to improve vaccine acceptability. **Objectives:** To assess the acceptance of COVID-19 vaccine among Egyptians and its determinants based on the health belief model. **Method:** A cross-sectional study was conducted among 1152 Egyptians, information was collected in two ways: a face-to-face interview in outpatient clinics, Faculty of Medicine, Zagazig and Cairo Universities and through social networking sites, including Facebook and WhatsApp between May and June 2021. **Results:** Overall, 37.5% accept to receive the vaccine, and those who plan to get the COVID-19 vaccination believe it is a more serious illness, are more susceptible to the disease, have a higher perception of infection risk, perceive more benefits from vaccination, and greater levels of cues to action and self-efficacy as well as reduced perception of barriers concerning the vaccine. Individuals who perceived COVID-19 as a more serious illness were aged 30 or more, female, high school or higher, working, urban residents, married, or chronically ill. **Conclusions:** Egypt has one of the lowest rates of COVID-19 vaccination acceptance, since vaccination appears to be the only method to stop the pandemic, the factors associated with low vaccine acceptance must be addressed.

## INTRODUCTION

Coronavirus disease 2019 (COVID-19) has spread rapidly globally, becoming a pandemic of international concern.<sup>1</sup> The greatest way to avoid COVID-19 infection is to stay away from it, regardless of physical and mental wellbeing, social interactions, and the global economy. All have suffered as a result of social alienation, mass economic closure, and lockdowns.<sup>2</sup> Consequently, the devastating implications of COVID-19 have increased the urgency of efficient vaccination to control the outbreaks. The entire globe is racing to stop the virus from spreading and is looking forward

**Corresponding Author:** Marwa Bayomi Awad Allah Mohammed, Department of public health, Faculty of medicine, Zagazig University, Egypt. Email: [tartourm@yahoo.com](mailto:tartourm@yahoo.com). DOI: 10.21608/ejcm.2021.95457.1186

to a safe and efficient vaccination.<sup>3</sup> Since vaccination is often regarded as the most effective method of preventing the spread of infectious illnesses from a public health standpoint.<sup>4</sup>

General public acceptance of the COVID-19 vaccine remains uncertain, and its refusal is growing worldwide.<sup>3</sup> Moreover, vaccine uptake may be further hampered by a widespread reduction in public trust in immunization and an increase in vaccine hesitancy.<sup>5</sup> It is anticipated that a 55–82 percent uptake is needed to gain herd immunity against COVID.<sup>6</sup>

Vaccine refusal and acceptance are inherently complicated, and decisions to obtain a vaccine may fluctuate according to circumstances, place and time. A limited value has been found for the demographic

determinants of global acceptance of the COVID vaccine. The WHO has identified several behavioral motivators for COVID vaccination including empowering environment, social influences, and motivation, so it is suggested to contextualize these motivators within COVID-19 vaccination national plans.<sup>7</sup>

HBM is used to anticipate and influence health behaviors, as it is made up of several primary constructs which are an important predictor of COVID vaccination uptake: perceived susceptibility to catch infection, perceived severity relates to beliefs concerning the negative effects of acquiring infection, perceived vaccine benefits in prohibiting infection, and perceived barriers to vaccination owing to psychological, physical, or economic considerations. Strategies or information sources that stimulate the adoption of a behavior are known as cues to action and the patient's confidence in adopting a habit or taking action, as receiving a vaccination is measured by self-efficacy.<sup>8, 9</sup> Consequently, investigation of significant HBM components that impact COVID-19 vaccination may be critical for designed interventions to improve vaccine acceptability. Thus, the objective of this study was: to assess COVID-19 vaccine acceptance among Egyptian and its determinants based on the health belief model.

## METHOD

During the months of May and June 2021, convenience sampling was used to perform a cross-sectional study among Egyptian citizens living in several governorates across Egypt.

The sample size was determined to be 1152 by open Epi data based on an infinite total population, assuming a 50% vaccination acceptance rate, a design effect 3, and a 95% confidence level.

Egyptian citizens aged 18 and over who live in various governorates around Egypt and are willing to participate in the study will be enrolled.

The researcher prepared a structured questionnaire based on the study's theoretical framework, which is based on the Health Belief Model, research objectives, literature review, relevant study methodologies that were previously validated, and even the objective of the study.<sup>1,10,11</sup> The study tools were translated into Arabic and re-translated by a bilingual expert, and the tool was validated by a committee of public health

experts who judged tool items for their relevance and appropriateness. The reliability test was performed using the reliability coefficients, which were high and proper for scientific purposes (Cronbach's alpha ranged from 0.78 to 0.90). A pilot study was conducted on ten people who were subsequently excluded from the study. The questionnaire was revised according to the results of the pilot study, and some modifications were made, mostly by simplifying the language and shortening the sentences for easier understanding.

Information was gathered in two ways: a face-to-face interview with 384 visitors of outpatient clinics, Faculty of Medicine, Zagazig and Cairo Universities, and the second way through social networking sites including Facebook and WhatsApp. The final form was sectioned into three parts

**First section:** It was used to collect information on the participants' medical and sociodemographic characteristics, such as gender, age, education, employment status, governorates of residence, place of residence, marital status and with a chronic condition.

**2<sup>nd</sup> section:** One question about participants' acceptance to be vaccinated against COVID-19. One point was assigned for acceptance to receive vaccine and no points for non-acceptance were considered.

**3<sup>rd</sup> section:** HBM constructs about the COVID-19 vaccine which consists of the following elements: **1- perceived susceptibility** [6items] include: grading their level of agreement for the risk of contracting COVID-19. **2- Severity** [4 items] include: grading their agreement with the severity and consequences of having COVID-19. **3- Benefit** [3items] include: grading their agreement with the benefits (value of receiving COVID-19 vaccine). **4- Barriers** [7 items] include: think the following hinder you from perceived barriers (obstacles to receive COVID-19 vaccine). **5- Cues to action** [3 items] include (triggers for receiving COVID-19 vaccination) as recommendations by physicians, family members and friends, respectively. **6- Self efficacy** [4items]: How they confident in their ability to receive the COVID-19 vaccines and prevent disease. Participants were then asked to respond, and the response was based on a 5-point Likert scale: (1) strongly disagree, (2) disagree, (3) neutral, (4) agree or (5) strongly agree. A different item response was added to get their sum. Then

**Table 1: Characteristics of the participants**

Characteristics	No (%)
Age	
≤ 30 years	380 (33.0)
> 30 years	772 (67.0)
Gender	
Male	485 (42.1)
Female	667 (57.9)
Education	
Secondary and below	368 (31.9)
High school or above	784 (68.1)
Working status	
Not working	432 (37.5)
Working	720 (62.5)
Governorates of residence	
Lower Egypt governorates	723 (62.7)
Upper Egypt governorates	429 (37.3)
Area of Residence	
Rural	297 (25.8)
Urban	855 (74.2)
Marital Status	
Unmarried	455 (39.5)
Married	697 (60.5)
Chronic condition:	
Absent	790 (68.6)
Present	362 (31.4)

classified according to their medians into high perception if more than it or low perception if less than it.

**Data management:** Analysis of data was done using Statistical Package for the Social Sciences (SPSS) version 19.0 using descriptive statistics including the mean, standard deviation, frequency, and percentage. Appropriate statistical tests including Student's t-test and Chi-square were performed. The level of statistical significance was set at 5% ( $p < 0.05$ ).

## RESULTS

Regarding participants' characteristics, Table 1 shows that the total number of participants who took part was 1152; more than half of them were female, aged more than 30 years, had high school or above, working, lived in low populated governorates, urban areas, married and free of chronic diseases. Regarding vaccine acceptance only 37.5% of our participants accept to get the COVID vaccine, through comparing the respondent's characteristics by their acceptance to get vaccinated against COVID-19; Regarding

participants' characteristics, Table 1 shows that the total number of participants who participated was 1152; more than half of them were female, aged more than 30 years, with a secondary education or above, working, live in Lower Egypt governorates, urban areas, married and free of chronic diseases. Regarding vaccine acceptance, only 37.5% of our participants accept to get the COVID vaccine, by comparing the respondent's characteristics with their acceptance to get vaccinated against COVID-19.

Table 2 demonstrates that subjects with secondary education or above, working, urban residents, suffering from chronic condition have significantly high vaccine acceptance. Age, gender, governorates of residence, marital status did not show significant association with vaccine acceptance. Regarding the relation between HBM variables and COVID-19 vaccine acceptance, Table 3 according to HBM demonstrates that a statistically significant difference was observed in all HBM domains between those who accept to get the vaccine and those who do not. This is because subjects who plan to get the vaccine perceive that they are more susceptible to disease, and they have a higher perception of infection severity, perceived more benefits from vaccination, greater levels of cues to action and self-efficacy and low perception of barriers concerning the vaccine. The best fitting logistic regression model for determining the independent factors affecting acceptability among the studied participants showed that High school or above, working, suffering from chronic illness, high perception of susceptibility, severity, barriers, self-efficacy and cues to action were highly statistically significant ( $P \leq 0.001^{**}$ ) and urban residence was statistically significant ( $P \leq 0.05^*$ ) independent predictors for vaccine acceptance.

## DISCUSSION

Vaccination has proven to be an effective strategy to minimize and eliminate COVID-19. The willingness of the population to be vaccinated is critical to success of the vaccination program. As a result, investigating the intents, motivators, and barriers that influence the general public's choice of vaccinate against COVID-19 is essential. This investigation may aid in the development of intervention plans with accessibility to the broader public, as well as target populations with a low vaccination tendency rate.

**Table 2: Respondent's characteristics by their acceptance to get vaccinated against COVID-19**

	Accept to get vaccine No=432		Not accept to get vaccine No=720		Chi square (P value)
	No	%	No	%	
<b>Age</b>					
≤ 30 years	146	38.4	234	61.6	0.2 (0.65)
> 30 years	28	37.1	486	62.9	
<b>Gender</b>					
Male	167	34.4	318	65.6	3.3 (0.06)
Female	265	39.7	402	60.3	
<b>Education</b>					
Secondary and below	72	19.6	296	80.4	74.2 (≤0.001)
High school or above	36	45.9	424	54.1	
<b>Working status</b>					
Not working	72	16.7	360	83.3	128.0 (≤0.001)
Working	36	50.0	360	50.0	
<b>Governorates of residence</b>					
Lower Egypt governorates	267	36.9	456	63.1	0.2 (0.6)
Upper Egypt governorates	165	38.4	264	61.6	
<b>Area of Residence</b>					
Rural	92	30.9	205	69.1	7.2 (0.007)
Urban	340	39.7	515	60.3	
<b>Marital Status</b>					
Unmarried	180	39.6	275	60.4	1.36 (0.24)
Married	252	36.2	445	63.8	
<b>Chronic condition:</b>					
No	196	24.8	594	75.2	172.7 (≤0.001)
Yes	23	65.2	126	34.8	
<b>Methods of data collection:</b>					
Face to face	133	34.6	251	65.4	2.0 (0.1)
Online	299	38.9	469	61.1	

**Table 3: Relation between HBM variables and COVID-19 vaccine acceptance**

	Accept to get vaccine Mean±SD	Don't accept to get vaccine Mean ± SD	Student t test (P value)
Perceived Susceptibility	15.9±2.6	11.5±2.4	28.8 (≤0.001)
Perceived Severity	13.9±2.3	9.9±1.9	30.7 (≤0.001)
Perceived Benefits	9.8±2.5	7.9±2.1	13.9 (≤0.001)
Perceived Barriers	17.4±4.1	26.1±4.2	34.2 (≤0.001)
Perceived Self efficacy	15.1±2.6	9.9±2.1	36.3 (≤0.001)
Perceived Cues to action	10.8±2.1	7.8±2.2	22.4 (≤0.001)

This study used an online and face to face questionnaire and collected responses across Egypt to evaluate the general public's acceptance of the COVID-19 vaccination, and to investigate numerous sociodemographic, health-related, and behavioral factors for these intents based on the HBM use.

Regarding the overall intention to receive the COVID-19 vaccine, it was low (37.5%); therefore, Egypt ranks among the countries with low rates. As in the entire Hong Kong population, the vaccine acceptance rate was 42.2%<sup>1</sup>, similarly, a higher level of acceptance (64.7%) was observed in Saudi Arabia.<sup>12</sup> In

**Table 4: Logistic regression analysis determining the independent factors affecting acceptability of COVID vaccine among the studied participants (n=1152).**

Independent factors	B coefficient	S.E.	P value	Exp(B)	95% C.I. for EXP(B)	
					Lower	Upper
High school or above working	-3.178	0.682	≤0.001**	0.042	0.011	0.159
Urban residence	-2.401	0.623	≤0.001**	0.091	0.027	0.307
chronic condition	-1.496	0.563	0.008*	0.224	0.074	0.675
High perception of Susceptibility	-1.846	0.444	≤0.001**	0.158	0.066	0.377
High perception of Severity	-6.165	0.798	≤0.001**	0.002	0.000	0.010
High perception of Barriers	-2.977	0.551	≤0.001**	0.051	0.017	0.150
High perception of Self-efficacy	-4.283	0.608	≤0.001**	0.014	0.004	0.045
High perception of Cues to action	-6.168	0.804	≤0.001**	0.002	0.000	0.010
Constant	-4.219	0.654	≤0.001**	0.015	0.004	0.053
	11.232	1.298	≤0.001**	75538.924	-	-

Chi-square test for model coefficient =494.3, P-value≤0.001\*\* SE: Standard Error, CI: Confidence Interval, \*≤0.05: Statistically significant, \*\*≤0.001: Highly statistically significant. Variable(s) entered on equation: education, working, residence, chronic condition, perception of susceptibility, severity, benefits, barriers, self-efficacy and cues to action.

addition, according to a study based on a sample of 13,426 people from 19 nations, there is a substantial difference in responses among countries as the global COVID-19 vaccines acceptance ranging from 54.8 percent in Russia to 88.6 percent in China. Moreover, vaccine decisions are multifactorial and subject to change over time.<sup>13</sup>

The poor acceptance rate can be attributed to the fact that a substantial number of respondents have doubts regarding vaccines, as vaccines production based on small-scale clinical trials. Furthermore, the differences in vaccine coverage between nations could potentially postpone the worldwide control of the pandemic and the accompanying societal and economic recovery until factors related to this extensive diversity of COVID-19 vaccine preparedness are properly investigated and addressed.

Also, the lack of information and the simultaneous announcement of too many producers at once, potential vaccination recipients are more inclined to mistrust the validity of less well-known manufacturers, thus reducing vaccine uptake. To overcome this barrier, the government should proactively share information about chosen vaccine manufacturers.

Participants aged 30 and over reported higher rates of immunization intention (66.2%), and similarly 78%

and 91.3% respectively among the adult population in the United States and China accepting the vaccine.<sup>1,14</sup> It is plausible to find increased vaccination intention among individuals in this age range since they are in the high-risk category for COVID. Besides, they are at a higher risk of developing more serious diseases and die as a result of COVID-19. Moreover, their perception of severity and benefits in the current study was higher among the older group with statistical differences.

There are various indicators that can determine COVID-19 vaccine reception intention. In terms of sociodemographic and health-related factors, the current study discovered that subjects with chronic diseases were statistically more likely to show vaccine acceptance and to have a greater perception of all HBM constructs. This finding supports the current strategy to consider these people as a high priority group for COVID-19 vaccination.<sup>1</sup>

Egyptian females were also more likely to receive the COVID-19 vaccine; however, which is consistent with other studies elsewhere.<sup>11,12</sup> on the contrary, there are conflicting reports in the literature about the impact of gender, with some males inclined to accept the vaccine.<sup>14</sup>

The intent to vaccinate was indicated by a significantly larger number of married individuals than it was by

single participants, which can be attributed to the reason that some participants have families and social responsibilities, and this reflects their responsible manner to protect their families. Similarly, in research conducted in China and Saudi Arabia, marital status was found to have a substantial impact on vaccination uptake.<sup>12,15</sup>

In addition, significant difference was observed in COVID-19 vaccination acceptance by location, whereby participants from the urban region reported a higher proportion. Similarly in Indonesia, 66.5% of urban residents accept the vaccine<sup>16</sup>, also among Malaysian the current residence significantly influenced vaccine acceptance<sup>17</sup>. This observation can be traced back to the different customs and traditions in both communities and urban areas that are densely populated and depend on the overcrowded public transportations. Consequently, individuals accept vaccination to protect themselves and their families. It was also observed that workers accept vaccination more than non-workers with a statistically significant difference in all domains of HBM as they spend long time in crowded setting and participating in activities with close contact with others. Also, people's level of education contribute to the acceptance of the vaccine as subjects with higher education have a high perception of severity, susceptibility, benefits and other domains of HBM compares to the less educated. Although the researcher use two different methods of data collection: face to face and online to reach different sectors of the population, no statistically significant difference was observed between the two groups which can be explained by the low acceptance rate of the COVID vaccine among all Egyptians irrespective of their characteristics, as those who don't use the social networks think the COVID is a delusion and they won't suffer from any disease so, the vaccine is useless and the other group who use the social networking sites have doubts regarding vaccines, as vaccines production based on small-scale clinical trials and their effect is controversial and it may have many side effects.

Perceived susceptibility, severity, benefits, and cues to action were the most significant predictors of the desire to get COVID-19 vaccination when using the health belief model.

In comparison to those who do not intend to get vaccinated, data on disease severity indicate that

individuals who intend to get vaccinated believe they are at a high risk of suffering or significant problems if infected with COVID-19. This highlights the need to change public perceptions of risk and severity, particularly among those who perceive the disease as being non-serious. In terms of cues to action, physician recommendations, relatives, and friends were important predictors that enhanced the intention to get the COVID-19 vaccine. Concerning the benefits, those plans to get the vaccine view a lot of benefits in getting the vaccine to protect them against COVID. Those who intend to receive the vaccination see a number of advantages in receiving the COVID-19 vaccine to protect themselves and others. Consequently, compliance with vaccination is based on an individual's risk-benefit assessment.<sup>18</sup>

Finally, self-efficacy was proven to be a significant predictor of COVID-19 vaccination intention, similar to what was reported by Dror et al.<sup>18</sup> as the perceived self-efficacy relates to a sense of control over unfamiliar situation or challenging events and tasks as a result of good conduct. Self-efficacy is a factor of intention and conduct in practices such as immunization that do not need long-term treatment adherence.<sup>19</sup> Regarding perception of barriers, acceptance of the vaccine was adversely associated with perceptions of barriers and potential harm caused by the vaccine as well as identifying the causes of vaccine rejection or reluctance may help to increase vaccination intentions in the general population.

All previous findings showed that the HBM constructions can be utilized to explain vaccination uptake, similar to prior research to predict COVID vaccination behavior in Hong Kong.<sup>1</sup> As a result, public health intervention initiatives that aim to improve people's perceptions of the advantages of vaccination, the severity of the disease, and their vulnerability to infection are necessary. Several calls to action should also be explored, such as allocating greater money to the Ministry of Health's awareness campaigns and making immunization available at work while removing the identified impediments.<sup>20</sup> More research are needed to determine the public acceptability of the COVID vaccination. To avoid a substantial increase in the number of cases, enormous health education campaigns are designed to target rural areas, men, young people, and unemployed Egyptians through community leaders and social

media to promote public awareness about the importance of the COVID vaccine. More attention should also be dedicated to elevating the perception of vaccination's benefits and the perceived severity of the disease. Finally, the Ministry of Health should dedicate more resources to public awareness campaigns, vaccination in workplaces, and encouraging others to express their positive thoughts. The findings of the current study conclude that Egypt has one of the lowest rates of COVID-19 vaccination acceptance, with only 37.5 percent of individuals agreeing to take the vaccine. Moreover, females over the age of 30 had a greater level of education, working, and living in urban areas with higher perceived benefits, severity, cues to action, and self-efficacy, had a higher level of acceptability for the COVID vaccination.

### **Ethical considerations**

The participation was completely voluntary, and the participants' identities were kept anonymous. Also, the purpose of the research was specified on questionnaire cover page. The research protocol was approved by Zagazig University institutional review board, Egypt (IRB 6974).

**Study limitation:** One limitation of the present study is the utilization of a convenient sample, which limits the likelihood of generalization of the results. Furthermore, the intention to get a vaccine does not always indicate real-vaccine uptake, particularly when there is a significant time gap between the assessment of intention and the observation of health-promoting behavior. self-reporting of actual behavior may be biased. Another limitation of our study is that not all sectors of community use social networking sites as it need access to a smartphone, tablet, or computer so the research try to overcome this problem by using face to face method in addition to online method, Finally, the study utilized a cross-sectional design that does not drive any causal conclusion.

### **Data Availability Statement**

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

### **Supplementary material**

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### **Conflict of interest:**

The researchers announced no conflict of interest.

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