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Knowledge and attitudes towards COVID-19 vaccination among medical and paramedical students

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ABSTRACT

Background: Vaccine hesitancy poses severe challenges in achieving population immunity. Achieving high COVID-19 vaccination acceptance rates to ensure medical students' coverage as future health care providers is necessary. This study aims to assess the knowledge and attitude towards the COVID-19 vaccine among medical and paramedical students to determine factors and barriers influencing vaccination decision making. *Method:* A cross sectional, survey based study was conducted among Al Rayan medical and paramedical students. Data were collected via an online questionnaire and analyzed by SPSS with descriptive statistics. *Results:* In total, 465 students completed the survey. Over all, students expressed good knowledge of vaccination safety. However, students expressed different opinions towards receiving the vaccine. 52.4% of students showed great uncertainty towards the vaccine, 20.9% refused to take it and only 26.7% expressed that they would take it with great confidence. However, 50.5% of students expressed doubts about the vaccine's efficacy and 52.7% thought the vaccination process was expedited. In addition, 50.6% of respondents think they do not need to be vaccinated because they are still young and healthy. *Conclusion:* Medical and paramedical students have different outlooks toward vaccination. Several factors contribute to their decision, such as the lack of confidence in data provided by the media and authorities regarding the safety and validation process. Therefore, there is a severe need to educate young adults regarding the importance of vaccination to minimize the negative consequences of COVID-19.

Keywords: COVID-19, Hesitancy, Vaccine, Knowledge, Medical students.

1. INTRODUCTION

SARS CoV 2 is a retro virus that is the cause of COVID-19 (Adil et al., 2021). It was first noted to have occurred in Wuhan, China, and the world health

Organization, WHO, reported the first case on December 31, 2019 (Adil et al., 2021). The outbreak was declared a global pandemic on March 11, 2020. Millions of people world wide have died of the SARS CoV 2 virus, with many cases confirmed in the Kingdom of Saudi Arabia (Ghadimi-Moghadam et al., 2020; Yezli & Khan et al., 2020). Approximately 80% of the cases in Saudi Arabia have recovered, while only 15% became seriously ill and required oxygen supply. However, it must be taken in to consideration that 5% were put in to intensive care units as they became critically ill (Nwankwo & Ezeome et al., 2011; Xiao et al., 2020; Horwitz et al., 2021). Symptoms of SARS CoV-2 include cough, fever, shortness of breath and fatigue (Yuki et al., 2020). Additionally, some patients had complications such as acuterespiratory distress syndrome, respiratory failure, septic shock, multi organ failure, sepsis, and throm boem bolisms (Dushianthan et al., 2011). Some patients' bodily organs, such as the heart, liver and kidneys, were injured, leading to a high mortality rate (Nwankwo & Ezeome et al., 2011). Central nervous system complications such as altered states of consciousness, impaired cognitive ability, seizures and encephalopathy have also been reported (Pugin et al., 2020; Leonardi et al., 2020).

Preventive strategies for SARS CoV 2 aim to reduce disease transmission by education, isolation, prevention, transmission management and treatment of infected people (Lotfi et al., 2020; Saied et al., 2021; George & Mallery et al., 2019). In addition increased awareness of vaccine programs has been under taken by pharmaceutical companies (Kaur & Gupta et al., 2020). However several reports suggestthat vaccines could have severe complications for some individuals (Iwasaki & Yang et al., 2020; Lambert et al., 2020). For example the Moderna vaccine has caused encephalopathy and seizures in patients with no known previous conditions, although there have been very few incidents (Goss et al., 2021; Román et al., 2021). Two people who received the Oxford/Astra Zeneca vaccine developed myelitis, but only two out of the thousands have taken the vaccine (Román et al., 2021). Bell's palsy and unexplained facial muscle weakness or paralysis were found in a few patients, while mild symptoms of other vaccine side effects have also been reported more widely (Cirillo & Doan et al., 2021). The unfortunate problem is that these vaccine reports have been over inflated in media out lets, creating vaccine hesitancy (Surapaneni et al., 2021).

Hesitancy is a multi dimensional issue with factors such as convenience, complacency and confidence complicating the 88 issues of safety perception, while also affected by the reception of disease risk, the effectiveness and the competence of health care systems (Sowa et al., 2021; Betsch et al., 2015). Historical, cultural, ecological, socio economic, health practices and political factors all influence perceptions about the decision to take the vaccine (Riad et al., 2021). In addition, common factors concerning vaccines, such as needles, pain and opposition to vaccinations in general, have all factored into hesitancy (Larson et al., 2014; Ullah et al., 2021). However, pro vaccination messaging through media and social media has significantly impacted vaccination programs (Ullah et al., 2021). Health care providers have been studied to determine acceptance of the COVID-19 vaccine. However providers and students show low acceptance of the vaccine (Saied et al., 2021; Barello et al., 2020; Sallam et al., 2021; El Sokkary et al., 2021). The personal choice concerning the vaccine is essential for health care workers, as they are more likely to be exposed to the illness and should protect them selves and others from further spread (Fares et al., 2021; Lucia et al., 2021). Therefore, vaccinations for health care workers are recommended due to their high exposure to sick patients and their influence on the greater community (Lucia et al., 2021; Betsch & Wicker et al., 2012). Accordingly, the main aim of this study is to assess the knowledge and attitude toward the vaccine for COVID-19 among paramedical and medical health care workers (Zaitoon et al., 2022; Li et al., 2021).

2. MATERIALS AND METHODS

The study was designed with a cross sectional survey based methodology conducted after IRB approval on November 15, 2021, from The Biomedical Committee of Research Ethics at the faculty of medicine at Umm Al-Qura University approved the study under approval no (HAPO-02-K-012-2021-12-893). The study continued for three months, from November 2021 to February 2022**.** The sample size of 465 paramedical and medical students from Al-Rayan colleges in Saudi Arabia (51% female and 49% male participants) was calculated based on the confidence level of 95%, a significant margin of 5%, population proportion of 50% and populations size rounded to 1300 students.

The online questionnaire consisted of an electronic consent form and an option to agree or disagree to participate, followed by 22 modified attitudes towards COVID-19 vaccination questions that had been previously validated and tested in research (Saied et al., 2021). The intention was to assess previous immunization behavior, general attitudes, and perceptions of vaccines, along with understanding current knowledge about the COVID-19 vaccines and personal experiences with the illness. Demographic data were also collected.

Statistical analysis

Analysis was conducted using a statistical package for social science version 26 (SPSS 26), with the p-value statistically significant when it was less than or equal to 0.05. The t-test was used to determine differences in means between demo graphic groups used as continuous variables. A chi test was also utilized to determine differences in proportions with in the categories of the categorical data. All participants' confidentiality was privileged and used only for research purposes.

3. RESULTS

This study included 465 participants aged between 18 and 29 years. The participant group comprised 51% female and 49% male (Table 1). 26.7% of the enrolled students accepted the vaccine, 52.4% were he sitant and 20.9% said they would refuse it (Figure 1). Sub categories included the specialty of the college with 20.6% in medicine, 16.8% in anesthesia, 29.2% in pharmacy and 33.1% in nursing. About half of the students 46.2% had just enough income, while approximately 1/3 expressed that they were with in good financial range (Table 1).

Table 1 Socio-demographic and academic factors (number, percent) of medical and paramedical students (n= 465)

Parameters		N	(%)
Language	Arabic	280	60.2
	English	185	39.8
Gender	Female	237	51.0
	Male	228	49.0
Age	18 - 21	135	29.0
	22 - 25	235	50.5
	26 - 29	95	20.4
Specialty	Anesthesia	78	16.8
	Clinical pharmacy	136	29.2
	Medicine	96	20.6
	Nursing	154	33.1
Academic Year	First Year	58	12.5
	Second Year	99	21.3
	Third Year	77	16.6
	Fourth Year	90	19.4
	Fifth Year	71	15.3
	Sixth Year	70	15.1
Average monthly household income	Barely sufficient without saving	215	46.2
	Insufficient	107	23.0
	Sufficient with enough to spare	143	30.8

Regarding the participants previous experience with the infection, 38.7% were not infected and 17.6% had a confirmed diagnosis of COVID-19 (Table 2). However, more than half said that some one had been confirmed with the virus in their close social network. Of those who had experienced some one close to them diagnosed with COVID-19, 25.4% accepted the vaccine, 51.2% were hesitant, and 23% refused the vaccine (Figure 2). There is who stated that they believed their knowledge of the infection was good, 17.6% were acceptors, but only 7.3% of those with a low level of knowledge said they would refuse the vaccine (Table 2).

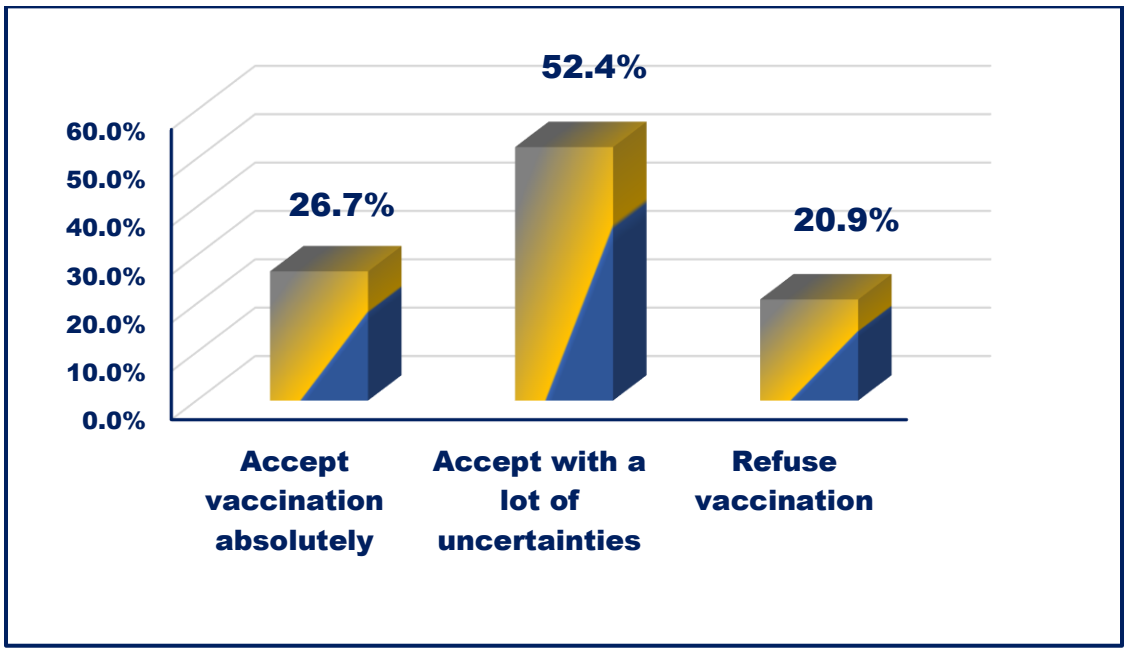

Figure 1 Hesitancy status about COVID-19 vaccination among medical and paramedical students

Table 2 COVID-19 vaccination linked parameters (number and percent) among medical and paramedical students (n= 465)

Parameter	N (%)
How do you evaluate your health condition in general?	
Very Good	82(17.6)
Good	141(30.3)
Neutral	122(26.2)
Bad	86(18.5)
Very Bad	34(7.3)
Have you been diagnosed with Coronavirus in the previous period?	
Not sure	67 (14.4)
No, I have not had corona	180 (38.7)
Yes, +ve COVID test	82 (17.6)
Suspected	136 (29.2)
Has someone in your close circle (such as a family member or close friend) been infected with the Corona virus in the previous period?	
I do not know	75 (16.1)
No	132 (28.4)
Yes	258 (55.5)
Have you ever been vaccinated for seasonal influenza?	
I was just vaccinated last year	162 (34.8)
No, I have never been vaccinated	90 (19.4)
Yes, I regularly get vaccinated every year	81 (17.4)
Yes, I was vaccinated this year for the first time	132 (28.4)
If you weren't vaccinated for seasonal influenza until now, do you plan to get vaccinated during the rest of the season?	
Maybe	99 (21.3)
No	195 (41.9)

Yes	171 (36.8)
Do you think there is enough information about the safety of vaccination against corona?	
No	232 (49.8)
Yes	233 (50.1)
What kind of vaccination do you prefer to get?	
Chinese – Sinovac	84 (18.1)
Moderna	93 (20.0)
Oxford – AstraZeneca	88 (18.9)
Pfizer	73 (15.7)
Russian - Sputnik V	77 (16.6)
No knowledge of the different types	50 (10.7)

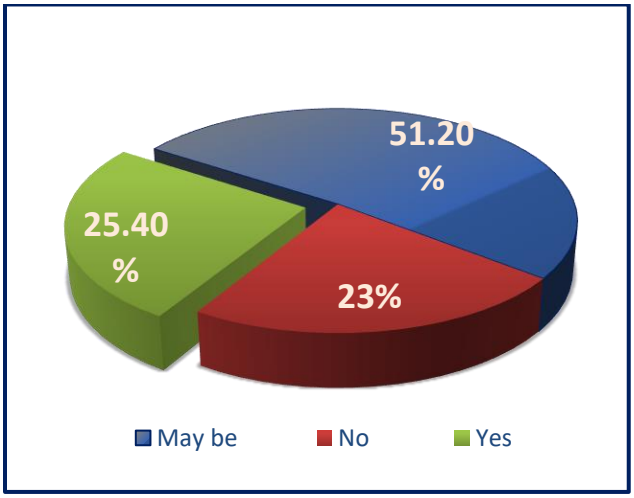

Figure 2 Students' intention to get the COVID-19 vaccine

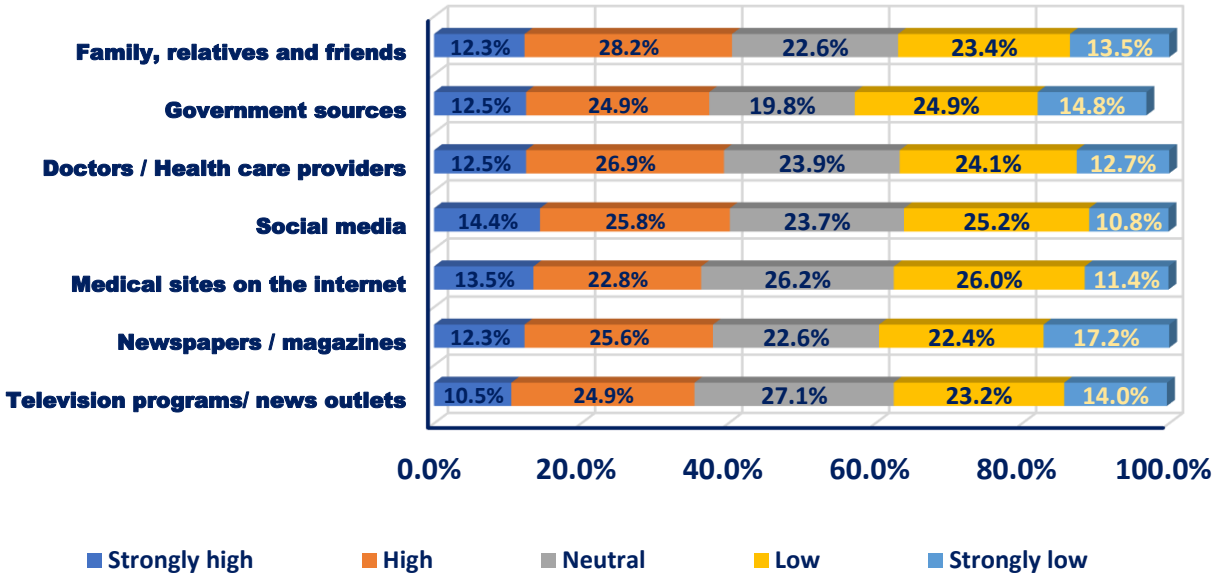

Figure 3 Different sources of information about the COVID-19 vaccination among medical and paramedical students

We also identified the primary sources for gaining knowledge about the infection. The government, social media and medical web sites were medically reputable. However, television and newspapers were the least common form of information gathering

(Figure 3). The students who had experienced side effects from other vaccinations constituted 221 respondents, of which 47.5% were against all vaccinations. An additional 44.5% of students said that they feared getting infected via the vaccine, while 49.5% believed there was no need to be vaccinated because they would have a low likelihood of complications (Table 3). Therefore, the absence of knowledge of the vaccine's safety and its side effects has led to significant hesitance and doubts about vaccines' importance (Table 4).

Table 3 Students' attitude regarding COVID-19 vaccination (n= 465)

Statement	Agree		Disagree	
	Number	%	Number	%
I think the vaccine's validation and provision ensure that it is safe for users.	255	54.8	210	45.2
Mass vaccination will result in overcoming the Corona pandemic.	242	52.0	223	47.9
The vaccination is the best way to beat the Corona virus's effects and complications.	238	51.2	227	48.8
I think the preparation of the Corona vaccine was rushed without enough trials.	245	52.7	220	47.3
I have concerns about the potential side effects of the vaccine.	219	47.1	246	52.9
I have some doubts about the vaccine's effectiveness against corona.	235	50.5	230	49.5
I had terrible experiences with side effects from Previous Vaccinations.	216	46.5	249	53.5
I am against all Vaccinations.	221	47.5	244	52.5
I am fearful of getting infected with the Coronavirus via the vaccine itself	207	44.5	258	55.5
I do not need to get vaccinated because I would be treated and recover without complications if I were to get infected.	230	49.5	235	50.6
I do not need to get vaccinated because I think I am not among those immunocompromised.	235	50.6	230	49.5

Table 1 Beliefs regarding COVID-19 vaccination among medical and paramedical students (n= 465)

Questions	Very Important	Important	Somewhat Important	Not Important
	N (%)	N (%)	N (%)	N (%)
How important do you believe the COVID-19 vaccine is?	80 (17.2)	114 (24.5)	110 (23.6)	161(34.6)
How important do you think it is for all members of society to obtain the Corona Vaccine?	81 (17.4)	111 (23.8)	127 (27.3)	146 (31.3)
Do you see that the Corona Vaccine should be mandatory for everybody?	63 (13.5)	114 (24.5)	120 (25.9)	168 (36.1)
How much do you care about the Corona Vaccine	56 (12)	115 (24.7)	116 (24.9)	178 (38.3)
Is it necessary for all health care workers to obtain the Coronavirus Vaccination?	89 (19.1)	109 (23.4)	124 (26.6)	143 (30.8)

4. DISCUSSION

The COVID-19 pandemic is still ongoing, significantly impacting the nations' economies, societies and politics. Therefore, herd immunity through universal vaccination could serve as one of the most effective preventative interventions for mitigating the burden of infectious diseases, including COVID-19. For example, Saudi Arabia has implemented free COVID-19 vaccines for all its citizens to promote their willingness to get vaccinated. However, an effective immunization campaign needs enough knowledge and positive attitudes towards the COVID-19 vaccine. Indeed, vaccine hesitancy is a limiting step in the world wide effort to effectively control the COVID-19 pandemic with its adverse socio economic and health consequences. The World Health Organization ranks vaccine hesitancy as one of the top ten threats to global public health (Li et al., 2021). In the current study, we surveyed the knowledge and attitude towards COVID-19 vaccines among 465 medical and paramedical students at Al Rayan colleges. Despite having a high level of knowledge about vaccination safety, only 26.7% of enrolled students were willing to be vaccinated, with 20.9% completely refusing the COVID-19 vaccine and 52.4% expressing great uncertainty about vaccination.Notably, the reported willingness rate in our study is lower than those documented in previous surveys that were conducted on students majoring in dental, nursing and medicine and showed the COVID-19 vaccine acceptance rates ranging from 56 to 91.9 percent in different regions or countries (Saied et al., 2021; Mustapha et al., 2021; Jain et al., 2021; Kanyike et al., 2021; Kelekar et al., 2021). The highly reported vaccine hesitancy among the enrolled students in our study has a substantial ethical issue, as it increases the exposure probability of the most vulnerable medical students when they come into contact with COVID-19 patients during their routine clinical practice, internship or structured training which further raises health disparities through reducing the possibility of herd immunity (Li et al., 2021).

Furthermore, as future health care workers, medical students, particularly those in an internship or structured training, are accountable for offering vaccine advice to patients. They are also reported as an essential reliable source of vaccination information. Considered a reliable source of patients' vaccine information, their attitudes toward vaccination might impact their vaccination decisions (Li et al., 2021). Therefore, it is crucial to implement practical, evidence based approaches to combat vaccine hesitancy among our students. More over, vaccine hesitancy represents a significant barrier to effectively managing and controlling the COVID-19 pandemic (Becerra & Becerra et al., 2022). A notion that has been confirmed by a computational based mathematical model that was performed by (Bartsch et al., 2020) and showed that the COVID-19 vaccine must have a coverage efficacy of at least 70% to effectively extinguish an ongoing pandemic by at least 80% without any other measures (Bartsch et al., 2020). Vaccine acceptance mirrors the general perception of diseases' risk, vaccine attitudes and requirements of the general population, which is critical for achieving high vaccination coverage of immunization programs, particularly for emerging infectious diseases like the COVID-19 pandemic (Wang et al., 2021). Accordingly, it is imperative not only to monitor the vaccination acceptance among all medical and paramedical students as the first line of the fight against the COVID-19 epidemic but also to rapidly correct their possible resistance/hesitancy against the COVID-19 vaccine. We reported that most factors linked with COVID-19 vaccine hesitancy among the enrolled students in our study were closely associated with concerns regarding the vaccines' safety, effectiveness and their related adverse effects. Where 221 students had experienced side effects from other vaccinations, of which 47.5% were against all vaccinations, while 49.5% believed there was no need to be vaccinated because they would have a low likelihood of complications (Table 3). Although most of the enrolled students perceive the importance of the COVID-19 vaccination and agree to make the vaccination mandatory (Table 2), these students still have significant hesitancy and refusal (Figure 1) secondary to a lack of certainty on the vaccine's safety and probable adverse effects, besides misinformation from social media as a main source of the related knowledge (Table 4).

The rapid speed of COVID-19 vaccines' development, implementation and authorization has raised significant concerns about the vaccines' safety and efficacy (Li et al., 2021). This concept has been percussed by (Larson et al., 2018), who confirmed that the more trust people had in vaccinations, the more likely they were to be vaccinated (Larson et al., 2018). Similar concerns have been previously raised by (Saied et al., 2021), through their studies that have been conducted among Egyptian medical students and health care providers respectively, to evaluate their COVID-19 vaccination approval landscape (Saied et al., 2021). The lack of confidence in the vaccination (believing the vaccine was ineffective, fear of adverse effects and concern about severe vaccine repercussions) was a well documented risk factor for vaccine hesitancy in multiple previous studies (Wang et al., 2020; Lucia et al., 2021; Kose et al., 2021), which was consistent with our findings (Lucia et al., 2021; Wang et al., 2020; Kose et al., 2021). Therefore, it's critical to implement tailored strategies to explain the potential benefits and risks of the COVID-19 vaccine using scientific evidence and data, to strengthen trust in the COVID-19 vaccine. Interestingly, some of the current study's COVID-19 vaccine associated barriers and false beliefs were related to the students' misinformation about the acquisition of COVID- 19 infection from the vaccine, where 44.5% of enrolled students said that they were afraid of getting infected via the vaccine. This might be explained by a lack of

proper knowledge about COVID19 vaccination that could be remedied in the future by enrollment of this topic in the medical education curricula to assist students in appraising the risks and advantages of vaccination. Despite various sources of information about COVID-19 vaccines, social media, government and internet websites were the most common sources of knowledge about COVID-19 and its vaccines, while television and newspapers were the least frequent sources of COVID-19 related information.

Vaccine decision making is frequently influenced by social networks' impacts, including colleagues, family members and health care personnel (Saied et al., 2021). The sources of COVID-19 vaccine related information and the degree of trust in these sources could shape the spectrum of vaccine acceptance (acceptance, hesitancy and refusal) (Qiao et al., 2020). Unfortunately, vaccine hesitancy is exacerbated by misinformation and conspiracy theories delivered by social media. Online social media facilitates the uncontrolled spread of fake news world wide, potentially leading to an infodemic (Puri et al., 2020). In line with our results, (Harapan et al., 2020) asserted that most of the COVID-19 linked information is disseminated through online or social media (Yufika et al., 2020). This information closely affects perceptions. Accordingly, improved information on COVID-19 vaccines has been reported to improve vaccines' acceptance (Kevin et al., 2021).

5. CONCLUSION

The current work demonstrated a relatively low level of COVID-19 vaccine acceptance (26.7%), with an apparent high hesitancy (52.4%) and refusal (20.9%) rates, among 465 enrolled medical and paramedical students at Al Rayan colleges. Thus, an effective vaccination policy and education are highly indicated to improve the current knowledge and change the attitudes of students to combat the COVID-19 pandemic. More over, we reported vaccine safety, efficacy and their potential side effects, as key concerns related to COIVD-19 vaccination acceptance barriers.

Limitations

Our study addressed a significant level of vaccine hesitancy among medical and paramedical students, as well as some related factors that under pin the current resistance to COVID-19 vaccines. However, there are some limitations to the present study. First, our study was conducted on medical and paramedical students at Al Rayan colleges, so the sample representativeness was restricted, which may have an impact on the generalizability and universality of the current findings. Second, because the survey was conducted online, the response rate can not be accurately assessed. Third, several circumstances could impact the decision to take the COVID-19 vaccination. Vaccination intentions and attitudes are not the same as vaccination behavior, which can vary depending on time, context, knowledge and other variables.

Author Contributions

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Ethical approval

The study was approved by the Biomedical Committee of Research Ethics at the faculty of medicine at Umm Al-Qura University (HAPO-02-K-012-2021-12-893).

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Conflict of interest

The authors declare that there is no conflict of interests

Data and materials availability

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

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