



COVID-19 Vaccine Acceptance by Occupations in Egypt, Cross-Sectional Survey

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ABSTRACT

Submission Date:

2024-07-24

Revision Date:

2024-09-25

Acceptance Date:

2024-09-26

Key Words:

COVID-19; Vaccine; Acceptance; Occupations; Survey; Egypt.

Background: COVID-19 vaccination acceptance and coverage are essential measures to prevent its transmission, particularly at workplace. **Objective:** To assess the COVID-19 vaccine acceptance among various occupations in Egypt. **Methods:** An online cross-sectional survey was conducted across Egypt from 1st of October to 1st of November 2021 to assess the COVID-19 vaccine acceptance among various occupations. Self-administered online questionnaire that included questions about the respondents' occupational titles and their willingness to take the COVID-19 vaccine. **Results:** A total 1606 participants were included. The mean age was 41.3 ± 11.7 years and 53.4% were males. The most common occupations were healthcare (26.3%), educational (16.5%), engineering (13.9%), and office and administrative support (12.5%). Approximately 80.2% of the participants accepted to take the vaccine. Healthcare practitioners had significantly higher acceptance than other occupations (85.6% versus 78.3%, $p=0.001$). Farming, fishing, and forestry occupations (28.3% versus 81.7%, $p<0.001$) as well as transportation occupations (59.4% versus 81.1%, $p<0.001$) had significantly lower acceptance than other occupations. Multivariable analysis revealed that the participants' educational level (OR: 1.49, 95% CI: 1.08-2.05) and monthly income (OR:2.78, 95% CI:1.24-6.10) were significantly associated with willingness to take the COVID-19 vaccine. **Conclusions:** COVID-19 vaccine acceptance differed significantly by occupation of the respondents. Despite the limitations of online survey study design, this study recommends conducting COVID-19 vaccine awareness programs for occupations with lower acceptance rate such as agricultural and transportation workers.

INTRODUCTION

COVID-19 has killed about 7 (6,948,764) out of about 767 million (767,726,861) infected persons worldwide, since the first case appeared in December 2019 to July 2023.¹ In Egypt, there have been about 516, 023 confirmed cases of COVID-19 with 24,830 deaths, reported to WHO, from 3 January 2020 to 5 July 2023.² As of the lockdown and the fear of spreading the virus, Covid-19 pandemic has extensively impacted the healthcare system,

societies and economy all over the world. The Covid-19 pandemic slowed down several industries such as manufacture,³ travel and tourism, agriculture, food, pharmaceutical, entertainment and sport industries.⁴ In response to the COVID-19 pandemic, CDC, OSHA and others had set COVID-19 workplace safety plans and guidelines to protect employees and to control the impacts of COVID-19 on the industrial sectors.⁵

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In December 2020, the first COVID-19 vaccine doses were administered, then Egypt started its vaccination program on 24 January 2021.⁶ Hence, COVID-19 vaccination becomes one of the measures to prevent and control COVID-19 infection. Later, worldwide COVID-19 vaccination coverage and acceptance becomes a main critical measure to prevent future COVID-19 outbreaks, especially at various workplaces and among various occupations.³ Many studies examined the COVID-19 vaccine acceptance among healthcare workers,⁷ however, up to our knowledge, few studies were conducted to examine the vaccine acceptance among other occupations both globally and in Egypt.^{8,9} So, the aim of this study is to assess the COVID-19 vaccine acceptance among various occupations in Egypt.

METHODS

The study was conducted across Egypt from October 1st to November 1st, 2021, during a period when the COVID-19 vaccine was not mandatory for Egyptians. This study was a cross-sectional survey by completing self-administered online questionnaire created on Google forms. The inclusion criteria were working, educated Egyptian person, at least 18 years old, lived in Egypt at the time of the survey. The social pages and official groups on social networking sites like Facebook and WhatsApp were used to identify the study population from the general population of Egypt

Sample size Calculation: The required sample size was calculated using OpenEpi Version 3.01 (<https://www.openepi.com/SampleSize/SSPropor.htm>). At 50% expected Covid-19 vaccine acceptance rate,¹⁰ a confidence interval of 0.95, an alpha error of 0.05 and power of 0.80; a total of 384 study participants were required from each geopolitical zone of Egypt ($n = 4$; the Nile Valley and the Delta, the Western Desert, the Eastern Desert, and the Sinai Peninsula). So, at least 1536 (384×4) respondents were needed for this survey. Adding 10% of this number to compensate for response failure, the final sample size was 1689 individuals.

Questionnaire structure: Using social media sites, the self-administered online questionnaire had been dispersed at random to all possible participants for one month from 1st of October to 1st of November 2021. They were then given directions on how to complete the questionnaire before being sent to the

link for the Google form questionnaire. Only those who select "accept to participate" were permitted to finish the remaining questions. Participation in the study was also regarded to have been agreed to by responding to all the questions and submitting them. The questionnaire, invitation, directions, informed consent and other related items were translated into Arabic language.

The questionnaire was designed after a comprehensive literature review of COVID-19 vaccine acceptance literature,^{11,12} and it included questions about the respondents' sociodemographic characters, occupational titles (according to Standard Occupational Classification (SOC) System, <https://www.bls.gov/SOC/>. Accessed on April 2021), if they were willing to take COVID-19 vaccine if available.

The questionnaire was translated into Arabic and administered in Arabic language. Two independent reviewers were chosen to validate the questionnaire, and they evaluated its clarity, ease of answer, and content validity of the questions. Moreover, a pre-test survey on 20 volunteers was completed to look for technical issues and typographical mistakes. The pre-test survey responses were not included in the data's final analysis.

Statistical analysis: The collected data were coded, processed and analyzed using Statistical Product and Service Solutions (SPSS) software, v.25 for windows. Quantitative data were presented using means and standard deviation while categorical data were presented using frequencies and proportions. Tests of statistically significant relationships were performed using Chi-square test or Fisher's exact test for categorical data and Student-t test for quantitative data. Multivariate analysis was conducted to assess the association of acceptance to take the COVID-19 vaccine and the socio-demographic criteria of the survey respondents that showed significant difference by Chi-square test. A 95% confidence interval was used and probability values of ≤ 0.05 were considered statistically significant.

RESULTS

The sample size of this study was 1689, however only 1606 individuals responded, and they comprised the final study participants.

Table 1: Sociodemographic criteria of the survey respondents (N=1606)

Criteria	N (%)
Age groups (in years)	
• 20 - <30	371 (23.1)
• 30 - <40	382 (23.8)
• 40 - <50	464 (28.9)
• 50 - <60	253 (15.8)
• ≥ 60	136 (8.5)
Age (mean ± SD in years)	41.3 ± 11.7
Gender	
• Male	858 (53.4)
• Female	748 (46.6)
Education	
• Secondary school	364 (22.7)
• College/University	608 (37.9)
• Master/Doctoral degree	634 (39.5)
Residence	
• Rural	594 (37.0)
• Urban	1012 (63.0)
Marital Status	
• Single	329 (20.5)
• Married	1120 (69.7)
• Divorced	58 (3.6)
• Widower	99 (6.2)
Monthly Income (Egyptian pound)	
• < 2000	219 (13.6)
• 2000 - < 5000	546 (34.0)
• 5000 - < 8000	612 (38.1)
• 8000 - < 10.000	166 (10.3)
• ≥ 10.000	63 (3.9)

The mean age of the participants was 41.3 ± 11.7 years (ranging from 22 to 65 years) and most of them were in the age group from 40 to less than 50 years. About two thirds of the participants lived in urban areas and were married. Moreover, 13.6% of the participants had a monthly income of less than 2000 Egyptian pound (EP) but 38.1% and 34.0% of them had a monthly income range from 2000 to 5000; and 5000 to 8000 EP, respectively (Table 1) Healthcare workers comprised the highest percentage of the study participants (26.3%) compared to other occupations, followed by educational, engineering, and office and administrative support occupations (16.5%, 13.9% and 12.5%, respectively). Construction and extraction Occupations have the lowest percentage (2.1%) among the study participants compared to other occupations (Table 2).

Table 2: The occupational titles of the survey respondents (N=1606)

Occupational title	N (%)
- Management	69 (4.3)
- Healthcare Practitioners	423 (26.3)
- Engineering	223 (13.9)
- Educational	265 (16.5)
- Legal	48 (3.0)
- Personal Care and Service	76 (4.7)
- Sales and Related	95 (5.9)
- Office and Administrative Support	200 (12.5)
- Transportation and Material Moving	69 (4.3)
- Farming, Fishing, and Forestry	46 (2.9)
- Installation, Maintenance, and Repair	58 (3.6)
- Construction and Extraction	34 (2.1)

Most of our study participants (80.2%, n = 1288/1606) accepted to take COVID-19 vaccine if available, however less than quarter of them (19.5%, n = 318/1606) refused to take it (data were not tabulated).

Regarding COVID-19 vaccine acceptance according to socio-demographic criteria of the survey respondents (Table 3), about 40% of the study participant who accepted to take the COVID-19 vaccine had an educational level of Master and or doctoral degree followed by those who had an educational level of college (39.5%) with statistically significant difference. Most of the study participant who accepted to take the COVID-19 vaccine were married (P value < 0.05). Participants with monthly income ranging from 2000 to less than 8000, and from 2000 to less than 5000 had the highest percentage of those who accepted to take the COVID-19 vaccine (38.7% and 34.1%, respectively) (P value < 0.05). However, age, gender and residence showed statistically insignificant difference between those who were willing to take the COVID-19 vaccine and

Table 3: COVID-19 vaccine acceptance by socio-demographic criteria of the survey respondents (N=1606)

Criteria	Acceptance to take COVID-19 Vaccine		P value	Adjusted OR (95% CI)
	Yes (N=1288)	No (N=318)		
Age				
• 20 - <30	284 (22.0%)	87 (27.4%)	0.29	-
• 30 - <40	309 (24.0%)	73 (23.0%)		
• 40 - <50	380 (29.5%)	84 (26.4%)		
• 50 - <60	208 (16.1%)	45 (14.2%)		
• ≥ 60	107 (8.3%)	29 (9.1%)		
Gender				
• Male	687 (53.3%)	171 (53.8%)	0.88	-
• Female	601 (46.7%)	147 (46.2%)		
Education level				
• Secondary school	264 (20.5%)	100 (31.4%)	<0.001*	1.49 (1.08-2.05)*
• College/ University	509 (39.5%)	99 (33.1%)		
• Master/ doctoral degree	515 (40.0%)	119 (37.4%)		
Marital Status				
• Single	256 (19.9%)	73 (23.0%)	0.03*	0.86 (0.51-1.45)
• Married	918 (71.3%)	202 (63.5%)		
• Divorced	42 (3.3%)	16 (5.0%)		
• Widower	72 (5.6%)	27 (8.5%)		
Residence				
• Rural	824 (64.0%)	188 (59.1%)	0.11	-
• Urban	464 (36.0%)	130 (40.9%)		
Respondent's monthly Income (EGP)				
• < 2000	152 (11.8%)	67 (21.1%)	<0.001*	2.78 (1.24-6.10)*
• 2000 - < 5000	439 (34.1%)	107 (33.6%)		
• 5000 - < 8000	499 (38.7%)	113 (35.5%)		
• 8000 - < 10.000	143 (11.1%)	23 (7.2%)		
• ≥ 10.000	55 (4.3%)	8 (2.5%)		

those who were not willing. Multivariate analysis revealed that the participants' s education level (OR: 1.49, 95% CI:1.08-2.05) and monthly income (OR:2.78, 95% CI:1.24-6.10) were significantly EGP, Egyptian Pound; p-value was claculated using Chi-square; Adjusted Odds Ratios were claculted for variables with signifcant chi-scaure test; * significant results associated with willingness to take the COVID-19 vaccine (Table 3).

Concerning the acceptance of the study participants to take the COVID-19 vaccine according to their occupations (Table 4), Healthcare practitioners had significantly higher acceptance than other occupations (85.6% versus 78.3%, $p=0.001$). Farming, fishing, and forestry occupations (28.3% versus 81.7%, $p<0.001$) as well as transportation occupations (59.4% versus 81.1%, $p<0.001$) had

significantly lower acceptance than other occupations.

DISCUSSION

Many studies examined different determinants of COVID-19 vaccine acceptance among general population including occupation but using less detailed non-standardized occupational classifications of their participants. Moreover, healthcare practitioners were the main occupational category that COVID-19 vaccine acceptance was examined because they are at high risk of infection; however, few studies examined COVID-19 vaccine acceptance among other occupations.^{7,8} Hence, the current study assessed the COVID-19 vaccine acceptance among different occupations including healthcare practitioners, using a standardized

Table 4: COVID-19 vaccine acceptance among the survey respondents according to their occupation (N=1606)

Occupation	Willing to take COVID-19 Vaccine		P value
	Yes (N=1288)	No (N=318)	
- Management	61 (88.4%)	8 (11.6%)	0.080
- Healthcare practitioners	362 (85.6%)	61 (14.4%)	0.001*
- Engineering	186 (83.4%)	37 (16.6%)	0.195
- Educational	213 (80.4%)	52 (19.6%)	0.937
- Legal	36 (75.0%)	12 (25.0%)	0.359
- Personal care and service	65 (85.5%)	11 (14.5%)	0.233
- Sales and related	72 (75.8%)	23 (24.2%)	0.267
- Office and administrative support	169 (84.5%)	31 (15.5%)	0.103
- Transportation and material moving	41 (59.4%)	28 (40.6%)	<0.001*
- Farming, fishing, and forestry	13 (28.3%)	33 (71.7%)	<0.001*
- Installation, maintenance, and repair	43 (74.1%)	15 (25.9%)	0.239
- Construction and extraction	27 (79.4%)	7 (20.6%)	0.907

occupational classification. The present study findings showed a general acceptance rate of 80.2% which differed significantly according to the occupation, education level, marital status and monthly income of the participants.

In the current study, the COVID-19 vaccine acceptance rate among the study participants was 80.2% which is in-between the range of the world wide reported rates of COVID-19 vaccine acceptance that ranged from 23.6 to 97%.¹⁴ Moreover, the current study COVID-19 vaccine acceptance rate was found to be lower than the acceptance rates in UK (95%)¹⁵, Ecuador (97%)¹⁶, Malaysia (94.3%)¹⁷, Indonesia (93.3%), and China (91.3%).¹⁴ On the other hand, the current study acceptance rates was higher than that found in South East Asia, 71%, Bangladesh, 61.6%¹⁸ United Arab Emirates 60.1%¹⁹ Ethiopia 51.64%²⁰ Saudi Arabia 64.7%²¹ Jordan (37.4%)²² Turkey (69.0%)²³ Italy (53.7%)²⁴ Sudan (48.2%).²⁵ Regarding Egypt, the acceptance rate reported by our study was also higher than that reported by other studies (31.1 to 71.1%).^{6, 26, 27}

Regarding different determinants of COVID-19 vaccine acceptance, our results did not show significant association with age of the participants, however other studies showed that acceptance rate was higher among elderly.^{19,28} Concerning gender, this study found that male participants had a relatively higher proportion (53.3%) of those who accepted to take the vaccine compared to female participants, but the difference was not statistically significant. Similar studies reported higher COVID-

19 vaccine acceptance rate among males.^{6,29} On the other hand, current study showed that married individuals had significantly higher COVID-19 vaccine acceptance rate compared to unmarried, which is in accordance with other studies.^{6, 21, 29,30} This finding can be explained by that married people might have fear to infect their family members or be infected from them, so they are more willing to take the COVID-19 vaccine to protect themselves and their family members.³¹

In the current study, those who accepted to take the COVID-19 vaccine had statistically significant higher educational level and monthly income. These findings are supported by similar studies reported that COVID-19 vaccine acceptance is higher among individuals with better educational level and higher income.^{28, 29, 30, 32} This might be related to having higher access to social media and other awareness programs leading to better knowledge about the importance of COVID-19 vaccination.^{21,30,33} Moreover, Hawkins et.al (2020) found that higher COVID-19 cases and mortality were substantially correlated with low socioeconomic level during the COVID-19 pandemic.³⁴

Our study showed different COVID-19 vaccine acceptance rates among the studied occupations, which is in accordance with Troiano and Nardi (2021) who reported that occupation is an important cause of variations in COVID-19 vaccine refusal.³⁵ Moreover, other studies reported higher acceptance rates among employed compared to unemployed.^{19,29} However, Metin et al. (2023) claimed that variations

of COVID-19 vaccine hesitation among variant occupations, might be influenced by both personal and social parameters.³⁶

Concerning the acceptance rate of our study participants by their occupations, healthcare practitioners (28.1% $n = 362/1288$) constituted the highest percentages of those who accepted to take the vaccine compared to other occupations. Moreover, 85.6% ($n = 362/423$) of the studied healthcare practitioners accepted to take the COVID-19 vaccine. This finding is in agreement with several studies^{7, 36, 37} and can be explained by that the frontline healthcare practitioners are at high risk of infection compared to other occupations, so need special consideration and focused biosafety.³⁸ In addition, the current study showed that healthcare practitioners followed by other occupations who accepted to take the vaccine including educational, engineering, and office and administrative support occupations (16.5%, 14.4% and 13.3%, respectively). These occupations usually have a good education level that can be a factor of their acceptance to take the vaccine due to increased awareness about the importance of the vaccination;³² however we did not examine the awareness of the study participants toward the COVID-19 vaccine. Although management occupations had the highest acceptance rate 88.4% ($n = 61/69$) within their category compared to other occupations, they had a relatively lower acceptance rate of 4.7% compared to other occupations. This might be explained by that management occupations constituted lower proportion (4.3%) of the study sample.

On the other side, the current results revealed that farming, fishing, and forestry occupations represented the lowest proportion (1.0%, $n = 13/1288$) of those who accepted to take the COVID-19 vaccine compared to other occupations. Also, Construction and Extraction Occupations had lower proportion (2.1%, $n = 27/1288$) of study participants who accepted to take the vaccine compared to other occupations. These findings can be related to the lower education level among these occupations compared to others, which might lead to lower awareness of COVID-19 vaccine that can result in lower acceptance rate among them. Hence, our results draw the attention to the abovementioned occupations which had lower COVID-19 acceptance rates specially those who is working in the

agriculture industry as they are exposed to certain environmental hazards such as pesticides, which might lead to poor clinical consequences from COVID-19.⁴ So, providing health education programs to these occupations is mandatory to increase their COVID-19 vaccine acceptance to protect them and their family members.³⁹

The current study has certain limitations. First, its cross-sectional design, using social media self-administered online questionnaire, which can lead to recall and selection biases. In addition, usage of social media might differ according to the occupation. Second, we did not assess the knowledge, attitude and practice of the COVID-19 vaccine among the respondents, nor the reasons of COVID-19 vaccine refusals, as these were not included in the objectives of the current study. Thus, the results should be generalized cautiously, and additional research is needed. Up to our knowledge this study is the first to assess the COVID-19 vaccine acceptance by occupations in Egypt using a standardized occupational classification.

CONCLUSIONS

COVID-19 vaccine acceptance differed significantly according to occupations. Healthcare practitioners had significantly higher acceptance than other occupations while farming, fishing, and forestry occupations as well as transportation occupations (59.4% versus 81.1%, had significantly lower acceptance than other occupations. The higher acceptance of healthcare practitioners may be related to their perceived risk. Despite the limitations of online survey study design, this study recommends conducting COVID-19 vaccine awareness programs for occupations with lower acceptance rate such as agricultural and transportation workers.

Ethical approval

The study was carried out in accordance with the world medical association declaration of Helsinki ethical principles,¹³ and was ethically approved by the Internal Review Board (IRB) of the faculty of medicine, Mansoura University, Egypt. Participants received guarantees of data confidentiality and anonymity. An invitation to participate, directions for filling out the questionnaire, and an informed consent option are all included in the concept of

informed consent. Participation in this study was voluntary, anonymous, and confidential. The study protocol was approved by the Institutional Review Board (IRB), Faculty of Medicine, Mansoura University, (code number: R.23.09.2323).

Funding source: The authors received no financial support related to this research

Conflict of interest: All authors have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgments: The authors acknowledge the respondents for their participation in this study.

Author contributions: First author: Idea, preparing the questionnaire, literature search, interpretation of results and writing; Second author: literature search, and writing; Third author: literature search and data collection; Fourth author: questionnaire distribution, data collection and literature search; Fifth author; literature search and data collection; Sixth author: Statistical analysis, literature search, writing and manuscript submission.

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Cite this article as: Mohamed El-Helaly, et al. COVID-19 Vaccine Acceptance by Occupations in Egypt, Cross-Sectional Survey. *Egyptian Journal of Community Medicine*, 2025;43(2):84-91.

DOI: 10.21608/ejcm.2024.306546.1309

