

Coronavirus Pandemic

Acceptance rate of COVID-19 vaccination and its predictors in Egypt: An online survey

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Abstract

Introduction: Public acceptance, understanding, and trust are some significant challenges facing COVID-19 vaccine coverage. Our study objective was to assess the acceptance rate of COVID-19 vaccination and its predictors among the Egyptian adult population.

Methods: An online survey was conducted on 1,053 participants from six randomly selected governorates in Egypt between March and April 2021 using an Arabic self-administrated questionnaire, developed using the Google Form App.

Results: Out of the 1,053 participants surveyed, 321 (31.5%) reported that they would accept taking the vaccine when it is available. The main reasons for refusing COVID-19 vaccination were doubt in vaccine effectiveness (80%), lack of trust due to rapid vaccine production (70%), deficiency of information about the vaccine (66%), and fear of vaccine side effects (55%). Regression analysis concluded that previous history of influenza vaccination ($p = 0.01$), perceived vaccine effectiveness (0.00), vaccine price ($p = 0.02$), and doctors' recommendation to take the vaccine ($p = 0.03$) were the only significant predictors of COVID-19 vaccine acceptance.

Conclusions: Low level of COVID-19 vaccination acceptance has been shown among the Egyptian population. To expand vaccination acceptance and coverage, the government should promote vaccine confidence by increasing the availability of clear, precise, and up-to-date information addressing public concerns. It should also provide free vaccinations and should reach out to doctors for promoting the vaccine.

Key words: COVID-19; vaccine; acceptance; predictors; Egyptian.

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Introduction

The coronavirus disease 2019 (COVID-19) pandemic presents a major threat to the global health system with worldwide devastating economic impacts [1]. Until now, this pandemic does not show any signs of decline and no specific antiviral therapies for COVID-19 are available [2]. The whole world works to minimize the severity of the COVID-19 pandemic and to decrease its health and socio-economic effects by focusing on preventive measures [3]. Vaccination is the most cost-effective method in the prevention of infectious diseases so the presence of an effective vaccine against COVID-19 is important [4]. Thus, researchers, the pharmaceutical sector, and governments have collaborated to develop effective and safe vaccines for COVID-19 at an unprecedented rate [5].

Despite these tremendous efforts, vaccine hesitancy can be a major obstacle to the future COVID-19 vaccination [6]. In 2015 the World Health Organization (WHO) defined vaccination hesitancy as a delay in approving or denying vaccination despite the availability of the vaccine [7]. Vaccine acceptance

represents the overall understanding within the general population of disease risk and the importance of vaccination, which is vital to the immunization programs in achieving high coverage rates, particularly during pandemics [8].

As pandemic vaccine acceptance varies across time, place, and persons. Several studies have been conducted to detect factors that can predict vaccine acceptance during pandemics. The reported factors include perceived risk, concerns about vaccine safety and effectiveness, misinformation about the need for vaccination, lack of faith in the health system, overall vaccination attitude, past vaccination history, doctors' recommendations, price, vaccination accessibility, and socio-demographic features [9-11]. A systematic review conducted before November 2020, found that the hesitancy of COVID-19 vaccination is rising globally, the purpose to obtain COVID-19 vaccine differs significantly across nations and most individuals who do not intend to get vaccinated are worried about the efficacy of new COVID-19 vaccines [10]. Public acceptance, understanding, and trust are major challenges facing COVID-19 vaccine coverage. A low

level of acceptance remains an important barrier to full population inoculation against this new terrific pandemic [12]. A high acceptance rate of the COVID-19 vaccine is crucial because the herd immunity threshold for SARS-CoV-2 is estimated to be between 55% and 82% [13].

This study aimed to assess the acceptance rate of COVID-19 vaccination and its predictors among the Egyptian adult population. This data is crucial for policymakers to plan well for future vaccination strategies against COVID-19.

Subjects and methods

Study design and setting

A cross-sectional study was conducted in Egypt between March and April 2021 through an online survey.

Sample size and sampling method

The sample size was calculated by using the OpenEpi program depending on the following data: the total population in Egypt is 102,334,404, the acceptance rate for COVID-19 vaccination was (64.7%) as documented in a prior study [11], confidence limit of 5%, design effect 3 (to remove heterogeneity), 95% confidence level. The sample size thus calculated was 1,053.

The sample selection was done as follows: Egypt is divided into upper Egypt and lower Egypt. As the population density in lower Egypt is twice that of upper Egypt, four governorates were selected randomly to represent lower Egypt while two governorates were selected randomly to represent upper Egypt. The selected governorates of lower Egypt included; Elsharkia, Elbehera, Elmonofia, and Kafr-el sheikh while the selected governorates of upper Egypt included; Aswan and Elmenia. Initially, the researchers shared the survey link via social media (Facebook, Twitter, WhatsApp, and Telegram) and through emails to their primary contacts. The primary participants were requested to roll out the survey further. On receiving and clicking the link, participants were auto-directed to the informed consent page, followed by the survey questionnaire. The responses of participants from the randomly selected governorates only were considered. Proportional allocation was also considered in the distribution of sample size across the selected governorates. A total of 351 participants were included from upper Egypt while the responses of 702 participants from lower Egypt were considered. Once the sample size was achieved no further responses were collected.

Inclusion criteria

The study included Egyptian individuals above 18 years who were able to understand the questionnaire, lived in the randomly selected governorates and accepted to share in the study.

Tools of data collection

An Arabic self-administrated questionnaire, developed by the researchers using Google Form adapted from previous research that measured acceptance of COVID-19 vaccination during the pandemic [14,15].

The questionnaire consisted of four parts:

Part I: The informed consent page contains a brief introduction on the research objectives, voluntary nature of the contribution, declarations of confidentiality, and inclusion criteria.

Part II: Sociodemographic characteristics such as gender, age, residence, education, occupation, and income.

Part III: Acceptance for future COVID-19 vaccination and reasons for non-acceptance. The acceptance for future COVID-19 vaccination was assessed on a four-point scale: absolutely not, probably not, probably yes, and absolutely yes. The answers were recoded into accepting vaccination (absolutely yes) and refusing vaccination (absolutely not, probably not, probably yes). The question of the reasons for non-acceptance was a multiple-choice question with the ability of the participants to choose more than one answer. The choices included: doubt in the ability of the vaccine to prevent infection, fear of its side effect, lack of enough information about it, lack of trust in it due to rapid production, and the choice “other” was added to allow the participants to express their reasons of nonacceptance if they liked.

Part IV: The main factors that affect the participants' decision to take the vaccine included: the effect of the COVID-19 pandemic on the participants' work/study, income, and daily life; the presence of confirmed or suspected cases in the region where participant lived in; self-perception of the COVID-19 risk; past history of influenza vaccination; vaccine-related knowledge of safety and effectiveness; vaccine accessibility (vaccination method, frequency, distance to vaccination site; doctors' recommendations to take the vaccine, and vaccine price. All questions in this part were closed-ended and answered on a dichotomous Yes/No basis except questions about the impact of the COVID-19 pandemic on participants were answered on a five-point Likert scale.

Table 1. Comparison between participants that accepted COVID-19 vaccination and those who refused vaccination.

Items	Accepted COVID-19 vaccination; N = 332(%)	Refused COVID-19 vaccination; N = 721(%)	p value*
Age			
< 36 years	111 (33.4)	221 (30.7)	0.8 (0.3)
> 36 years	221 (66.6)	500 (69.3)	
Gender			
Male	176 (53.0)	371 (51.5)	0.2 (0.6)
Female	156 (47.0)	350 (48.5)	
Education			
High	70 (21.1)	157 (21.7)	0.1 (0.9)
Middle	150 (45.2)	317 (44.0)	
Low	112 (33.7)	247 (34.3)	
Residence			
Upper Egypt	130 (39.2)	221 (30.7)	7.3 (0.01)*
Lower Egypt	202 (60.8)	500 (69.3)	
Income			
Enough and more	50 (15.1)	200 (27.7)	23.4 (0.0)*
Enough	230 (69.2)	397 (55.1)	
Not enough	52 (15.7)	124 (17.2)	
Working			
Yes	232 (69.9)	462 (64.0)	3.4 (0.06)
No	100 (30.1)	259 (36.0)	
Pandemic effect on daily life			
Much or very much	214 (64.4)	429 (59.5)	2.5 (0.2)
Fair	100 (30.1)	253 (35.1)	
Little or very little	18 (5.5)	39 (5.4)	
Pandemic effect on work			
Much or very much	210 (63.2)	425 (58.9)	2.02 (0.3)
Fair	104 (31.3)	258 (35.7)	
Little or very little	18 (5.5)	38 (5.4)	
Pandemic effect on income			
Much or very much	100 (64.7)	225 (24.3)	32.2 (0.0)*
Fair	178 (23.5)	290 (54.1)	
Little or very little	54 (11.8)	206 (21.6)	
Presence of cases where you live			
No	42 (12.7)	136 (18.9)	6.2 (0.01)*
Yes	290 (87.3)	585 (81.1)	
Perceived risk of infection			
No	58 (17.6)	156 (21.6)	2.3 (0.1)
Yes	273 (82.4)	565 (78.4)	
Past influenza vaccination			
No	273 (82.4)	437 (39.6)	49.4 (0.0)*
Yes	59 (17.6)	284 (60.4)	
Hearing about COVID- 19 vaccine			
No	178 (53.6)	417 (57.8)	1.5 (0.2)
Yes	154 (46.4)	304 (42.2)	
Knowing side effects of COVID-19 vaccine			
No	254 (76.5)	506 (70.1)	4.5 (0.03)*
Yes	78 (23.5)	215 (29.9)	
Vaccine accessibility is an essential factor in vaccination decision making			
No	89(26.8)	223 (30.9)	1.8 (0.1)
Yes	243(73.2)	498 (69.1)	
COVID-19 vaccination is a successful way to prevent and control disease			
No	136 (41.0)	643 (89.2)	274.5 (0.0)*
Yes	196 (59.0)	78 (10.8)	
Doctors' recommendation is an essential factor in vaccination decision making			
No	59 (17.7)	234 (32.4)	24.4 (0.0)*
Yes	273 (82.3)	487 (67.6)	
Vaccine price is an essential factor in vaccination decision making			
No	118 (35.5)	390 (54.1)	31.3 (0.0)*
Yes	214 (64.5)	331 (45.9)	

*Significant difference $p < 0.05$.

Pilot study

The pilot study was conducted through an online survey on 10% of the sample (105 participants) at the beginning of March 2021 to test the response to different items of the questionnaire and the applicability of the study then the questionnaire was modified according to the result of the pilot study. The results of the pilot were excluded from the results of the study. The Cronbach’s alpha coefficient of the questionnaire was 0.78 indicating acceptable internal consistency.

Statistical management

The collected data were analyzed using SPSS (Statistical Package for the Social Sciences) version 20.0. The chi-square test and nominal regression analysis were used. Microsoft Excel 2019 program was used for creating graphs.

Administrative design and ethical consideration

The study was approved by IRB of Faculty of Medicine, Zagazig University (reference no: #6803). The participants were informed that their contribution was voluntary, and consent was implied through their completion of the questionnaire.

Results

The socio-demographic characteristics of our study group (1,053 participants) were as follows: 52.0% were males, 68.5% were more than 36 years old, 44.3% had middle level of education, 65% were working, and 60% of them perceived their income as enough. Figure 1 shows the acceptance rate of COVID-19 vaccination; only 31.5% of our study participants accept to take the vaccine when it is available. Figure 2 demonstrates the

Figure 1. The acceptance rate of COVID-19 vaccination among Egyptian population.

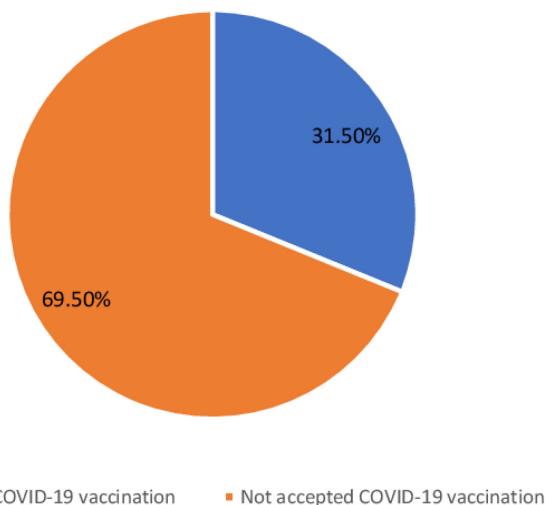
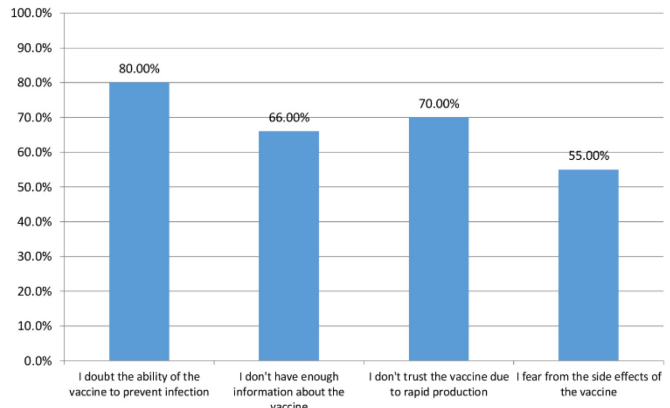


Figure 2. Distribution of reasons for non-acceptance of COVID-19 vaccination.



main causes for non-acceptance of COVID-19 vaccination arranged in the following sequence: firstly, doubt in the ability of the vaccine to prevent the infection (80%), lack of trust in the vaccine due to rapid production (70%), deficiency of information about the vaccine (66%) and lastly fear from its side effects (55%). Table 1 presents a comparison between participants that accepted future COVID-19 vaccination and those that refused vaccination in different items of questionnaire where statistically significant differences between the two groups were present in the following factors; residence ($p = 0.0$), income ($p = 0.0$), working ($p = 0.04$), impact of pandemic on income ($p = 0.0$), presence of suspected case in the living area ($p = 0.01$), received influenza vaccine in the last season ($p = 0.0$), knowing side effect of vaccine ($p = 0.03$), perceived vaccine effectiveness ($p = 0.0$), doctors’ recommendation to take the vaccine ($p = 0.0$), and price of the vaccine ($p = 0.0$).

Table 2 shows the findings of the regression analysis to predict the factors that affected the COVID-19 vaccine acceptance level in our study group, where received influenza vaccine in the last season ($p = 0.01$), perceived vaccine effectiveness ($p = 0.00$), doctors’ recommendation to take the vaccine ($p = 0.03$) and price of the vaccine ($p = 0.02$) were the only statistically significant factors affecting the acceptance level of COVID-19 vaccine.

Discussion

This study was performed to assess the COVID-19 vaccine acceptance level and its predictors among the Egyptian population. Among 1,053 participants, only 31.5% reported that they accept the vaccine and are ready to take it when it is available (Figure 1). A wide variation in the rate of COVID-19 vaccine acceptance

was noticed between different countries and even in the same country during different times. For example, a study done in Egypt found that out of 672 participants surveyed, 450 (67%) said they would accept a COVID-19 vaccine if it is recommended for them [16]. One systematic review explored that the highest COVID-19 vaccine acceptance rates (> 90%) among the general public were found in four countries; Ecuador (97.0%), Malaysia (94.3%), Indonesia (93.3%), and China (91.3%) while the lowest vaccine acceptance rates (< 60%) were found in 7 countries; Kuwait (23.6), Jordan (28.4), Italy (53.7), Russia (54.9), Poland (65.3), US (65.9) and France (58.9) [17]. In the US, Nguyen *et al.* reported that between September and December 2020, acceptance of COVID-19 vaccination increased from

39.4% to 49.1% among adults and non-acceptance decreased from 38.1% to 32.1% [18]. In a survey conducted earlier in 2020 by Kaplan and Milstein in US, only about one-third of the US population reported that they were very likely to accept the vaccination and about one in five adults reported that they are very unlikely to take the vaccine under any circumstances. Unless and until the origins of such wide variation in acceptance of the COVID-19 vaccine are understood, differences in vaccine coverage between countries could delay global control of the pandemic [19].

The low level of COVID-19 vaccine acceptance in this study was referred by the participants to; doubt in vaccine effectiveness (80%), lack of trust due to rapid production (70%), lack of information about the

Table 2. Nominal regression analysis of factors affecting the acceptance of the study group to COVID-19 vaccine.

Items	B coefficient	Wald	p value*
Age			
< 36 years	0.675	0.534	0.46
> 36 years	Ref		
Gender			
Male	0.337	0.227	0.63
Female	Ref		
Education			
High	0.073	0.005	0.94
Middle	0.818	0.438	0.50
Low	Ref		
Residence			
Upper Egypt	Ref		
Lower Egypt	1.049	1.77	0.183
Income			
Enough and more	1.949	2.47	0.11
Enough	1.687	2.77	0.09
Not enough	Ref		
Working			
Yes	Ref		
No	0.44	0.242	0.632
Pandemic effect on daily life			
Much or very much	14.55	0.00	0.9
Fair	14.90	0.00	0.9
Little or very little	Ref		
Pandemic effect on work			
Much or very much	0.538	0.353	0.55
Fair	1.76		
Little or very little	Ref		
Pandemic effect on income			
Much or very much	1.24	1.419	0.28
Fair	0.584	0.219	0.61
Little or very little	Ref		
Presence of cases where you lived in.	1.76	1.31	0.25
Perceived risk of infection	0.177	0.02	0.87
Past influenza vaccination	2.253	6.57	0.01*
Hearing about Covid- 19 vaccine?	1.14	1.20	0.27
Knowing side effect of Covid- 19 vaccine?	0.537	0.29	0.58
Vaccine accessibility is an essential factor in vaccination decision making	1.158	1.17	0.27
Covid-19 vaccination is a successful way to prevent and control disease	2.20	6.91	0.00*
Doctors' recommendation is an essential factor in vaccination decision making	19.7	4.44	0.03*
Vaccine price is an essential factor in vaccination decision making	1.59	4.95	0.02*

*Significant difference $p < 0.05$.

vaccine (66%), and fear of side effects of the vaccine (55%) (Figure 2). Consistently, Harapan *et al.* in 2020 clarified that among 1,359 respondents, 93.3% of respondents would accept vaccination for 95% effectiveness, but this acceptance decreased to 67.0% for 50% effectiveness [20]. Also, Kreps in 2020 found small but significant increases in vaccine acceptance with increases in effectiveness and reduced acceptance with increases in serious adverse reactions [21]. Furthermore, Callaghan *et al.* in 2021 (in a large survey) documented the main reasons for refusing the vaccine including; fear of lack of effectiveness, lack of information, and the misleading information by the anti-vaccine advocacy groups [22]. Higher trust in information from governmental sources was the main factor affecting acceptance of the vaccine as reported by Jeffrey *et al.* in 2021 [23]. Similarly, Szilagyi *et al.* in 2020 found that countries with a vaccine acceptance rate greater than 80% tended to have a strong trust in central governments which provided real, clear, and up-to-date information about the disease and the vaccine [24]. Lack of trust due to the rapid production of the vaccine (as most vaccines were in the third phase trial when introduced to the population) was an important reason for low COVID-19 vaccine acceptance reflecting the role of mass media and social media in spreading terrifying information about the vaccine and political intentions behind its rapid production.

Vaccine acceptance is multi-factorial, identifying the factors affecting the acceptance is crucial for predicting the vaccination coverage rate of the general population. Regression analysis conducted in this study concluded that there was no significant effect of socio-demographic criteria of the participants on the level of COVID-19 vaccine acceptance. This is contrary to many other studies. A web-based survey conducted in Saudi Arabia by Al-Mohaithef and Padhiin in 2020 concluded that respondents who were above 45 years and married were significantly associated with higher vaccine acceptance [25]. Similarly, Allam *et al.* in 2020 revealed that males had higher acceptance of COVID-19 vaccines due to their higher perception of COVID-19 dangers [26]. Lazarus *et al.* in 2021 also observed that older males with high income were more likely to accept the vaccine, whereas respondents between 25 to 64 years of age were more likely to accept it to fulfill an employer's vaccine recommendation [27]. Finally, regarding the effect of occupation on the level of acceptance Dror *et al.* mentioned that healthcare workers caring for COVID-19 patients had higher levels of acceptance in contrast to parents, nurses, and medical workers not caring for SARS-CoV-2 positive

patients who expressed higher levels of vaccine hesitancy [28].

The predictors of COVID-19 vaccine acceptance in this study were history of taking influenza vaccine, effectiveness, and price of the vaccine in addition to doctors' recommendation to take the vaccine. Wang *et al.* in 2020 noted that people who accepted influenza vaccination in 2019 had higher acceptance of the COVID-19 vaccination [29]. Gostin and Salmon also noted that the people who tend to take the seasonal vaccination had a higher acceptance rate for the new vaccine. In 2020, Reiter *et al.* found that the acceptance increased significantly if the healthcare provider recommended vaccination for participants [31]. Taking the influenza vaccine in the past season, trusting in the effectiveness of the COVID-19 vaccine, or appreciating doctor's recommendations were significantly associated with higher levels of acceptance as mentioned by Wang *et al.* [14].

Although our study was the first study to measure the level of COVID-19 vaccine acceptance across Egypt, it had some limitations. It is a cross-sectional study that represents the community response at the point of the study. However, the responses of the participants were collected by web-based self-administrated survey instead of a face-to-face interview which may lead to potential bias in their responses. The study also suffers from a selection bias since this is an online survey and the accessible population does not represent the whole country or even the whole adult population, they represent only those who have access to the internet and social media. Therefore, the findings of the study cannot be generalized to the entire Egyptian population. There is also an inherent volunteer bias, i.e., only those who have a strong public opinion are more likely to answer the survey. Last but not least, although the acceptance rate is assessed on a four-point scale, it is transformed in the analysis into a simple yes or no question, which may not adequately assess several important aspects of vaccine acceptance, which severely affect the study's internal validity.

Conclusions

Our study revealed a low level of COVID-19 vaccination acceptance among the Egyptian adult population and the significant predictors for vaccination acceptance, which include, the previous history of flu vaccination, vaccine effectiveness, vaccine price, and doctors' recommendations to take the vaccine. So, the Egyptian government should be ready to handle low COVID-19 vaccination acceptance through important strategies such as promoting vaccine confidence by the

availability of clear, precise, and up-to-date information to address public concerns, providing free vaccination, and integrating doctors in promoting the vaccine.

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Authors' contributions

All authors were responsible for the study. All authors contributed to the study conception, design, and collection of the data. Material preparation was performed by [Randa M. Said]. Data management was performed by [Ghada M. Salem]. The discussion was contributed by [Amira E. Abdelsalam]. The first draft of the manuscript was written by all authors. All authors read and approved the final manuscript.

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