# Medical Science

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# Barriers to managing COVID-19 pandemic: Attitude towards vaccination and implications for public health

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## ABSTRACT

*Background*: In order to achieve long-term optimum public health response, herd immunity is required, and this may happen if general populations willingly offered the COVID-19 vaccine. The current study aimed to explore the attitudes toward COVID-19 vaccine, and to outline the common barriers interfering with vaccination among Egyptian population. A cross-sectional study has been carried out among 1282 participants utilizing a self-administered questionnaire. *Results*: Negative attitude was associated with low trust in the capability of the country instructions to combat COVID-19 (OR=5.97, CI95%: 3.37-10.57), unsatisfactory knowledge (OR=15.73 CI95%: 9.54-25.92), being worried about adverse effects (OR=2.97, CI95%: 1.96-4.52), being not committed to protection measures like PPE, HH and social isolation (OR=2.16, CI95%: 1.42-3.25), not working (OR=3.04, CI95%: 2.11-4.36), low education (OR=10.12, CI95%: 7.11-14.40), don't know deep experienced trials of vaccines (OR=1.76, CI95%: 1.45-2.13), being female (OR=3.09, CI95%: 2.17-4.39), increase age (OR=1.03, CI95%: 1.01-1.06) and depression symptoms (OR=1.64, CI95%: 1.12-2.41 ). *Conclusion*: The main barriers of negative attitude toward vaccine include worrying about vaccine side effects, poor knowledge regarding COVID-19 and mistrusting the country's ability to combat it.

**Keywords:** COVID-19, Vaccination, Attitude, Hesitancy, Refusal, Barriers

## 1. INTRODUCTION

The coronavirus disease 2019 (COVID-19) outbreak is an extraordinary pandemic that influences human beings worldwide. This pandemic started in Wuhan city in China and rapidly spread globally. By the last months of 2020, health profession authorities reported more than 44 million confirmed cases of COVID-19 and about 1 million deaths globally. Unfortunately, this pandemic is rapidly increasing (Ho et al., 2021). In the Dark Continent, the first confirmed case of COVID- was documented in Egypt on mid-February 2020. Later on, other Africans countries followed Egypt. Despite the obvious challenges in preventing the expanding pandemic, and unlike the developed world, many countries in Africa reported a delay in the exponential growth

trajectory of COVID-19 pandemic (Saglietto et al., 2020). This delay could be explained by unavailability of disease screening measures and the drawbacks of lockdowns status carried out during the pandemic's early stage. The difference in geographical nature and variations in climate regions has also been claimed to impact the prevalence of COVID-19. This might justify the late pandemic reporting in Africa when compared with other countries over the world (Margolin et al., 2020)

As COVID-19 pandemic continues, most countries implemented strict preventive measures. Side-by-side with those preventive measures, Identification and active surveillance of high-risk populations have become more crucial, especially if we considered the disease's high transmissibility in asymptomatic patients (Liu et al., 2020). $R^0$ which is the number of secondary cases per infected individual ranges among different countries from 2.0 to 2.5 (Qian et al., 2020). However, those variations may be justified by numerous viral epidemiological features, viral viability and infectivity in aerosols among different settings (Sharif et al., 2020). With resurgent waves of COVID-19 pandemic, arguments escalate over the reinstatement of lockdowns and communities' livelihood.

In the past months, vaccines became the hopeful savior which is expected to overcome the worst health and economic crisis over the world (Lin et al., 2021). Vaccines are well identified by health authorities and the medical community as a unique tool ensuring public health successes and contributing to optimum eradication of many pandemics (European Centre for Disease Prevention and Control, 2012). Initial immunization trials have reported promising results highlighting the good immunological response and the safeness of the COVID-19 vaccine. Nevertheless, for many people, this is not an adequate justification for whole-heartedly accepting vaccination. They doubt the benefits and usefulness of the vaccine, concern about their efficacy and argue the need for them, an attitude we describe as vaccine hesitancy. Vaccine hesitancy is different from vaccine refusal. Even those who consent to receive the vaccine can harbor hesitancy towards specific aspects of vaccination (Yaqub et al., 2014). The major concern is that hesitancy soon turns into refusal, as proposed by theory and experience (Salathé et al., 2008), and unvaccinated clusters develop in which pandemic outbreaks can occur (Jansen et al., 2003). Since the influenza pandemic of 2009, hesitant attitudes towards vaccination became increasing. For many people, in addition to the healthcare professionals, attitudes toward vaccination are affected by a wide range of other information sources, including websites and social media. Reports issued by Healthcare authorities highlighted the upgrowth of growing challenges to seta trustful relationship with patients. A trustful relationship could otherwise alleviate concerns and reassure reluctant patients (Yaqub et al., 2014).

Successful vaccination programs primarily rely on the rates of vaccine uptake among the population. Even though COVID-19 vaccine is still incompletely available for whole populations, community preparation and development of effective policies and messaging for vaccination must be planned and successfully conducted to maximize uptake once a vaccine becomes available. This study was conducted to assess the attitudes toward vaccination and identify the common barriers interfering with vaccination among the Egyptian general population (explore factors associated with intention to receive the vaccine against the current pandemic of COVID-19)

## 2. MATERIAL AND METHODS

### Study design and setting
A cross-sectional study was conducted from November 1st to December 1st, 2020 among sample of Egyptian populations.

### Participant's inclusion and exclusion criteria
The inclusion criteria of participants included Egyptians between 18 and 72 years of age, who agreed to be engaged in the current study. Non-Egyptian populations were excluded.

### Sampling and Sample size
To our knowledge, only one research conducted in this area among medical students and reported 46% hesitancy to vaccinate (Saied et al., 2021) but no published research has reported on the percentage level of intention to vaccinate against COVID-19 among public Egyptians, so it is estimated that the level of intent is equal to the level of intent (p = q = 0.5) and with an acceptable level of precision (D) of 0.03. The sample has 1014 participants. Predicting a drop-out of 10%, the sample increased to 1127. A total of 650 hard copies were distributed and the online Google form link was sent to social media. The total number of questionnaires collected was 1402. Incomplete printed questionnaires were excluded (n = 120) with 1,282 questionnaires given with a response rate of 91.4%.

**Ethical considerations**

The current study has been commenced after obtaining ethical approval from Research Ethical Committee REC, number (3/2021FAML), Faculty of Medicine, Menoufia University, Egypt. To maintain the respondent's confidentiality, a consent form was appended to the online questionnaire. By clicking the 'Begin survey' link, the participant conveys his/her agreement to be recruited in the study. An informed consent was electronically generated. Regarding the personal interviews, written informed consent was signed by the participants and documented.

**Data collection tool**

A web-based anonymous survey was conducted using an online questionnaire (using Google forms). The authors utilized the social network platforms of social media; Facebook, WhatsApp and Instagram, to disseminate the survey link to the public. Personal interviews and cell phone calls in addition to the social networking sites were the main data collection ways. The surveys included standardized information regarding the study's aim and objectives, procedures, personal rights of participation or withdrawal, and declarations of obtained data privacy. By submitting the form, the participant was considered to be providing consent to the study. The survey was encrypted so that it would not be collected from the same electronic system twice. Participants were requested to complete the semi-structured questionnaire and when do that, they received a note prompting them to distribute the survey link to all their accessible contacts. In this work, the tools utilized are a questionnaire consisting of four main parts:

Demographics and health-related data of the participants, including: age, gender, residence, education, occupation and income. In addition, the volunteers reported if they previously received the vaccine of influenza and, whether they had ever had COVID-19.

Knowledge towards COVID-19 was adopted from Kasemy et al., (2020). This part consisted of 15 questions covering the clinical presentations, mode of transmission, risky groups of populations, management of current pandemic and the sources of gained information.

Attitude towards COVID-19 vaccination was evaluated utilizing a one-item question on a five-point scale 'definitely not' to 'Yes, definitely' (How likely to do you think you are to get a COVID-19 vaccine when one is approved?). Responses ranged from "1- very unlikely" to "6very likely". During data analysis, this variable was coded as follows: (0) intend to vaccinate (responses of 5-6), (1) unsure about whether to vaccinate (responses of 3-4), and (2) unwilling to vaccinate (responses of 1-2) (Paul et al., 2020). Anxiety and depression symptoms subscale was the fourth part of the questionnaire. Hospital Anxiety and Depression Scale (HADS) questionnaire was utilized to assess anxiety and depression symptoms. It is a fourteen-item scale categorized under two subscales: seven items assigned for anxiety and seven items describe depression. Scoring for each item ranges from zero to three. A subscale score >8 denotes anxiety or depression (Pukhraj et al., 2017).

To enhance the objectivity and reliability of the present work, and to avoid inter and intra-observer bias, the investigators (2 physicians and 2 civilian individuals) received comprehensive training regarding the questionnaire for 2 hours, followed by followed by a test to assess readiness, question quality and reporting. The reliability of the questionnaire was tested and the Cronbach's alpha coefficient was 0.76 (Taber, 2018).

**Phases of the study**

The current work was conducted over 2 phases. First phase is a Pilot study was carried out among thirty participants of different age and sex groups (15 direct interview participants and 15 online participants) to ensure the questionnaire adequacy for language, design, and time. Furthermore, to explore the impending barriers and challenges that might confront the execution of the work and tackle any variations between online and direct responses.

In the second phase, online and Google forms besides personal contacts were used to gather the data, particularly after the authorities' strict preventive measures to halt the pandemic spread. The questionnaire was disseminated to populations of different age, sex, occupation and socio-economic levels to achieve a natural real response. As the Central Agency for Public Mobilization and Statistics (CAPMAS) in Egypt reported an illiteracy rate of 25.8%, it was neither feasible nor right to stand on online forms only (Egypt Independent, 2017). In addition, considering the online questionnaire exclusively might be a source of bias, as it will address only the educated individuals and people who are knowledgeable about filling online surveys. Accordingly, direct administered questionnaire was inevitable. Respondents (only Egyptians) between 18 and 72 years of age who understood the content of the questionnaire and accepted to participate in the study were considered eligible to contribute to the study via clicking the link (n=752) or filling in the paper-based questionnaire forms that have been distributed throughout the outpatients' clinics and governmental places (n=530).

**Statistical analysis**

Results were statistically analyzed utilizing SPSS version 27 (SPSS Inc., Chikago, IL, USA). Data were presented as numbers and % or mean ±SD. Binary logistic regression analysis was conducted, which analyses independent predictors with odds ratios for a binary outcome. P value <0.05 and 95% Confidence interval were considered.

## 3. RESULTS

Table 1 describes the general characteristics of the studied participants. The participants' mean age was 24.90±9.26 years. Out of 1282 participants, 61% were females, and 58.8% were highly educated. Satisfactory knowledge of COVID-19 was reported among 74.6% and 12.2% of the participants were infected with COVID-19. Worrying about vaccine adverse effects was shown in 83.6% while, mistrust of the currently available vaccines was shown in 82.7%. Anxiety and depression symptoms were reported among 69% and 55.4%, respectively. Commitment to protection measures was reported among 51.2% while seeing country instructions were enough to combat COVID-19 was shown among 39%.

**Table 1** Participants' characteristics among the individuals included in the current study

|  | N*=1282 | % |
|---|---|---|
| Age (years) |  |  |
| Mean ±SD/ Range | 24.90±9.26/ 18-72 |  |
| Sex |  |  |
| Male | 500 | 39.0 |
| Female | 782 | 61.0 |
| Residence |  |  |
| Urban | 753 | 58.7 |
| Rural | 529 | 41.3 |
| Education |  |  |
| Low | 528 | 41.2 |
| High | 754 | 58.8 |
| Occupation |  |  |
| Not working | 807 | 62.9 |
| Working | 475 | 37.1 |
| Income |  |  |
| Not enough | 382 | 29.8 |
| Enough | 900 | 70.2 |
| Knowledge of COVID-19 |  |  |
| Unsatisfactory | 326 | 25.4 |
| Satisfactory | 956 | 74.6 |
| Previously vaccinated against influenza |  |  |
| Yes | 638 | 49.8 |
| No | 644 | 50.2 |
| Do you know about a vaccine related immunity |  |  |
| Yes | 702 | 54.8 |
| No | 580 | 45.2 |
| Infected with COVID-19 |  |  |
| Yes | 156 | 12.2 |
| No | 1126 | 87.8 |
| Do you see that deep experienced trials of vaccines are required |  |  |
| Yes | 866 | 67.6 |
| No | 124 | 9.7 |
| I don't know | 292 | 22.8 |
| Do you recommend children vaccination |  |  |
| Yes | 344 | 26.8 |

| | | |
|---|---|---|
| No | 572 | 44.6 |
| I don't know | 366 | 28.6 |
| Are you worried about vaccine side effects | | |
| Yes | 1072 | 83.6 |
| No | 210 | 16.4 |
| Do you mistrust the current available vaccines | | |
| Yes | 1060 | 82.7 |
| No | 222 | 17.3 |
| Anxiety symptoms | | |
| Yes | 884 | 69.0 |
| No | 398 | 31.0 |
| Depression symptoms | | |
| Yes | 710 | 55.4 |
| No | 572 | 44.6 |
| Are you committed to protection measures like PPE, HH and Social isolation | | |
| Yes | 656 | 51.2 |
| No | 626 | 48.8 |
| Do you see country instructions are enough to combat COVID-19? | | |
| Yes | 500 | 39.0 |
| To some extent | 628 | 49.0 |
| No | 154 | 12.0 |

*N: number

Intention to receive the vaccine was reported among 45.2% while 54.8% of the participants were divided into not likely to be vaccinated (26.4%) and undecided (28.4%) (Figure 1). A logistic regression performed to ascertain the predictors that participants with no intention to get vaccinated may have was statistically significant, $\chi2= 733.36$, p < 0.001. The model explained 58.3% (Nagelkerke $R2$) of the variance in negative attitude and correctly classified 81.7% of cases. Negative attitude was associated with low-trust in the capability of the country instructions to combat COVID-19(OR=5.97, CI95%: 3.37-10.57), unsatisfactory knowledge (OR=15.73 CI95%: 9.54-25.92), being worried about vaccine side effects (OR=2.97, CI95%: 1.96-4.52), being not committed to protection measures like PPE, HH and Social isolation (OR=2.16, CI95%: 1.42-3.25), Not working (OR=3.04, CI95%: 2.11-4.36), Low education (OR=10.12, CI95%: 7.11-14.40), don't know deep experienced trials of vaccines (OR=1.76, CI95%: 1.45-2.13), being female (OR=3.09, CI95%: 2.17-4.39), increase age (OR=1.03, CI95%: 1.01-1.06) and depression symptoms (OR=1.64, CI95%: 1.12-2.41 ) (Table 2).
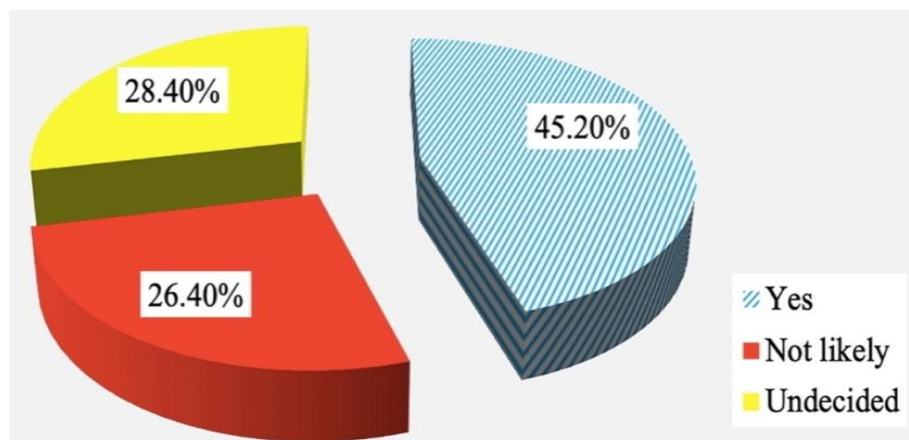


**Figure 1** Distribution of the studied participants regarding their intention to get vaccinated against COVID-19.

**Table 2** Predictors of no intention (Not likely + Undecided) to get vaccinated against COVID-19 among participants included in the current study

| Predictors | p value | OR | CI95% Lower | Upper |
|---|---|---|---|---|
| Unsatisfactory Knowledge about COVID-19 | <0.001* | 15.73 | 9.54 | 25.92 |
| Low Education | <0.001* | 10.12 | 7.11 | 14.40 |
| Do you see country instructions are enough to combat COVID-19? (Yes) | <0.001* | 5.97 | 3.37 | 10.57 |
| Sex (Male) | <0.001* | 3.09 | 2.17 | 4.39 |
| Occupation (Risky working) | <0.001* | 3.04 | 2.11 | 4.36 |
| Are you worried about vaccine side effects? (No) | <0.001* | 2.97 | 1.96 | 4.52 |
| Are you committed to protection measures like PPE, HH and Social isolation (Yes) | <0.001* | 2.16 | 1.42 | 3.25 |
| Deep experienced trials of vaccines (Yes) | <0.001* | 1.76 | 1.45 | 2.13 |
| Depression symptoms (No) | 0.010* | 1.64 | 1.12 | 2.41 |
| Do you mistrust the current available vaccines? (No) | 0.194 | 1.36 | 0.85 | 2.16 |
| Age | 0.001* | 1.03 | 1.01 | 1.06 |
| Do you know about a vaccine related immunity(Yes) | 0.987 | 0.99 | 0.72 | 1.37 |
| COVID-19 infection (Not Infected) | 0.951 | 0.99 | 0.64 | 1.53 |
| Anxiety symptoms (No) | 0.177 | 0.76 | 0.51 | 1.13 |
| Rural Residence | 0.001 | 0.58 | 0.42 | 0.80 |
| No enough Income | <0.001 | 0.36 | 0.24 | 0.55 |

*: significant<0.05 (Reference), OR: Odds ratio, CI: Confidence interval

## 4. DISCUSSION

The ability to achieve long-term successful public health response, herd immunity estimated to be 60-67% for COVID-19 is required and this may happen if COVID-19 vaccination was to be given for most of the population. Information regarding herd immunity and vaccination estimates is evolving rapidly. Although worldwide studies suggest that to achieve herd immunity, up to 60% of the population have to receive the vaccine, this proportion might be considerably lower based on differences in population different characteristics such as susceptibility and exposure (Britton et al., 2020; Anderson et al., 2020; Randolph et al., 2020).

Since the data were gathered before the availability of a novel vaccine, the degree to which intentions are associated with subsequent specific vaccine uptake behavior cannot be judged. This study showed that only 45.2% of participants conveyed their intentions to receive the vaccine for COVID-19 when a vaccine became readily available. This percentage is near to USA, where the intention to be vaccinated was high as 72% when reported in early April, but in October, it dropped to 48% (Galvin, 2020). In contrast, studies conducted in China, UK and Saudi Arabia reported intended acceptances of 88.6–91.3% (Wang et al., 2020), 79% (Neumann-Böhme et al., 2020) and 64.72% respectively (Al-Mohaithef et al., 2020). "Unsure" responses were given by about 28% of the participants. It is comparable with the percentages reported by Neumann-B€ohme et al., (2020) in Europe and Sherman et al., (2020) and Paul et al., (2020) in UK. The low intention to COVID vaccination might be due to confusion, decreased trust in health care providers, and exposure to unfiltered biased information through social media which can interrupt or impede effective care in life-threatening conditions. Apprehensions regarding the novelty of the COVID-19 vaccine are crucial obstacles to vaccine willingness. A study conducted by Wong et al., (2020) in Malaysia showed that more than 50% of the respondents were worried and expressed their uncertainty about if COVID-19 vaccine is the right solution.

The current study found a significant association between vaccine hesitancy and unwillingness and increased age and being not at risky occupation. The results disagree with Al-Mohaithef and Padhi (2020) in Saudi Arabia who showed better acceptance of COVID-19 vaccination among old-aged participants than their counterparts. This may be attributed to uncertainty and doubts about the vaccine side-effects among healthy elderly people who judge their own health to be good seemed to be the main factors behind rejection (Van Essen et al., 1997). Lower perceived risk among older or not risky occupation is another explanation of the lower acceptance of a vaccine among this age group.

Knowledge about the disease is expected to influence the acceptance to receive the vaccination. Satisfactory knowledge of COVID-19 was reported among 74.6% which is higher than a study conducted in April 2020 in the same region and it was 64.1%. The study showed that unsatisfactory knowledge about COVID-19 could predict hesitancy and unwillingness towards vaccination which agrees similar study conducted in the UK (Paul et al., 2020). No vaccination intention was associated with low education and the persons not committed to protection measures and social isolation. Educated people are more likely to recognize health education messages than illiterate and less-educated people. The people of lower educational levels had insufficient and inadequate knowledge concerning the COVID-19 and vaccination. A study conducted in Egypt by Barakat and Kasemys (2020) howed that the negative attitude toward COVID-19 were more common among highly educated populations; and increasing educational level was associated with more application of preventive behaviors.

Vaccination intention was high among men. A systematic analysis conducted by Liu et al., (2020) reported that men are more receptive to COVID-19 vaccination and more likely to adopt other pharmaceutical interventions. As evident in the literature, women are more likely to worry about getting infected and more concerned about coronavirus's adverse effects. This explains women's adherence to prophylactic measures, including hand sanitization, wearing masks and social distancing. The current study also agrees with studies conducted in the UK (Paul et al., 2020), US (Newbold et al., 2020), France (COCONEL Group, 2020) and Australia (Rhodes et al., 2020). Moreover, people who have mental illness are more vulnerable to COVID-19 infection. This might be justified by disorganized thinking, which may prevent a full understanding of the magnitude and gravity of the current situation and the prophylactic procedures to halt the spread of the virus, including vaccination (Hamada et al., 2020).

The current study reported higher vaccine intention among those living in urban are as compared to rural ones. This might be explained by variations in educational and socio-economic standards among urban and rural areas (Loomba et al., 2020). There was a highly statistically significant association between vaccine intention and confidence in ability of the country instructions to combat COVID-19 and worry about vaccine side effects. A study conducted by Jolley and Douglas (2014) in England reported a significant inverse relationship between vaccination intentions and anti-vaccine conspiracy beliefs. This effect might be attributed to perceived risks of vaccines, and negative feelings of powerlessness decreased trust in governmental authorities. Higher trust in the health system and governmental authorities is reported as a common association with applying prophylactic health services such as vaccination (Al-Mohaithef et al., 2020). Providing corrective factual knowledge concerning the vaccines to the populations through online platforms and their trusted community leaders (eg., religious symbols, community groups and mass media icons) to advocate vaccination may show promising improvements in modifying misinformation (European Centre for Disease Prevention and Control, 2012).

Public health campaigns fighting against COVID-19 should emphasize public orientation and increasing trust among populations, especially those who are undecided or unwilling on the safety, effectiveness, and adverse effects of vaccines, also, to highlight the importance of adherence to the strict quarantine measures and providing flawless information regarding the coronavirus disease. The findings of the current study and agreeing with prior work highlight a demand to shape such community-based campaigns to sub-groups including those living in rural areas, lower socio-economic levels, and women. However, and on a wider scale, Community-based campaigns established by healthcare authorities should also engage those who are already willing to receive the vaccine. This is expected to encourage them to respond more effectively if they encounter misinformation (WHO reports, 2016; Thorneloe et al., 2020; Paul et al., 2020).

**Strength and Limitations**

There was no ability to study why people might prefer one vaccine over another as this depends on the country leaders' ability to provide one specific or more vaccines. This study was conducted at only a single moment in time, and during a world-wide pandemic and of course, possible surges or declines in infection rates or unrelated factors could influence public intentions to vaccinate as happened in knowledge in this study; hence conclusion might be changed from time to time. So constant monitoring of vaccine opinion over time or from time to time could help detect shifts in intentions .

Despite these limitations, this study provided self-reported behavioral data, which could benefit future research, especially after addressing the barriers and comparing pre- and post-vaccination intentions. Our study of attitudes was directed towards COVID-19 vaccine and vaccination by asking about previous vaccination in a trial to show which extension do fears of a COVID-19 vaccine influence participant response to vaccine attitudes. This analysis was also conducted during the second wave of COVID-19 after announcements about the success of vaccine trials to detect this announcement's effect and not every announcement could be met by welcoming. Vaccines in our country will be given to risky groups like healthcare professionals and old ages. Combining this low distributional goal and prevalent negative attitudes towards vaccines urge the development of public health messaging emphasizing trusting vaccine safety, especially among the targeted group studied in this research.

## 5. CONCLUSION

This study showed that a low level of intention of receiving COVID-19 vaccine was found among the participants. No intention to vaccination was found among females, old aged, not working and low educated participants. The main barriers of negative attitude toward vaccine include worrying about vaccine adverse effects, mistrusting in the country's ability to combat COVID-19 and poor knowledge about COVID-19. Demographics related to poor vaccine acceptance could be the backbone in guiding decision-makers to direct the health education campaigns toward the right target populations.

**Abbreviations**

| | |
|---|---|
| COVID-19: | corona virus disease |
| CI: | Confidence Interval |
| HADS: | Hospital Anxiety and Depression Scale |
| OR: | Odds Ratio |
| UK: | United Kingdom |
| US: | United States |

**Authors' contributions**

Z.K. Conceptualized and designed the study, defined the intellectual contents, participated in review literature and data acquisition, did data analysis, interpretation and participated in manuscript preparation, drafting and review. H.S. Conceptualized and designed the study, participate in review literature and data acquisition. A.T. Conceptualized and designed the study, participate in review literature and data acquisition. A.B. Participated in review literature, data interpretation and participated in manuscript preparation, drafting and review. A.S. Participated in review literature, data interpretation and participated in manuscript preparation, drafting and review and the corresponding author. All authors approve the manuscript.

**Competing interests**

The authors declare that they have no competing interests

**Informed consent**

Informed consents were obtained from all participants involved in the current study. Furthermore, data were handled anonymously to maintain the confidentiality of the participants.

**Ethical approval**

The current study was approved by Research Ethical Committee REC, Faculty of Medicine, Menoufia University, Egypt (ethical approval code 3/2021FAML).

**Data and materials availability**

All data associated with this study are present in the paper.

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