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Acceptance and Hesitancy of COVID-19 Vaccination among College Students in Jeddah, Saudi Arabia: A Questionnaire-Based Study

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Abstract

Introduction: Additional impact of misinformation can spread through multiple channels and the accelerated pace of vaccine development has further heightened public anxieties and could compromise acceptance. The current study is designed to estimate the level of vaccine acceptance and to determine the key factors that may be associated with vaccine rejection among college students in Jeddah, Saudi Arabia.

Methods: A cross-sectional study was conducted through an anonymous online survey at various college campuses of King Abdulaziz University in Jeddah. A standardized questionnaire was circulated through online avenues, and students had to give written consent before attempting to answer it. The questionnaire used in this study was based on previous surveys, including one conducted in Saudi Arabia and evaluated by public health experts. The questionnaire was self-administered and contained two sections: one on demographic and clinical factors of the residents, and the other on vaccine acceptance and preference.

Results: A total of 491 students filled and submitted the questionnaire. The demographic data (table 1) shows distribution of the participants in important categories. Most of the study participants were male, 303 in number, comprising of 61.7% of all. About intention or acceptance to be vaccinated among the included students, in the present study. A number of 426 (around 87%) of the study participants were ready to receive the vaccines in accordance with the government health policies or had already registered for getting the 1st shot of the vaccine. More than 62% of the students had already received at least one dose of the covid-19 vaccine. About 53 % of the included students had doubts regarding effectiveness of vaccination and more than 55% were concerned about the overall safety of the vaccines.

Conclusions: The majority were willing to receive the COVID-19 vaccine or had already received at least one dose, but some cited a lack of information or a desire to see others get vaccinated first as barriers to getting the vaccine themselves. The most common side effect experienced by participants after receiving the vaccine was fever followed by tiredness, body pain, and headache.

Keywords: COVID-19, Awareness, Vaccine, Acceptance, Hesitancy, Saudi.

Introduction

In recent times, there has been an enormous health, social and financial impact due to the COVID-19 pandemic. For many key aspects of this modern disease, the level of uncertainty is extremely high, further intensified by an excess of contradictory information [1]. There are currently no specific antiviral treatments for COVID-19. As immunization is widely accepted as one of the most successful and cost-effective health interventions to prevent infectious diseases, vaccines against COVID-19 are considered to be of great importance to prevent and control COVID-19, and countries worldwide are trying to accelerate the research and development of COVID-19 vaccines [2]. There is a lot of conflicting information from different sources that has already caused much controversy [3]. Keeping in view the large circulating volume of mis- or disinformation, researchers and public health educators need to build a society that opposes falsehood being spread about COVID-19 as the vaccine becomes available [3].

Many organizations are competing to develop a safe and effective vaccine for COVID-19. According to the World Health Organization, a vaccine is the best way to prevent the spread of SARS-CoV-2, and there are currently more than 50 COVID-19 vaccine candidates in trials. Two notable vaccines are the German Biontech vaccine and the American Pfizer vaccine [4]. The results of the second phase of clinical trials were encouraging in terms of effectiveness and safety, but the vaccines are still in their third phase of clinical trials. Some countries have already granted vaccination licenses and have started vaccinating certain high-risk groups such as the elderly and healthcare workers. However, it is uncertain if and when the vaccine will be made available to developing countries, which make up the majority of the world's population [5]. Due to multi-faceted catastrophic consequences associated with the COVID-19 outbreak, there is an intense international effort in developing a safe and effective COVID-19 vaccine, with an estimate of over 100 candidate vaccines currently in different development stages, and several candidate vaccines already finishing their trials.

Some vaccines against COVID-19 have already been launched for public use. So, good understanding is warranted to investigate the acceptability of a COVID-19 vaccine to prepare for effective promotion strategies [5]. The success of COVID-19 vaccination program will largely depend on people's acceptance of the vaccine. Besides factors specific to the COVID-19 vaccine, individuals' attitudes towards general vaccination may also affect their COVID-19 vaccine acceptance. Despite of the extraordinary speed of scientific discovery regarding COVID-19, there are still a lot of uncertainties and concerns on novel vaccines in terms of safety and effectiveness, which may significantly impede people's willingness for COVID-19 vaccine uptake [6]. The additional impact of misinformation spread through multiple channels and the accelerated pace of vaccine development has further heightened public anxieties and could compromise acceptance. Governments and societies should determine current levels of willingness of their people to receive a potentially safe and effective COVID-19 vaccine and identify correlates of vaccine hesitancy and acceptance [7]. The current study is designed to estimate the level of vaccine acceptance and to determine the key factors that may be associated with vaccine rejection among college students in Jeddah, Saudi Arabia. We aim to address both the needs and challenges for COVID-19 vaccination among the students, as their perception of COVID 19 risks to themselves can be important factor in their vaccine acceptance. For example, young adults (aged 18 to 30) may develop an optimistic bias believing that they have a lower risk of infection or risks pose a less serious threat to themselves than to other age groups.

Methods

A cross-sectional study was conducted through an anonymous online survey at various college campuses of King Abdulaziz University in Jeddah. The minimal sample size of participating students from King Abdulaziz University was calculated to be 384 participants, selected using a random sampling technique. Only students in the age group of 18 to 25

years who were studying at King Abdulaziz University campuses were included in the study. A standardized questionnaire was circulated through online avenues, and students had to give written consent before attempting to answer it. The questionnaire used in this study was based on previous surveys, including one conducted in Saudi Arabia and evaluated by public health experts. The questionnaire was self-administered and contained two sections: one on demographic and clinical factors of the residents, and the other on vaccine acceptance and preference. The study used descriptive statistics such as frequencies and percentages to summarize nominal and ordinal data. Demographic and clinical determinants of vaccine acceptance were also evaluated. A chi-squared test was used to assess the association between the determinants and the outcome variables. Any p-value less than 0.05 was considered to indicate a statistically significant association or difference. The distribution of factors related to COVID-19 among the respondents was also demonstrated. The research team kept all data confidential, and it was analyzed using SPSS 18 version. This study was approved by the ethical committee of King Abdulaziz University.

Results

A total of 491 students filled and submitted the questionnaire. The demographic data (table 1) shows distribution of the participants in important categories. Most of the study participants were male, 303 in number, comprising of 61.7% of all. Majority of participants were in the age group of 21-25 years with 353 individuals, following by the younger age group of 18-20 years comprising of 119 participants (24.2%). Most responding students were studying in 2nd year, making 24.2% of all participants followed by 4th year students which make up 22 % of total. The top the university faculties which participated in the study according to the number of students included faculty of medicine with 180 students, faculty of law with 51 students and faculty of dentistry contributing with 36 students participating in the research. The 1st part of Table 2 shows the impact of Covid 19 infection among participants as well as their self-perception about their health condition. 165 students (33.6%) got infected with COVID 19 in the past whereas 335 (68.2%) of them reported a family member or friend suffering

from the viral infection. Around 98 % of participants perceived that they have favorable health condition, with 276 students reporting very good status and 204 students opting for good status. Only 50 of the study participants reported to be suffering from some chronic health conditions, out of which 6 were having Diabetes Mellitus, 4 were hypertensive and 21 were suffering from Asthma. The 2nd part of Table 2 has two further divisions. The first part is related to questions assessing the future risk of acquiring Covid 19 infection and its possible consequences while the second part is related to the hesitancy of participants for covid-19 vaccine. The responses to questions related to perceived fear Covid-19 infection shows that around 50% of the study participants thought that they will get infected in the near future while around 60% of them were worried of contracting the viral infection. More than 77% believed that Covid-19 infection can lead to serious complications while 75% agreed that they can have severe sickness if they suffering from the Covid-19 infection.

Table 3 is directly related to the perceived hesitancy of the participating students for Covid-19 vaccine. Most of the participants, close to 93%, agreed with the statement that vaccination is the most effective way of controlling spread of vaccine while 96% of them were of the opinion that vaccination decreases one's chances of acquiring Covid-19 infection or suffer from its complications. However, 53 % of participants had doubts regarding effectiveness of vaccination and more than 55% were concerned about the overall safety of the vaccines. The table 3 also shows intention of the students for getting vaccinated against covid-19 infection. 426 (around 87%) of the study participants were ready to receive the vaccines in accordance with the government health policies or had already registered for getting the 1st shot of the vaccine. More than 62% of the students had already received at least one dose of the covid-19 vaccine. The last part of table 3 shows the barriers of the respondents who are not willing to get vaccinated. The two conditions are offered to the participants, which if fulfilled, may remove the barriers to getting vaccinated. The students who were not willing to get vaccinated otherwise, 46 were willing for vaccination when they will know that many others have taken the vaccine injections while

Table (1): The demographic distribution of the participants

Demographics		n	%
Gender	Female	188	38.3%
	Male	303	61.7%
Age	18 to 20	119	24.2%
	20 to 25	353	71.9%
	above 25	19	3.9%
University	Jeddah University	125	25.5%
	King Abdulaziz University	366	74.5%
Year	2nd	119	24.2%
	3rd	83	16.9%
	4th	108	22.0%
	5th	90	18.3%
	6th	43	8.8%
	Foundation year	48	9.8%

60 of them said they will be ready for vaccination against covid-19, once they get sufficient information regarding the various aspects of COVID-19 vaccine. The table 4 gives an overview of the complications suffered by the study participants as a result of receiving vaccines. The most common side-effect experienced was that of fever with 156 (31.8%) participants suffering from the symptom. This was followed by tiredness, body pain and headache which was experienced by 18.7%, 16.5% and 12.4% of the study subjects. Only 21% responded that they did not suffer from any health problems due to vaccine injections. Table 5 shows that the mean rank value for VH(Vaccine hesitancy Score) was higher in the Female group (Mean Rank = 263.117) compared to the male (Mean Rank = 235.380) group. A Kruskal-Wallis test showed this difference was statistically significant, $H = 4.53$, $p = 0.033$. The Mean Rank value for VH_Score was highest in the above 25 group (Mean Rank = 277.474) followed by the 18 to 20 (Mean Rank = 247.122) and 20 to 25 (Mean Rank = 243.928) group. A Kruskal-Wallis test showed this difference was not statistically significant. The Mean

Rank value for VH_Score was highest in the 1 complication group (Mean Rank = 204.814) followed by the 2 complications group (Mean Rank = 168.663). A Kruskal-Wallis test showed this difference in Hesitancy Score by no. of complications was statistically significant, $H = 71.53$.

Discussion

Several factors, including perceived severity of infection, education, ethnicity, and cultural background, have been identified as contributing to low vaccine acceptance rates [8]. Complex factors related to human behavior, such as the "theory of planned behavior," may also play a role in vaccine hesitancy. Both quantitative and qualitative studies are needed to understand the reasons behind hesitancy towards the COVID-19 vaccine, as it could hinder efforts to control the pandemic [9]. A quantitative and qualitative studies are needed to explain the reasons behind hesitancy towards COVID-19 vaccine since it could jeopardize the effort of the pandemic control. The aim of this study was to determine the acceptance of the COVID-19 vaccine among university students, who are expected to have a high level of vaccine acceptance due to their education. The study also evaluated demographic and clinical determinants of vaccine acceptance.

In Saudi Arabia, vaccination against COVID-19 has been strongly recommended for college students, and there have been no reported cases of refusal. Therefore, assessing vaccine acceptance among university students, an important segment of the healthcare workforce, can provide insight into their beliefs and misconceptions about the vaccine. If vaccine acceptance is suboptimal among university students, they may be less likely to recommend the vaccine to their family and friends, potentially contributing to increased vaccine hesitancy in the general population. About intention or acceptance to be vaccinated among the included students, in the present study. A number of 426 (around 87%) of the study participants were ready to receive the vaccines in accordance with the government health policies or had already registered for getting the 1st shot of the vaccine.

Table (2): Occurrence of COVID-19 and predisposing factors among the students

Factors		n	%
Have you yourself suffered from COVID-19 infection in the past	No	326	66.4%
	Yes	165	33.6%
Has anyone in your family and friends suffered from COVID-19 in	No	156	31.8%
	Yes	335	68.2%
How do you perceive your overall health?	Poor	11	2.2%
	Good	204	41.5%
	Very Good	276	56.2%
	No	477	97.1%
Diabetes	Yes	14	2.9%
	No	487	99.2%
Hypertension	Yes	4	0.8%
	No	470	95.7%
Asthma	Yes	21	4.3%
	No	477	97.1%
Do you think your chances of getting COVID-19 in the next few months is great?	Strongly Disagree	78	15.9%
	Disagree	164	33.4%
	Agree	177	36.0%
	Strongly Agree	72	14.7%
Do you worry about the likelihood of getting COVID-19?	Strongly Disagree	59	12.0%
	Disagree	140	28.5%
	Agree	197	40.1%
	Strongly Agree	95	19.3%
The complication from COVID-19 is serious?	Strongly Disagree	18	3.7%
	Disagree	71	14.5%
	Agree	280	57.0%

You can get very sick if you get COVID-19?	Strongly Agree	122	24.8%
	Strongly Disagree	35	7.1%
	Disagree	88	17.9%
	Agree	254	51.7%
	Strongly Agree	114	23.2%

More than 62% of the students had already received at least one dose of the covid-19 vaccine. The acceptance of the COVID-19 vaccine among college-educated individuals varies globally, with rates ranging from 27.7% in the Republic of Congo to 78.1% in Israel [10]. Higher acceptance rates (90%) have been reported among the general population in some Asian countries such as China[2], Indonesia[11], and Malaysia [12]. This suggests that being a college student, or even a health sciences student, is not necessarily a major determinant of vaccine acceptance. Cultural factors may be more influential than health literacy, and some authors attribute high vaccine acceptance rates to public trust in governments [7]. In addition, vaccine acceptance rates can vary over time. For example, acceptance among Australian parents dropped from 85.8% in April 2020 to 75.8% after one year [13, 14].

A decline in acceptance has also been observed in Europe [15]. According to a nationwide survey in China, only 67% of the general population was willing to accept the COVID-19 vaccine. However, acceptance rates varied by province, with rates ranging from 71.8% in Hubei to 79.9% in Xinjiang [16]. In nine provinces, acceptance rates were below the national average. This suggests that acceptance may vary based on the educational and modernization characteristics of a given province. The most common reasons for vaccine hesitancy in China were doubts about vaccine safety (74.6%) and concerns about effectiveness (22.4%) [16]. The decline in vaccine acceptance may be due to the dissemination of misconceptions and the reported side effects that are believed to be related to the vaccine. In this study, approximately 25% of the participants were willing to pay 200-1000 SAR and 7.4% were willing to pay more than 1000 SAR to receive the COVID-19 vaccine. In

contrast, a very low level of vaccine acceptance was reported among university students in the Democratic Republic of Congo, with only 27.7% willing to receive the vaccine [17]. Vaccine acceptance in Latin America was similar to the level reported in this study, with acceptance rates of 70% in Brazil and Ecuador [7, 18]. In Europe, acceptance rates varied by location. In southern countries, lower acceptance rates were reported in Italy (53.7%) and France (58.9%), while a low acceptance rate (44.2%) was reported among healthcare workers in Malta [7, 19]. In northern countries, a higher acceptance rate of 80% was reported in Denmark [7].

The Middle East has some of the lowest reported vaccine acceptance rates, which are much lower than the rate reported in this study. Low rates in the Middle East have been linked to the belief in conspiracy theories [20]. However, a higher acceptance rate of 75% was reported in Israel [21]. In Kuwait and Jordan, acceptance rates were 23.6% and 28.4%, respectively [22], which are much lower than the 64.7% acceptance rate reported among the general population in Saudi Arabia in a national web-based study [23]. In comparison, the acceptance rate among university students in this study (87%) was slightly higher than the acceptance rate among the general Saudi population, but similar to the 70% acceptance rate among university students found in a study by Barry et al. [24]. Another study by Alfageeh et al. found a lower acceptance rate of 48% among 2,319 participants in the general population through a web-based survey [25]. and a similar rate (48%) was found among 3,101 participants in the general population in a study by Magadmi and Kamel [26]. These findings suggest that health literacy may not play a significant role in vaccine acceptance [26]. About 53 % of the included students, in the present study, had doubts regarding effectiveness of vaccination and more than 55% were concerned about the overall safety of the vaccines. Like the findings of this study, a systematic review by Lin et al. [15] found that low confidence in the COVID-19 vaccine was often related to concerns about safety and effectiveness. In this study, 41% of the participants had concerns about vaccine safety, and 20% said they would not recommend the vaccine to their family or patients. This could have a significant indirect effect on vaccine acceptance in the general

population, as people often trust the opinions of doctors and other healthcare workers in their family [15]. The results of the current study regarding previous history of COVID-19, 165 students (33.6%) got infected with COVID 19 in the past whereas 335 (68.2%) of them reported a family member or friend suffering from the viral infection. Research has shown that having a personal experience with COVID-19 can make individuals more willing to receive the vaccine. Additionally, having a good understanding of the potential side effects of the COVID-19 vaccine has been associated with a willingness to accept the vaccine. Knowing someone with COVID-19 in their social network has also been significantly associated with acceptance of the COVID-19 vaccine [20-25].

In the present study, the common reported side effects among the included students who get vaccinated was that of fever with followed by tiredness, body pain and headache which was experienced by 18.7%, 16.5% and 12.4% of the study subjects. Only 21% responded that they did not suffer from any health problems due to vaccine injections. The reduction in vaccine acceptance rate could be attributed to dissemination of misconceptions and reported few side effects that might be related to the vaccine. Vaccine hesitancy in the current study was higher among students who experienced side effects of the vaccine but the difference was not statistically significant. In developed countries, the acceptance rate of the mRNA COVID-19 vaccine among college students in Italy was 91.8%, while only 1% were vaccine skeptics [27]. However, for the viral vector vaccine, the acceptance rate was much lower at 57.3%. The difference in acceptance rates between the two vaccines among students in Italy was statistically significant [27]. The authors of this study also explored the opinions of those who had different views on the two vaccines and found that 38.2% of them had hesitancy towards the viral vector vaccine. In contrast, acceptance of the mRNA vaccine was found to be independent of demographic factors such as age, gender, marital status, and education. Regarding factors affecting COVID-19 vaccine hesitancy in the present study, based on vaccine hesitancy Score, females were have a significantly higher hesitancy compared to males. There have been several studies in China and Italy that have found males are more likely to accept vaccination

Table (3): Perceptions and attitudes regarding COVID 19 among the students

Items		n	%
Vaccination is the best way to control the spread of COVID-19?	Strongly Agree	266	54.2%
	Agree	192	39.1%
	Disagree	29	5.9%
	Strongly Disagree	4	0.8%
Vaccination decreases your chance of getting COVID-19 or its complication?	Strongly Agree	272	55.4%
	Agree	200	40.7%
	Disagree	17	3.5%
	Strongly Disagree	2	0.4%
You are concerned about the efficacy of COVID-19 vaccination?	Strongly Disagree	93	18.9%
	Disagree	138	28.1%
	Agree	200	40.7%
	Strongly Agree	60	12.2%
You are concerned about the safety of COVID-19 vaccination?	Strongly Disagree	100	20.4%
	Disagree	119	24.2%
	Agree	201	40.9%
	Strongly Agree	71	14.5%
Are you willing to get vaccinated as per government recommendations or already registered for vaccination	Yes	426	86.8%
	Not Sure	43	8.8%
	No	22	4.5%
Have you received the vaccine?	Yes	308	62.7%
	No	183	37.3%
I will only take the vaccine if the vaccine is taken by many others	Strongly Disagree	3	4.6%
	Disagree	16	24.6%
	Agree	27	41.5%
	Strongly Agree	19	29.2%
I will only take the vaccine if I am given adequate information about it?	Strongly Disagree	1	1.5%
	Disagree	4	6.2%
	Agree	34	52.3%
	Strongly Agree	26	40.0%

than females [28]. In one online survey in China, females were less likely to accept the vaccine than males. Another national study in China found that 64.4% of females and 72% of males were willing to accept the vaccine [16]. A Chinese web survey also found that men were 1.35 times more likely to accept the vaccine than women. Among college students in Italy, the acceptance rate of the COVID-19 vaccine was significantly lower among females (53%) compared to males (67%).[27]. In four Arabic countries, females were found to have lower vaccine acceptance compared to males [29]. In Africa, a study in Nigeria found that women were less likely to accept the vaccine than men (OR= 0.77 [30]. However, in Afghanistan, the proportion of females who were willing to be vaccinated was higher than that of males [31]. In Belgium, a developed country, males were 1.53 times more likely to be willing to receive the COVID-19 vaccine compared to females.

Association between age and vaccine hesitancy was not statistically significant in this study because the age range among students is narrow and no significant difference is detected. Age has been found to be an important predictor of willingness to accept the COVID-19 vaccine in several studies. In China, an increase in age was associated with a significant increase in the willingness to accept the vaccine among the general population [28]. Another nationwide study in China found that vaccine acceptance increased with age among the Chinese population [16]. Similarly, younger age groups had a significantly lower acceptance of the vaccine compared to older age groups among college students in Italy [27]. Among Belgian participants, the percentage of vaccine skeptics increased with older age groups, reaching 13.3% in people above 65 [32]. Furthermore, in Nigeria, people aged over 25 years old were 1.7 times more likely to accept a future COVID-19 vaccine than those below 25 years old [30]. This study is limited by a quantitative approach which lack to in-depth exploration of reasons behind inadequate vaccine acceptance. Combination of both quantitative and qualitative approaches would be more efficient to answer the questions about acceptance of COVID-19 vaccine.

Conclusions

About a third of the students reported that they had previously been infected with COVID-19 and most participants believed that vaccination is the most effective way to control the spread of the virus. More than half of the participants were worried about getting infected with COVID-19 in the future and believed it could lead to serious complications. More than a half of the students had doubts about the vaccine's effectiveness were concerned about its safety. However, the majority were willing to receive the COVID-19 vaccine or had already received at least one dose, but some cited a lack of information or a desire to see others get vaccinated first as barriers to getting the vaccine themselves. The most common side effect experienced by participants after receiving the vaccine was fever followed by tiredness, body pain, and headache.

Conflict of interests

The authors declared no conflict of interests.

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Table (4): Common side effects associated with COVID-19 vaccination among vaccinated students

Side effects		n	%
Fever	No	152	49.4%
	Yes	156	50.6%
Tiredness	No	216	70.1%
	Yes	92	29.9%
Body Pain	No	227	73.7%
	Yes	81	26.3%
Joint Pain	No	269	87.3%
	Yes	39	12.7%
Headache	No	247	80.2%
	Yes	61	19.8%
Chills	No	269	87.3%
	Yes	39	12.7%

TABLE (5): Demographic and health factors influence the hesitancy towards COVID-19 vaccine

Group			Descriptive statistics			Test statistics		
Outcome	Predictor	Group	n	Mean	Median	Mean Rank	H	p
Covid Vaccine Hesitancy Score (VH)	Gender	Male	303	1.736	1.833	235.380	4.535	0.033
		Female	188	1.850	1.833	263.117		
	Age	18 to 20	119	1.786	1.833	247.122	1.041	0.594
		20 to 25	353	1.772	1.833	243.928		
		above 25	19	1.888	2	277.474		
		Good	204	1.825	2	261.265	10.632	0.005
	Perceived Health	Very Good	276	1.728	1.667	230.935		
		Poor	11	2.235	2.375	340.909		
		0	89	1.463	1.333	120.185	71.534	< .001
	No. of Complications	1	105	1.862	2	204.814		
		2	43	1.690	2	168.663		
		3	30	1.456	1.333	123.367		
		4	22	1.288	1.167	84.818		
		5	15	1.511	1.500	124.033		
		6	4	1.792	1.833	176		

