Acceptance of COVID-19 Vaccines Among Physicians in Mid Delta Region of Egypt: A Cross-Sectional Study

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Research Article

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Abstract

Background Safe and effective vaccines became an important preventive tool to protect people against novel Corona Virus Disease infection. Since physicians are at higher risk for contagion of COVID-19 infection, they were prioritized for early vaccination. Also, they are role models who can improve adherence of people to vaccination.

Aim of the study: to determine the acceptability of COVID-19 vaccines among physicians in the Gharbia governorate, Egypt.

Methods: A cross-sectional study recruited working physicians through snowballing random sampling technique. Data was collected by using a self-administered electronic questionnaire which measured the self-perceived risk to COVID-19 infection, the attitudes and acceptance of COVID-19 vaccines.

Results: The study enrolled 1268 physicians, 22% of them were vaccinated .Only 24% expressed their acceptance towards COVID-19 vaccines, while 36.7% didn't agree to get vaccinated. Vaccination unacceptance was significantly associated with increasing age, female gender, higher educational attainments, limited income, no direct patients' contact, diagnostic subspecialty, and working in a rural health facility ($p = 0.004, 0.02, <0.0001, <0.0001, 0.01, 0.01, 0.002$ respectively).

Conclusions: Though physicians are at higher risk of infection, they had poor acceptance of COVID-19 vaccines which may, induce reluctance of people to get vaccinated. Special actions should be tailored to address the significant mediators associated with vaccine unacceptability.

Introduction

The new SARS-CoV-2 "severe acute respiratory syndrome coronavirus-2" which causes Coronavirus Disease (COVID-19) started in late 2019 and because of its rapid spread, WHO in January 2020, considered it as a "public health emergency of international concern". On 11 March 2020, WHO declared that COVID-19 is a global pandemic (WHO 2020a).

WHO reported that, by 25 June 2021, the confirmed COVID-19 cases were over 179 million globally with 3,895,661 deaths while in Egypt, 279,184 confirmed COVID-19 cases with 16,002 deaths were documented (WHO 2021).

As the health care workers (HCWs) are at the frontline in defending COVID-19 pandemic, they are both disease victims and disease transmitters. They are at risk of infection with COVID-19 because of their frequent close direct and indirect contact with

COVID-19 patients, contacts, visitors, and maybe other health care workers who may be infected with COVID-19 (Chou et al. 2020; Mahajan et al. 2020). This risk is aggravated by the contaminated environment, over crowdedness, insufficient isolation facilities, and inadequate knowledge, awareness,

and practice of HCWs about proper infection control practices (**WHO 2020b** ; Gan et al. 2020 ; Wu and McGoogan 2020).

Although not all the countries register precisely the number of COVID-19 infections and deaths among HCWs, the prevalence of infection among HCWs around the world was documented by several studies in a range of 3–19% (Alajmi et al. 2020; Ali et al. 2020; **Bandyopadhyay 2020; CDC 2020**). According to the Egyptian Medical Syndicate on their website on 25 June 2021, the number of COVID-19 deaths among physicians was 577 (Egyptian Medical Syndicate 2021).

Despite the implementation of the preventive measures globally in the form of quarantine measures, travel constraints, physical distancing, and the obligation of wearing facemasks, the COVID-19 pandemic can't be controlled. The only hope as a successful preventive measure is the vaccination against COVID-19 to limit infections, mitigate its propagation and save people's lives (Fares et al. 2021).

By March 2021, there were about 83 vaccines in the clinical development stage and 184 vaccines were in the pre-clinical development stage (**WHO 2020c**). Globally, there were many vaccines found to be safe and effective, including Pfizer, Moderna, Oxford/AstraZeneca, Sputnik V, Janssen, Sinopharm, and Sinovac (Cohen 2021; **Dal-Re et al. 2021 ; Jones et al. 2021**).

Due to the limited amounts of COVID-19 vaccines, governments have to set the high-risk groups as a priority to be vaccinated. These high-risk groups include health care workers, old people, and those with chronic diseases (Kaur and Gupta 2020).

According to WHO, by 24 June 2021, there were a total of 2,624,733,776 doses of COVID-19 vaccines which have been globally administered, and in Egypt, a total of 4,138,935 doses of vaccines have been administered by 23 June 2021 (**WHO 2021a**).

The Egyptian government makes great efforts to make enough amounts of COVID-19 vaccines available for the Egyptian population with the priority to healthcare workers (**Fares et al. 2021**).

The success of any vaccination program relies on high vaccine acceptance and public willingness to get the vaccine, so what is important is to build public confidence in those emergency-released vaccines (Rhodes et al. 2021).

Vaccine hesitancy which is “the delay in acceptance or refusal of vaccination despite the availability of vaccination services” (**MacDonald 2015**), is a barrier to the success of immunization programs as it was declared by WHO as one of the major 10 threats to the global health (**WHO 2020d**).

The availability of COVID-19 vaccines doesn't usually be translated into its uptake because the vaccination is voluntary (**Dal-R'e et al. 2020**). Several studies found that many health care workers aren't ready to accept vaccines of COVID-19 even after being available in their countries (Shaw et al. 2021; Verger et al. 2021).

Reasons of hesitancy towards COVID-19 vaccines may be attributed to worries about safety and possible side effects of those emergency released vaccines. As well as the speed of their development and approval (Roy et al. 2020; Wang et al. 2020 and Shekhar et al. 2021).

Health care workers are considered by their patients as a reliable source of information about vaccination (Deem 2018); so their acceptance, refusal, or hesitancy to take COVID-19 vaccines will strongly affect the attitude of the general population towards COVID-19 vaccines, as people usually depend on information and actions of their health care workers as a guide for their decisions (Shaw et al. 2021).

Owing to the scarcity of information regarding the hesitancy of health professionals towards the COVID-19 vaccine in Egypt, the present study aimed to determine the acceptability of COVID-19 vaccines among physicians in Gharbia governorate, Egypt, and to address the associated factors of unacceptability.

Methods

Study design and setting:

A web-based cross-sectional study was held from March to June 2021 in Gharbia governorate which is located in the Middle Nile Delta region of Egypt with 5,306,767 populations (CAMPAS 2020).

Study sample:

The target population of this study was physicians on duty at healthcare facilities related to Tanta university hospitals and the Ministry of Health and Population (MOHP) in Gharbia governorate. Exclusion criteria included; physicians who were not actively enrolled in work; in special vacation and retirement.

The sample size was calculated using CDC EPI-INFO 2002 software program. The estimated number of physicians in the Gharbia governorate was 8,317 physicians according to the Egyptian medical syndicate in the governorate. Based on recently published literature, the assumed proportion of the expected outcome (vaccination acceptance) was 50% (Shekhar et al. 2021), with a precision of 3%, confidence level of 95%, and margin of error of 0.5%; a minimum calculated sample of 368 physicians was required. However, we then more than tripled the minimum sample size to ensure wide coverage of physicians in different specialties and job ranks, as well as to overcome any invalid questionnaires.

Participants were recruited using a snowballing random sampling technique. Physicians were contacted by the authors where an electronic survey link using google survey format was sent to participants' emails and cellphones. Also, the survey tool was distributed via links posted on social media platforms in several HCW groups and distributed to administrative leaders in various health facilities. Besides, the respondents were asked to share the questionnaire with eligible colleagues and friends in their social network contact lists. By the end of the study period, 1309 questionnaires were obtained, 41 questionnaires were excluded for being invalid questionnaires and the overall sample size reached 1268.

The nature and aim of the study were explained in detail at the beginning of the electronic survey. At the beginning of the survey, it was declared that they were able to withdraw from the study at any stage. Then, the respondents were kindly asked to fulfill the questionnaire anonymously. Privacy and confidentiality were ensured throughout the survey.

Tools of the study:

Data was collected by using an anonymous self-administered electronic questionnaire which was structured based on similar literature (Grech et al. 2020; Shekhar et al. 2021), it consisted of three parts. The first part; included sociodemographic information. The second part explored the self-perceived risk of COVID-19 infection, exposure history, nature of the work, and degree of contact with patients with COVID-19 infection.

The third part consists of 6 questions related to the acceptance of the COVID-19 vaccine. For validation of the questionnaire, it was reviewed by three experts, whose notes and recommendations were taken into consideration. In current study the test-retest reliability was good (intra-class correlation = 0.82) and the internal consistency (Cronbach α = 0.89).

Statistical analysis:

The analysis of data was conducted through SPSS (IBM) Chicago version 21. Vaccination acceptance was considered as the outcome variable. Explanatory variables included demographics, nature of their work, medical comorbidities, vaccination history, and perceived risk of COVID-19 infection.

Data were presented as frequency and percentage, Chi-squared test was used to examine the difference between substantial groups, when it was not appropriate, Monte-Carlo Exact test was applied instead. The level of significance (*p-value*) was < 0.05.

Results

Out of 1268 respondents, 71.5% aged between 31 to 40 years and 59.4% were females. The majority were married and from urban residences. The physicians who worked in urban health facilities represented 77.2%. 56.4% of them worked in frontline positions, 43.5% in a primary medical subspecialty. Most of the respondents had no medical co-morbidity (65.9%) and 5.8% reported they had chronic cardiovascular diseases (Table 1).

Regarding COVID-19 vaccine acceptability, Table 2 shows that 36.7% of studied physicians refused to take the vaccine if available, 39% would wait for a review while only 24.3% accept to take it. 19.2% and 41.6% reported that they were diagnosed with COVID-19 or one family member was diagnosed with COVID-19 respectively. About one-fifth of physicians wouldn't advise their friends and families to get vaccinated for COVID-19 (21.6%). When they asked "Do you think you are at risk for getting COVID-19 during the next 1 year?", 55% of them answered they believed that they would get mild symptoms that would not require hospitalization. 32.5% of included physicians reported that they directly take care of COVID-19 patients.

Table 3 investigated the demographic characteristics of participated physicians as predictors for vaccine acceptance, it was noticed that physicians of the youngest age groups, male gender, married ones, and from urban residence significantly accepted to take the vaccines (54%, 43.3%, 40%, 40% respectively) compared to related groups. Vaccine acceptance was significantly higher among physicians who worked in frontline positions and of primary surgical and surgical subspecialty (40.5%, 54.7% respectively). Likely, it was significantly higher between physicians who had someone they personally knew diagnosed with COVID-19 and had direct contact with COVID-19 patients (47.7%, 40.8%, $p < 0.0001$ respectively). Moreover, all the physicians who believed that they may get severe COVID-19 symptoms that may require admission to the intensive care unit accepted the idea to take the vaccine while the highest refusal rate was among physicians who think that they are immune because they already have the disease (41%).

Table 4 demonstrated that getting the influenza vaccine last year was significantly associated with vaccine acceptability (56.1%, $p = 0.0001$). As well, absence of medical co-morbidity, obesity, and nonsmoking status (41.2%, 50.9%, 39.4%, $p = 0.014, 0.024, 0.019$ respectively) also associated with higher vaccine acceptability.

As shown in Fig. 1 the most frequently reported reasons for vaccination unacceptability were; fear of adverse side effects followed by, the short duration of clinical trials then, safety and efficacy concerns at a rate of 60%, 49.5%, and 33.2% respectively

Discussion

As COVID-19 vaccines became available, countries put the vaccination of healthcare workers as a priority, due to the importance of their protection. The attitudes of healthcare workers towards vaccination can strongly affect their decision of vaccine intake as well, the opinion and attitude of the general population towards vaccination (Paudel et al. 2021).

Regarding the acceptability of the COVID-19 vaccine among physicians, the present study showed that only 24.3% of the included physicians accepted to take the vaccine when available while 36.7% of them refused to take it and 39% would wait for a review before deciding to take it.

Comparable findings were reported by another study done in Egypt by Fares et al., as they found that 21% of HCWs were willing to take the COVID-19 vaccine and 28% were not willing while the largest percentage of their participants were found undecided (51%) (Fares et al. 2021).

Nearly similar findings were found in other countries in Africa by Nzaji et al. as they found in their study in the Democratic Republic of Congo that about 28% of HCWs were willing to take the COVID-19 vaccines when available (Nzaji et al. 2020).

However, in Ghana, Agyekum et al., found that 39.3% of HCWs accepted to get the COVID-19 vaccines while more than half of them indicated non-acceptance (Agyekum et al. 2021).

In Saudi Arabia, Qattan et al., in their study found that more than half of their healthcare workers were willing to take the COVID-19 vaccine if it is provided free by their government, while 49.48% were not willing (Qattan et al. 2021).

A lower percent of vaccine refusal was reported in the United States, as Shekhar et al., in their study reported that only 8% of HCWs refused to be vaccinated, with a higher percentage of them accepted to take the vaccine (36%) while the greatest percent was the HCW who waited for a review before being vaccinated (56%) (Shekhar et al. 2021). Nearly similar percent of vaccine acceptance was reported by Paudel et al., in Nepal (38.3% of their participants) (Paudel et al. 2021).

A higher percent of COVID-19 vaccines acceptance was detected in the United States as Shaw et al. found that 58% of HCWs accepted to get the vaccine if available (Shaw et al. 2021).

Also, in Canada and Belgium, the level of COVID-19 vaccine acceptance was high in 48.6% of the physicians, 23 % showed moderate acceptance while only 28.4% showed hesitancy towards vaccination (Verger P et al.2021). A much higher rate of physicians' acceptance was recorded by an Canadian study, as Dzieciolowska et al., found that 80.9% accepted to take the vaccine while only 19.1% refused (Dzieciolowska et al. 2021).

According to the authors' point of view, these differences in willingness to take COVID-19 vaccines among different countries may be attributed to the high prevalence of conspiracy theories about COVID-19 as it was intentionally introduced into the world to get benefits on developing vaccines for it. Also, the spread of misinformation about the quality and safety of COVID-19 vaccines especially among developing countries affect the level of vaccine acceptance among people including physicians and other healthcare workers.

The current study showed that 19.2% of the included physicians were diagnosed with COVID-19 and 41.6% had a family member diagnosed with COVID-19. Comparable results were reported by Qattan et al., in their study among HCWs in Saudi Arabia (Qattan et al. 2021).

Lower percent of HCWs who were diagnosed or had family members diagnosed with COVID-19 were reported by Paudel et al., in Nepal (13.9% and 9% respectively) and by Shekhar et al., in United States (2.6% and 13% respectively) (Paudel et al. 2021 and Shekhar et al. 2021). On contrary, Fares et al., in their study in Egypt, found that more than one-third of their HCWs were previously diagnosed with COVID-19 (Fares et al. 2021).

Regarding how the Egyptian physicians perceived the risk of acquiring COVID-19 during the next year, more than half of our included physicians believed that they may get the disease but with mild symptoms that may not require hospitalization. On the other hand, 9.8% were sure that they will not get COVID-19 and only 1.3% believed that they will get a serious disease that may require admission to the intensive care unit.

In the United States, Shekhar et al. 2021 found that the majority of their participants thought that they are at risk to get COVID-19 with a higher percentage than ours of HCWs (21%) who thought that they may be at risk of getting a serious disease that may require hospitalization with less than 8% were confident that they will not get COVID-19 (Shekhar et al. 2021). Furthermore, in Saudi Arabia, Qattan et al. 2021 found that the majority of HCWs believed that COVID-19 poses a significant risk to the people of Saudi Arabia (Qattan et al. 2021). These findings may explain the reported higher level of vaccine acceptance among HCWs in the United States and Saudi Arabia more than in Egypt.

The current study showed that 32.5% of physicians were directly taking care of COVID-19 patients, while about half of the HCWs in the study of Shekhar et al., had taken care of COVID-19 patients directly (Shekhar et al. 2021).

As regards the sociodemographic characteristics of recruited physicians as predictors for vaccine acceptance, the current study found that the level of COVID-19 vaccine acceptance was higher among the younger physicians, males, married ones, and those who live in urban areas with statistical significance (54%, 43.3%, 40%, and 40% respectively).

In contrary to our findings, Dzieciolowska et al. found that the level of COVID-19 vaccine was higher among Canadian physicians aged more than 50 years, while they agreed with ours regarding the gender of physicians with high vaccine acceptance (Dzieciolowska et al. 2021).

Also, Shekhar et al. 2021 in the United States reported figures that contradict our age group of physicians with high vaccine acceptance. They found that the acceptance of vaccination against COVID-19 increased with increasing age as 47% aged more than 70 years old. But they agreed with our findings as they found that male HCWs and those in urban areas had higher acceptance of the vaccine (Shekhar et al. 2021).

Also, gender was detected as a predictor of the level of COVID-19 vaccine acceptance among physicians and other healthcare workers in Saudi Arabia as Qattan et al. 2021 found that more males (72.19%) accepted to be vaccinated when available than females but at the same time they didn't find any significant difference among different age groups (Qattan et al. 2021). The same findings were reported by two similar studies conducted in Egypt and Ghana (Fares et al. 2021 ; Agyekum et al. 2021).

The higher likelihood for male physicians to accept to take COVID-19 vaccine than females could be explained by the authors due to the increased perception of males about the risk of the disease more than females

Regarding the place of work, the present study found that the COVID-19 vaccine acceptance was higher among frontline physicians and of primary surgical and surgical subspecialty with statistical significance (40.5%, 54.7% respectively). The same findings were found in Saudi Arabia by Qattan et al. 2021 (Qattan et al. 2021). This could be due to the perceived risk of contagion infection between frontline HCWs is high rather than their colleagues in other departments.

In contrary to our results, Dzieciolowska et al. didn't find any association between the COVID-19 vaccine acceptance and the type of workplace (Dzieciolowska et al.2021).

Moreover, in the present study, all physicians who thought that they will acquire severe COVID-19 symptoms that may need admission to the intensive care unit were willing to get COVID-19 vaccine while the refusal rate was highest among those who believed that they are immune as they already get the disease (41%).

On contrary, Shekhar et al..2021 reported that only 36% of their HCWs who found themselves at risk to get severe COVID-19 that may require entrance into the intensive care unit were willing to be vaccinated while the highest percent of vaccine refusal was among HCWs who were sure that they won't get COVID-19 (Shekhar et al. 2021).

Qattan et al.2021 in Saudi Arabia, found that physicians and other HCWs with low or very low concern about getting COVID-19 infection were less willing to get the vaccine (Qattan et al. 2021).

In the present study, we found that physicians who got the influenza vaccine in the last year accepted to take the vaccine more than those who didn't. As well, the absence of medical co-morbidities, obesity, and smoking were associated with higher vaccine acceptability. Similar results were reported by Qattan et al.2021 in their study (Qattan et al. 2021), whereas nearly similar findings were found in a study done by Shekhar et al.2021 except in the effect of smoking as they found that more than half of HCWs wither smokers or non-smokers wait for a review before deciding to et COVID-19 vaccine (Shekhar et al. 2021).

Regarding the reasons for not accepting to get COVID-19 vaccine, the present study found that the most frequent reasons for vaccination unacceptability among the included Egyptian physicians were; fear of adverse side effects as it was reported by more than half of physicians followed by, the short duration of clinical trials performed on the vaccine then, concerns about the vaccine safety and efficacy were reported by only one-third of physicians.

Similar findings with the same order of reasons of unacceptance were reported by Qattan et al.2021 in their study among HCWs in Saudi Arabia (Qattan et al. 2021).

This was also in agreement with Fares et al., findings in Egypt, as they found that lack of enough clinical trials done on the vaccine before its use was reported as the main cause of vaccine refusal in 92.4% of their participants and fear of its unexpected side effects was in 91.4% of them. Also, the unknown level of its protection or immunity duration and the rumors about the type of available vaccines in Egypt has participated in hindering vaccination acceptance (Fares et al. 2021).

In the United States, Shekhar et al.2021 found that the most frequent concerns were worries about the vaccine efficacy, side effects, and rapidity of its development. Moreover, some HCWs showed poor trust in the government and regulatory authorities and, also in justification of prescribing the vaccine (Shekhar et al. 2021).

Concerns about vaccines' safety, effectiveness, and duration of clinical trials and testing were also reported as common reasons for vaccination hesitancy or unacceptance in other studies done in Australia and United States (Dodd et al., 2021 and Pogue et al., 2020).

All these findings suggest the importance of dissemination of true information about COVID-19 vaccines through medical agencies, governmental authorities, and professional societies, to increase vaccine acceptance and its uptake by physicians and other HCWs (Shekhar et al. 2021).

Conclusions

The level of acceptance of the COVID-19 vaccine among physicians is low, with only less than a quarter of them was willing to get the vaccine and the rest refused to be vaccinated or were undecided and chose to wait for a review for more data about the vaccine before receiving it. Some of the physicians' demographic characteristics, their health condition, and their perception about their risk of getting COVID-19 infection were important associated determinants for vaccine acceptance among them.

Recommendations:

The present study provides the Egyptian authorities with data and predictors of COVID-19 acceptance among physicians and their concerns that can be modified to increase the level of vaccine acceptance among them and in turn among the whole community. Thus we can reach the desired coverage rate of vaccination. This can be accomplished through awareness campaigns via the governmental health authorities to disseminate transparent information about the available vaccines; their safety and efficacy.

Declarations

Ethics approval and consent to participate

An ethical approval was obtained from the Research Ethics Committee at the Faculty of Medicine, Tanta University before conduction of the study. As well, we get permission from responsible local Ministry of Health Authorities in the Gharbia governorate. All procedures performed in the study followed the 1964 Helsinki declaration and its later amendments. The nature and objectives of the study were explained in details at the beginning of the electronic survey and consent for participation in the study was taken from all individual respondents before being enrolled in the study.

Consent for publication

Not applicable

Availability of data and materials

The datasets generated and analyzed during the current study are not publicly available due to belongingness of these data to the local health authorities in the Gharbia governorate. However, he

datasets are available from the corresponding author on a reasonable request.

Competing interests

The authors declare that they have no competing interests.

Funding

The authors declared that no funding for this work was received.

Authors' contributions

WM had designed the study methodology, collected the related data and drafted the manuscript. AA had participated in data collection and writing the manuscript. MM helped in data gathering , performed the statistical analysis of recruited data and was responsible for the publishing. The manuscript was extensively reviewed by both authors.

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Tables

Table 1
Sociodemographic characteristics of the studied physicians

Variables	n = 1268	%
Age(years)	113	8.9
- 18–30	907	71.5
- 31–40	200	15.8
- 41–50	48	3.8
- 51–60		
Gender	515	40.6
- Male	753	59.4
- Female		
Social status	246	19.4
- Single	1022	80.6
- Married		
Residence	1143	90.1
- Urban	125	9.9
- Rural		
Health care facility	979	77.2
- Urban area	119	9.4
- Suburban area	170	13.4
- Rural area		
Education	54	4.3
- Bachelor degree	79	6.2
- Diploma degree	105	8.3
- Associate degree	456	36
- Master's degree	574	45.3
- Doctorate's degree		
Nature of work	715	56.4
- Frontline position	553	43.6
- Others, no direct patients contact		

Variables	n = 1268	%
Primary area of work	551	43.5
- Primary medical and medical subspecialty	139	11.0
- Primary surgical and surgical subspecialty	306	24.1
- Diagnostic subspecialty	272	21.5
- Others		
Income	320	25.2
- Not enough	712	56.2
- Enough	236	18.6
- Enough and saving		
Education	54	4.3
- Bachelor degree	79	6.2
- Diploma degree	105	8.3
- Associate degree	456	36
- Master's degree	574	45.3
- Doctorate's degree		
Medical condition	835	65.9
- No chronic morbidity	73	5.8
- Cardiovascular diseases	29	2.3
- COPD-Lung diseases	15	1.2
- Diabetes Mellitus	3	0.2
- Cancer	27	2.1
- Immuno-compromised/on immunosuppressant	112	8.8
- Obesity	25	2.0
- Smoking	149	11.8
- Others		

Table 2

Risks of COVID-19 infection and vaccine acceptance among the studied physicians (n = 1268).

Variables	No.	%
Have you or your family member or someone you know been diagnosed with COVID-19?	243	19.2
- I was diagnosed with COVID-19	528	41.6
- A family member was diagnosed with COVID-19	371	29.3
- Someone I personally know diagnosed with COVID-19	126	9.9
- No one I personally know diagnosed with COVID-19		
When the COVID-19 vaccination becomes available, would you take it?	465	36.7
- No	495	39.0
- Wait for review	308	24.3
- Yes		
Would you advise friends and family to get vaccinated for COVID-19?	274	21.6
- No	496	39.1
- Not sure	498	39.3
- Yes		
COVID-19 Vaccine for health care workers should be:	65	5.1
- Mandated by employer	424	33.4
- Mandated by the government	343	27.1
- Not sure	436	34.4
- Voluntary		
Did you receive the COVID-19 Vaccine?	986	77.8
- No	282	22.2
- Yes		

Variables	No.	%
Do you think you are at risk for getting COVID-19 during the next 1 year?	234	18.5
- No,I already have the disease and I am immune to it (not diagnosed by PCR).	124	9.8
- No, I am sure that I won't get infected.	28	2.1
- No, I have already recovered and won't re-infect (diagnosed by PCR).	706	55.7
- Yes, I believe I will get mild symptoms that will not require hospitalization.	160	12.6
- Yes, I believe I will get moderate symptoms that probably will need hospitalization.	16	1.3
- Yes, I believe I will get severe symptoms that will probably require admission to the intensive care unit.		
Have you directly or indirectly taken care of COVID-19 patients?	475	37.5
- No	381	30.0
- Yes, but with no direct patients' contact	412	32.5
- Yes, with patients' contact		

Table 3

Sociodemographic characteristics of participated physicians as predictors for vaccine acceptance

Variable	No, <i>n</i> = 465	Wait for review, <i>n</i> = 308	Yes, <i>n</i> = 495	<i>Test of significance p-values</i>
Age(years)	37(32.7%)	15(13.3%)	61(54%)	$\chi^2 = 19.2$
- 18–30	341(37.6%)	219(24.1%)	347(38.3%)	0.004^*
- 31–40	66(33%)	62(31%)	72(36%)	
- 41–50	21(43.8%)	12(25%)	15(31.2%)	
- 51–60				
Gender	169(32.8%)	123(23.9%)	223(43.3%)	$\chi^2 = 7.61$
- Male	296(39.3%)	185(24.6%)	272(36.1%)	0.02^*
- Female				
Social status	89(36.1%)	71(28.9%)	86(35%)	$\chi^2 = 3.94$
- Single	376(36.8%)	237(23.2%)	409(40%)	0.13
- Married				
Residence	411(36%)	274(24%)	458(40%)	$\chi^2 = 5.29$
- Urban	54(43.2%)	34(27.2%)	37(29.6%)	0.07
- Rural				
Educational level	6(11.1%)	6(11.1%)	42(77.8%)	$\chi^2 = 81.32$
- Bachelor degree	34(43.1%)	20(25.3%)	25(31.6%)	$< 0.0001^*$
- Diploma degree	21(20%)	15(14.3%)	69 (65.7%)	
- Associate degree	172(37.7%)	135(29.6%)	149(32.7%)	
- Master's degree	232(40.4%)	132(23%)	210(36.6%)	
- Doctorate degree				
Income	113(35.3%)	91(28.4%)	116(36.3%)	$\chi^2 = 9.96$
- Not enough	275(38.6%)	168(23.6%)	269(37.8%)	0.04
- Enough	77(32.6%)	49(20.8%)	110(46.6%)	
- Enough and saving				

 χ^2 Chi square test, MCET Monte Carlo Exact Test ,* P < 0.05

Variable	No, <i>n</i> = 465	Wait for review, <i>n</i> = 308	Yes, <i>n</i> = 495	Test of significance <i>p</i> -values
Nature of work	238(33.3%)	187(26.2%)	290(40.5%)	$\chi^2 = 8.4$
- Frontline position	227(41%)	121(21.9%)	205(37.1%)	0.01*
- Others, no direct patients contact				
Primary area of work	195(35.4%)	116 (21 %)	240(43.6%)	$\chi^2 = 61.6$
- Primary medical and medical subspecialty	33(23.7%)	30 (21.6%)	76(54.7%)	< 0.0001*
- Primary surgical and surgical subspecialty	149 (48.7%)	90 (29.4%)	67 (21.9%)	
- Diagnostic subspecialty	88(32.3%)	72(26.5%)	112(41.2%)	
- Others				
Health care facility	361 (36.9%)	223 (22.8%)	395 (40.3%)	$\chi^2=12.56$
- Urban area				0.014*
- Suburban area	57 (33.5%)	69 (40.6%)	44 (25.9%)	
- Rural area	47 (39.5%)	41 (34.5%)	31 (26%)	
Have you or your family member or someone you know been diagnosed with COVID-19?	70(28.8%)	96(39.5%)	77(31.7%)	$\chi^2 = 95.13$
	260(49.3%)	83(15.7%)	185 (35%)	< 0.0001*
- I was diagnosed with COVID-19	93(25.1%)	101(27.2%)	177 (47.7%)	
- A family member was diagnosed with COVID-19	42(33.3%)	28(22.3%)	56 (44.4%)	
- Someone I personally know diagnosed with COVID-19				
- No one I personally know diagnosed with COVID-19				

χ^2 Chi square test, MCET Monte Carlo Exact Test ,* P < 0.05

Variable	No, <i>n</i> = 465	Wait for review, <i>n</i> = 308	Yes, <i>n</i> = 495	Test of significance <i>p</i> -values
Do you think you are at risk for getting COVID-19 during the next 1 year?	96(41%)	55(23.5%)	83(35.5%)	<i>MCET</i> = <i>60.3</i>
- No, I already have the disease and I am immune to it (not diagnosed by PCR).	43(34.7%)	21(16.9%)	60(48.4%)	<i>< 0.0001*</i>
- No, I am sure that I won't get infected.	0(0%)	16(57.1%)	12(42.9%)	
- No, I have already recovered and won't re-infect (diagnosed by PCR).	268(38.0%)	171(24.2%)	267(37.8%)	
- Yes, I believe I will get mild symptoms that will not require hospitalization.	58(36.3%)	45(28.1%)	57(35.6%)	
- Yes, I believe I will get moderate symptoms that probably will need hospitalization.	0(0%)	0(0%)	16(100%)	
- Yes, I believe I will get severe symptoms that will probably require admission to the intensive care unit.				
Have you directly or indirectly taken care of COVID-19 patients?	205(43.2%)	88(18.5%)	182(38.3%)	$\chi^2 = 24.6$
- No	125(32.8%)	111(29.1%)	145(38.1%)	<i>0.0003*</i>
- Yes, but no direct patients' contact	135(32.7%)	109(26.5%)	186(40.8%)	
- Yes, with patients' contact				
χ^2 Chi square test, MCET Monte Carlo Exact Test ,* P < 0.05				

Table 4

Vaccination history and some medical comorbidities of participated physicians by vaccine acceptance

Variable	No, <i>n</i> = 465	Wait for review, <i>n</i> = 308	Yes, <i>n</i> = 495	Test of significance <i>p</i> -values
Getting influenza vaccine last year	380(44.4%)	212(24.8%)	264(30.8%)	$\chi^2 = 88.4$
- No(<i>n</i> = 856)	85(20.6%)	96(23.3%)	231(56.1%)	<i>0.0001*</i>
- Yes (<i>n</i> = 412)				
Children received vaccines	110 (36.3%)	84 (27.7%)	109 (36%)	$\chi^2 = 8.71$
- No(<i>n</i> = 303)		169 (22.1%)	299 (39.2%)	<i>0.06</i>
- Yes(<i>n</i> = 763)	295 (38.7%)	55(27.2%)	87(43.1%)	
- No applicable(<i>n</i> = 202)	60 (29.7%)			
Medical comorbidities	284 (34%)	207 (24.8%)	344 (41.2%)	$\chi^2 = 7.89$
- No <i>n</i> = 835	181(41.8%)	101 (23.3%)	151 (34.9%)	<i>0.014*</i>
- Yes <i>n</i> = 433				
Cardiovascular disease	436 (36.5%)	293 (24.5%)	466 (39%)	$\chi^2 = 0.65$
- No (<i>n</i> = 1195)		15 (20.6%)	29 (39.7%)	<i>0.7</i>
- Yes <i>n</i> = 73	29 (39.7%)			
Diabetes mellitus	459 (36.6%)	302 (24.1%)	492 (39.3%)	$\chi^2 = 2.99$
- No (<i>n</i> = 1253)		6 (40%)	3 (20%)	<i>0.2</i>
- Yes (<i>n</i> = 15)	6 (40%)			
COPD-Lung disease	459 (37%)	295 (23.8%)	485 (39.2%)	<i>MCET</i> = 6.75
- No (<i>n</i> = 1239)	6 (20.7%)	13 (44.8%)	10 (34.5%)	<i>0.034*</i>
- Yes (<i>n</i> = 29)				
Cancer	462 (36.5%)	308 (24.3)	495 (39.1%)	<i>MCET</i> = 6.03
- No (<i>n</i> = 1265)		0	0	<i>0.049*</i>
- Yes (<i>n</i> = 3)	3 (100)			

 χ^2 Chi square test, MCET Monte Carlo Exact Test ,* *P* < 0.05

Variable	No, <i>n</i> = 465	Wait for review, <i>n</i> = 308	Yes, <i>n</i> = 495	Test of significance <i>p</i> -values
Obesity BMI ≥ 30	430 (37.2%)	288 (24.9%)	438 (37.8%)	$\chi^2 = 7.5$
- No (<i>n</i> = 1156)		20 (17.9%)		<i>0.024*</i>
- Yes (<i>n</i> = 112)	35 (31.3%)		57 (50.9%)	
Immunocompromised /on immune-suppressants	451 (36.3%)	301 (24.3%)	489 (39.4%)	$\chi^2 = 3.76$
- No (<i>n</i> = 1241)	14 (51.9%)	7 (25.9%)	6 (22.2%)	<i>0.15</i>
- Yes (<i>n</i> = 27)				
Smoking	458 (36.8%)	296 (23.8%)	489 (39.4%)	$\chi^2 = 7.9$
- No (<i>n</i> = 1243)		12 (48%)		<i>0.019*</i>
- Yes (<i>n</i> = 25)	7 (28%)		6 (24%)	
Other Medical condition	384 (34.3%)	280 (25%)	455 (40.7%)	$\chi^2 = 22.9$
- No (<i>n</i> = 1119)		28 (18.8%)		<i>0.0001*</i>
- Yes (<i>n</i> = 149)	81 (54.4%)		40 (26.8%)	
χ^2 Chi square test, MCET Monte Carlo Exact Test ,* <i>P</i> < 0.05				

Figures

Figure 1

Reasons for COVID-19 vaccine unacceptance.