

## Original Article

# Predictors of COVID-19 Vaccines Acceptability among Egyptian Population: An On-line Cross-Sectional Study

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## Abstract

**Background:** since COVID-19 emergence in December 2019, health systems in collaboration with scientists all over the world struggled to face this pandemic. Population acceptance of vaccination is a very important factor necessary to achieve herd immunity. This study aimed to assess the prevalence of vaccine acceptance and its predictors among the Egyptian population.

**Methods:** An online cross-sectional study was conducted on a total sample of 846 individuals selected by using the non-probability snowball sampling technique during August and September 2021. Data was collected by An Arabic questionnaire which included data on the socio-economic characters of the participants, health-related variables, and the outcome variable (participants' vaccine acceptance). The odds ratio and 95% confidence interval were used to identify the association between vaccine acceptance and socio-demographic and health-related variables.

**Results:** Of 846 participants, 467 accept vaccination representing 55.2% of the total sample. Vaccine acceptance was associated with a higher age group (>50 years), male gender, urban residents, educated, married, high-income individuals, and healthcare workers. Also, vaccine acceptance was associated with a history of chronic disease, fair/poor self-rated health status, negative history of COVID-19 infection, and a high perception of the infection risk. About 83.4% of vaccine refusals believed that the vaccine is not safe, while 50.7% believed it is ineffective.

**Conclusion:** Socio-demographic and some health-related characters are significant predictors of vaccine acceptance among the population. These variables must be taken into consideration in interventions aimed to increase the population vaccination rate.

**Keywords:** acceptability, COVID-19 vaccines, Egyptian population, on-line cross-sectional study, predictors

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## INTRODUCTION

The acute respiratory syndrome caused by Corona virus firstly appeared in China on December 2019 and referred to it as COVID-19 disease leading to considerable morbidity and mortality all over the world with approximately 249 Millions confirmed cases and 5 Million deaths reported to World Health Organization till 5 November, 2021.<sup>(1)</sup>

The aim of the health systems is to achieve herd immunity sufficient for interruption of virus spread in the community and consequently, limiting COVID-19 disease incidence and its adverse health effects.<sup>(2)</sup>

Vaccination of 82% of the population is necessary to achieve a level of herd immunity necessary to control viral transmission in the community and pandemic stoppage.<sup>(3)</sup>

To put an end for COVID-19 pandemic, great

efforts from scientists all over the world have been made to produce effective vaccines against COVID-19 disease.<sup>(4)</sup>

Identification of the predictors of COVID-19 vaccination acceptance and hesitancy is necessary for proper design and application of control strategies and increasing public awareness.<sup>(5)</sup>

Knowledge, attitude and intention of the people towards COVID-19 is a major concern for the healthcare managers and policy-makers as vaccination is considered the most effective tool for controlling the pandemic. Also, there is great importance for rapid vaccination of vulnerable population groups.<sup>(6)</sup>

Several researches were conducted to identify the predictors of acceptance newly applied vaccines. The most important factors responsible for vaccine hesitancy were vaccine safety and effectiveness, unknown long-term adverse health effects, misinformation and misconception about vaccines and

vaccine preventable diseases, and loss of trust in healthcare system.<sup>(7-11)</sup>

Limited confidence in COVID-19 vaccines among population and dominance of rumors and conspiracy theories are the most important obstacle facing public health workers and managers all over the world.<sup>(12)</sup>

A systematic review study pointed out that, vaccine acceptance is significantly affected by number of reported cases and case fatality ratio. So, reporting the number of COVID-19 morbidity and mortality is essential as it is associated with the level of vaccine acceptance.<sup>(13)</sup>

In order to reach the required level of herd immunity, there is an urgent need for proper identification of vaccine acceptance level and its predictors among population. This study respond to this issue by measuring the prevalence of vaccine acceptance and its associated factors which will be helpful for policy-makers to identify the prevalence and causes of vaccine acceptance and refusal and consequently proper designing of health messages that targets the population needs and worries with the end result of achieving the required level of herd immunity and pandemic ending.

## METHODS

This an online population-based cross-sectional study was conducted during August and September 2021 through an electronic, validated, self-administered questionnaire constructed using Google forms with link sharing to participants on social media applications such as Facebook, WhatsApp, and Telegram.

### Target population

All adult population aged 18 year or more, having internet access and living in Egypt at the time study fulfillment were eligible to be included in the study.

### Sample size and sampling technique

The sample size required to perform the study was calculated using Epi Info version 7. Based on the assumptions of vaccine acceptance rate 50%, confidence level 95%, marginal error 4%, the required sample size to perform the study was 601. Also, 10% of the calculated sample size was added to for non-response. So, the minimum required sample size was 661. However, to make our sample more representative, all submitted questionnaires during the data collection period were included in the study (846 questionnaires).

Non-probability snowball sampling technique was used in the study. Initially, the questionnaire link was shared to author contacts on social media applications (Facebook, WhatsApp, and Telegram) and those, in

turn, were asked to share the link to their contacts and so on.

### Study tools

An electronic, Arabic, self-administered questionnaire was used in the study which was designed after reviewing studies with similar objectives.<sup>(14-20)</sup> The questionnaire included simple explanation of study objectives and procedures. Also, the participants were not be able to respond to the entire study questionnaire before they approved a formal consent to participate in the study. Also, they approved their age is 18 year or more and they were in Egypt at the time of study conduction. The questionnaire included the following data (i) socio-demographic data; age, sex, residence, marital status, education, occupation, and income (ii) health-related data; history of chronic disease, self-rated health status, previous COVID-19 infection, family/friends infection, perceived risk of infection with COVID-19 and perceived COVID-19 as a dangerous disease (iii) outcome variable of the study (acceptance of COVID-19 vaccination); it was assessed by using two questions with response options as "Yes" or "No". The first question is: Are you received the COVID-19 vaccine? If he responded with "No", then he asked the second question: have you intending to receive the COVID-19 vaccine in the future? Those who received the COVID-19 vaccine or intend to receive it in the future were categorized as "vaccine acceptant" while those who were not receiving the vaccine and not intending to receive it were categorized as "vaccine refusing". In addition to that, the population sources of information about COVID-19 vaccine and the causes of vaccine refusals (vaccination barriers) among those who were not intending to receive vaccines and were investigated

The questionnaire was reviewed by two staff members of the public health department, Al-Azhar Faculty of Medicine, where some modifications were performed. Also, a pilot study was conducted on 30 subjects to assess the validity of the questionnaire and its applicability. The results of pilot study were not included in the final data analysis.

### Statistical analysis

Data were analyzed using SPSS version 20. Descriptive statistics in the form of frequencies and percent were calculated for all study variables. The association between the independent and dependent variables was assessed by calculating Odds ratios at 95% confidence interval using the two tailed Fishers exact test. P value < 0.05 was considered a level of significance.

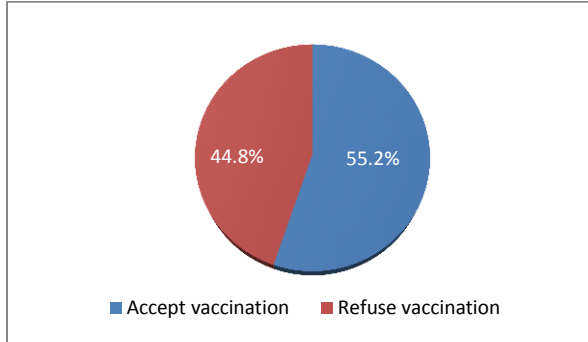
### Ethical considerations

This study was conducted in accordance with the

international guidelines of research ethics. Approval of the ethical committee at Al-Azhar Faculty of Medicine was obtained with reference number R-1205. At the beginning of the questionnaire, there was a written informed consent that must be approved by the participants to be able to complete the questionnaire. Confidentiality of the collected data was strictly maintained.

## RESULTS

From the 846 studied individuals, 467 individuals (55.2%) accepted vaccination while 379 individuals (44.8%) refused vaccination.



**Figure 1. COVID-19 vaccine acceptance among studied Egyptian population**

The likelihood of vaccine acceptance was significantly higher (OR >1) among older age group (> 50 years), university or higher educated, governmental and non-governmental workers, high family income/month (> 5000 L.E and > 10000 L.E), and health workers. On the other side, the likelihood of vaccine acceptance was significantly lower (with OR <1) among female gender, rural residents, unmarried individuals, and individuals living outside greater Cairo governorates (Table 1).

The likelihood of vaccine acceptance was significantly higher (OR >1) among individuals with history of chronic disease, fair/poor self-rated health status, negative history of COVID-19 infection, and a high perception of the infection risk. On the other side, the likelihood of vaccine acceptance was significantly lower (OR <1) among those who consider COVID-19 not a dangerous disease (Table 2).

There were 83.4% of participants who refused vaccination believed that the vaccine is not safe, 59.9 % refused vaccination due to fear of vaccine side effects while 50.7% believed that it is not effective. Also, 44.6% considered COVID-19 not a dangerous disease, 36.4% believed that their health is strong and there is no need for a vaccine, whereas 21.9% refused vaccination due to lack of information (Table3).

**Table 1. Socio-demographic factors associated with vaccine acceptance**

	Total (N= 846) No. (%)	Accept vaccination (N= 467) No. (%)	Refuse vaccination (N=379) No. (%)	OR (95% CI)	P value
<b>Age</b>					
- 18-30	439 (51.9)	236 (50.5)	203 (53.6)	1	
- 31-50	292 (34.5)	146 (31.3)	146 (38.5)	0.86 (0.64- 1.16)	0.3
- > 50	115 (13.6)	85 (18.2)	30 (7.9)	2.44 (1.54- 3.85)	<0.001*
<b>Gender</b>					
- Male	497 (58.9)	318 (68.1)	179 (47.2)	1	
- Female	349 (41.1)	149 (31.9)	200 (52.8)	0.42 (0.32- 0.56)	<0.0001*
<b>Governorate</b>					
- Great Cairo	419 (49.5)	262 (56.1)	157 (41.4)	1	
- Sharkia	282 (33.3)	146 (31.3)	136 (35.9)	0.64 (0.47- 0.87)	0.005*
- Ismailia	83 (9.8)	33 (7.1)	50 (13.2)	0.40 (0.24- 0.64)	<0.001*
- Dakahlia	28 (3.3)	12 (2.5)	16 (4.2)	0.45 (0.21- 0.97)	0.04*
- Others	34 (4.1)	14 (3.0)	20 (5.3)	0.42 (0.21- 0.85)	0.014*
<b>Residence</b>					
- Urban	527 (62.3)	321 (68.7)	206 (54.4)	1	
- Rural	319 (37.7)	146 (31.3)	173 (45.6)	0.54 (0.41- 0.72)	<0.0001*
<b>Marital status</b>					
- Married	337 (39.8)	241(51.6)	96 (25.3)	1	
- Unmarried (Single/ Divorced/widow)	509 (60.2)	226 (48.4)	283 (74.7)	0.32 (0.24- 0.43)	<0.001*
<b>Education</b>					
- Non-educated	84 (9.9)	26 (5.6)	58 (15.3)	1	
- Primary/Secondary	319 (37.7)	160 (34.3)	159 (42.0)	1.24 (1.34- 3.75)	0.002*
- University or higher	443 (52.4)	281(60.1)	162 (42.7)	3.87 (2.34- 6.39)	<0.001*
<b>Occupation</b>					
- Not working (Housewife/ Students/ Retired)	309 (36.5)	139 (29.8)	170 (44.9)	1	
- Governmental workers					
- Nongovernmental workers (Private /Free worker)	370 (43.7)	234 (50.1)	136 (35.9)	2.10 (1.54- 2.86)	<0.001*
	167 (19.8)	94 (20.1)	73 (19.2)	1.57 (1.08- 2.30)	0.02*
<b>Family Income/month</b>					
- <2000	186 (22.0)	84 (18.0)	102 (26.9)	1	
- 2000- 5000	399 (47.2)	212 (45.4)	187 (49.3)	1.38 (0.97- 1.95)	0.07
- > 5000- 10000	187 (22.1)	120 (25.7)	67 (17.7)	2.17 (1.43- 3.30)	<0.001*
- > 10000	74 (8.7)	51 (10.9)	23 (6.1)	2.69 (1.52- 4.76)	<0.001*
<b>Health workers</b>					
- No	663 (78.4)	314 (67.2)	349 (92.1)	1	
- Yes	183 (21.6)	153 (32.8)	30 (7.9)	5.67 (3.72- 8.63)	<0.001*

\* Significant

**Table 2. Health-related factors associated with vaccine acceptance**

	Total (N= 846) No. (%)	Accept vaccination (N= 467) No. (%)	Refuse vaccination (N=379) No. (%)	OR (95% CI)	P value
<b>History of chronic disease</b>					
- No	697 (82.4)	369 (79.0)	328 (86.5)	1	
- Yes	149 (17.6)	98 (21.0)	51 (13.5)	1.71 (1.18- 2.47)	0.004*
<b>Self-rated overall health status</b>					
- Excellent/ good	584 (69.0)	279 (59.7)	305 (80.5)	1	
- Fair/Poor	262 (31.0)	188 (40.3)	74 (19.5)	2.8 (2.03- 3.80)	<0.0001*
<b>Previous COVID-19 infection</b>					
- Yes	176 (20.8)	85 (18.2)	91(24.0)	1	
- No	541(64.0)	327 (70.0)	214 (56.5)	1.64 (1.16-2.30)	0.005*
- Not sure	129 (15.2)	55 (11.8)	74 (19.5)	0.80 (0.50- 1.26)	0.353
<b>Family/friends infection</b>					
- Yes	531 (62.8)	299 (64.0)	232 (61.2)	1	
- No	315 (37.2)	168 (36.0)	147 (38.8)	0.89 (0.67- 1.17)	0.43
<b>Perceived risk of infection with COVID-19</b>					
- Low	182 (21.5)	87 (18.6)	95 (25.1)	1	
- Moderate	421 (49.8)	224 (48.0)	197 (52.0)	1.24 (0.87- 1.76)	0.249
- High	243 (28.7)	156 (33.4)	87 (22.9)	1.96 (1.32- 2.90)	< 0.001*
<b>Perceived COVID-19 as a dangerous disease</b>					
- Yes	214 (25.3)	130 (27.8)	84 (22.2)	1	
- No	481(56.9)	244 (52.2)	237 (62.5)	0.67 (0.48- 0.92)	0.014*
- Not sure	151(17.8)	93 (20.0)	58 (15.3)	1.04 (0.68- 1.59)	0.913

\* Significant

**Table 3. Causes of vaccine refusal (vaccination barriers)**

Variable	No. <sup>±</sup>	%
- Not safe	316	83.4
- Fear of side effects	227	59.9
- Not effective	192	50.7
- COVID-19 is not dangerous disease	169	44.6
- My health is strong and there is no need for vaccine	138	36.4
- Lack of information	83	21.9
- Already immune through COVID-19 infection	73	19.3
- Against vaccines in general	23	6.1

\* More than one answer was allowed.

There were 87.7% of participants get their information about COVID-19& COVID-19 vaccines from internet and social media, 66.7% from mass media, 38.9% from family and friends while only 19.3% get their information from healthcare providers (Table 4).

**Table 4. Source of information about COVID-19 & COVID-19 vaccines**

	No. <sup>±</sup>	%
- Internet& Social media	742	87.7
- Mass media	564	66.7
- Family& Friends	329	38.9
- Healthcare providers	163	19.3

\* More than one answer was allowed.

## DISCUSSION

This study was conducted to assess the level of COVID-19 vaccine acceptance among Egyptian population and its predictors. There were 467 individuals had received or intend to receive COVID-19 vaccine whenever available. This represented acceptance rate 55.2%. Similar an online study was conducted in Egypt between January and March 2021 by Omar and Hany who were assessed population intention and attitude toward COVID-19 vaccine. They found a lower acceptance rate, where 25% of

population accept vaccination, 54% explored vaccine hesitancy while 21% refuse vaccination.<sup>(14)</sup> Categorization of the outcome variable is obvious to be having a role in this difference. In addition to that, the time of study conduction may have an additional role, where people concerns and worries about vaccine had minimized due to intensive health education campaign. Also, with the progression of vaccination process, individuals' observations revealed that there is no occurrence of serious side effects among vaccinated individuals. This increases the rate of vaccine acceptance and encourages more people to be vaccinated. On the other side, another Egyptian study conducted in March 2020 revealed that 73% of studied population was intending to take the vaccine whenever available.<sup>(21)</sup> This high percent could be explained by the fact that the study was conducted short period after disease emergence with wide spread of panic state and disease phobia all over the world including Egypt. However, as the time passed, the storm subsided and people concern becomes directed toward vaccine safety and efficacy. In addition to that, differences in the socio-economic standard of studied population, questionnaire design and statement, categorization of the outcome variable and different localities may have a role in these variable findings.

These variable findings were also observed in two Saudi studies targeting general population with vaccine acceptance rates were 44.7% and 64.7%.<sup>(15, 16)</sup> Also, variable findings were reported in studies conducted in other Arab countries with vaccine acceptance rate 37.4% in Jordan<sup>(18)</sup>, 53.1% in Kuwait<sup>(19)</sup>, 51.9% in Lebanon<sup>(22)</sup>, 57% in Oman<sup>(23)</sup>, and 79.6% in Libya (for vaccine with an efficacy 90% or more)<sup>(24)</sup>. The same thing was observed in international studies conducted in Ethiopia<sup>(17)</sup>, Uganda<sup>(20)</sup>, Mozambique<sup>(25)</sup>, Malaysia<sup>(26)</sup>, Pakistan<sup>(27)</sup>, Russia<sup>(28)</sup> with acceptance rate range from 41.7% in Russia to 83.3% in Malaysia.

There is a very important finding in the current study which is high vaccination acceptance among health workers (from 183 health workers participated in the study, 153 accepted COVID-19 vaccination representing acceptance rate 83.6%). This finding disagrees with findings of three Egyptian studies conducted during December 2020 and January 2021 targeting healthcare workers with lower acceptance rate<sup>(29, 30, 31)</sup>. This high difference may be attributed to high mortality reported among the Egyptian healthcare workers since disease emergence and the proven efficacy and safety of the vaccine which convinced the health workers to the importance of vaccination. Also, health workers were 6.67 times more likely to accept vaccination in comparison with other population. High rate of vaccine acceptance among health workers was reported by Fu et al, in China<sup>(32)</sup> and Duala et al, in Mozambique<sup>(25)</sup> with

acceptance rate 76.4% and 86.6% respectively. High rate of vaccination acceptance among health workers reflects their trust in the health system, vaccine efficacy and safety.

Vaccine acceptability was significantly associated with the socio-demographic factors as age, gender, residence, marital status, education, occupation, and income. Higher age group (> 50 year) was more likely to accept vaccination (OR=2.44) in comparison with younger age groups. This finding agrees with the finding of Nikolovsk et al, in U.S. where 93.1% of individuals aged 65 or higher accept vaccination.<sup>(33)</sup> They attributed their findings to disease risk perception (higher in older individual) and previous experience with disease prevention and control via routine and mass immunization campaigns. Another study conducted in Ethiopia by Abebe et al, revealed similar finding.<sup>(17)</sup> They explained their finding by the reported high rate of COVID-19 morbidity and mortality among this age group. The current study supported these assumptions where significant positive association was observed between risk perception and vaccine acceptance (OR= 1.96). Also, Al-Mohaithef and Padhi study in Saudi Arabia and Alhaffar et al, study in Lebanon revealed similar findings.<sup>(16, 22)</sup> Al-Mohaithef and Padhi study found significant association between perceived risk of infection and vaccine acceptance (OR=2.13).<sup>(16)</sup> This comes in line with the significant association observed in this study between vaccine acceptance and history of chronic disease and fair/bad self-rated health status.

Also, significant association was observed between gender and vaccine acceptance. Female was less likely to accept vaccination (OR=0.54). This agreed with the findings of similar studies conducted in Saudi Arabia<sup>(15)</sup>, Jordan<sup>(18)</sup>, and Kuwait<sup>(19)</sup>. Female have more concerns about the unknown long-term side effects of COVID-19 vaccine especially its effect on pregnancy, lactation, and future generations and consequently they are more hesitant toward COVID-19 vaccination.<sup>(14)</sup> Furthermore, female are more likely to believe in the conspiracy theory than men. Consequently, they are more resistant to accept vaccination.<sup>(15)</sup> The same findings was observed by systematic review meta-analysis study where older age groups and male gender were more likely to accept vaccination.<sup>(13)</sup>

Residence is another significant predictor of vaccine acceptance. Rural residents were less likely to accept vaccination (OR=0.54). Rural residents are of lower socioeconomic standards with poor education and little income in comparison with urban residents. Poor educated individuals are less accessible to information about COVID-19 vaccine and consequently, more hesitant towards it.<sup>(14)</sup> On the other side, individuals with good knowledge about COVID-19 vaccine will be able to identify the importance of

vaccine.<sup>(17)</sup> This comes consistent with the current study findings where more educated individuals and those with good or high family income were more likely to accept vaccination.

### Study limitations

This study encounters many limitations; being a cross-sectional design, so, it explored the population intention at one point of time. Further studies are needed to identify the changes in population intentions towards COVID-19 vaccines. Selection bias is another limitation of study due to several reasons; being utilized an online self-administered questionnaire, it targeted only individuals who have internet access. Also, self-administered questionnaire led to exclusion of those who can't read and write. Furthermore, the non-probability snow-ball sampling design led to an unequal selection probability of studied participants from the target populations. However, the online method was the most suitable for study conduction during COVID-19 pandemic.

### CONCLUSION AND RECOMMENDATIONS

The current study revealed moderate level of vaccine acceptance among Egyptian population. Socio-economic and health-related (except family/friend infection) variables were significantly associated with vaccine acceptance. The most common vaccination barriers among vaccine refusing participants were vaccine safety and effectiveness. Internet and social media and mass media were the commonest sources of information about COVID-19 and its vaccine. So, they are the most suitable tools to be used in the health education campaigns and information dissemination about COVID-19.

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### COMPETING INTEREST

Author declares that he has no competing interests.

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