Analyzing COVID-19 Vaccine Hesitancy among University Students in UAE: A Cross-Sectional Study

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COVID-19 · Vaccine · Vaccine hesitancy · University students · Medical students

Abstract
Introduction: While vaccines may be a key measure in overcoming the pandemic, their hesitancy among the population may impede the ongoing efforts of governments and health authorities in a country. Universities are considered the hubs of the transition of individuals to young adults, understanding the hesitancy of this population stratum and addressing apprehensions that may exist is of utmost importance. This study aims to explore the attitude and hesitancy of students in UAE universities toward the COVID-19 vaccines along with comparing two particular demographics to see if there exists a difference in outcomes—medical and nonmedical students.

Methods: A web-based self-administered questionnaire was sent following Ethics Committee approval, to students at various universities in the UAE containing questions regarding general demographic data, COVID-19 related anamnestic characteristics as well as questions on motivational factors and refusal factors regarding the vaccine. Using Statistical Package for the Social Sciences version 28, descriptive analyses were performed for the demographic variables and inferential statistics were carried out using Pearson’s Chi-squared (χ²) test. Results: A total of 385 participants consented to the survey, with a majority of female respondents (76.6%). In our demographics which included respondents of an average age of 21 years, 91.4% were expatriates, and 48.1% were based in Dubai. Approximately 67% of those surveyed had been vaccinated, with SinoPharm being the most commonly taken vaccine (70.4%). “Concerns over side effects” seems to be the most common reason for vaccine refusal (58.7%) among all demographics whether vaccinated or not. Our sample included a majority of students with a medical and health sciences background (58.7%), who disagreed more often with the belief that they were completely protected by receiving the COVID-19 vaccine as compared to the nonmedical students. Conclusion: COVID-19 vaccination rates among university students in UAE are lower than the national average, demonstrating the importance of integrating a specific awareness program for this group. Preparing medical students for the future is a beneficial long-term strategy, and hence, further research regarding vaccine hesitancy must be done focusing primarily on them to ensure their future patients receive the best vaccine-related recommendations.

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Introduction

The world is united in its attempt to control the morbidity and mortality caused by the COVID-19 pandemic. Governments across the globe have made plans to control the spread of the SARS-CoV-2 virus. Surveillance, contact tracing, and quarantine all have their place in this fight, unfortunately, these measures, effective as they may be, are insufficient. The key to controlling a pandemic with minimal mortality and morbidity is by establishing an effective vaccination program as a primary prevention measure [1].

UAE started administering and advertising the inactivated COVID-19 vaccine developed by Sinopharm in July 2020. Over time, Sputnik V, Pfizer BioNTech, and Oxford-AstraZeneca COVID-19 vaccines were also introduced in the country. People above the age of 18 were targeted with the education sector being one of the main ones to facilitate a safe return to campuses after months of online classes [2]. However, the implementation of a vaccination program is not without its challenges, with vaccine hesitancy among the population being one of the key barriers [3]. Vaccine hesitancy is defined as a delay in acceptance or refusal of vaccination despite the availability of vaccination services. It is a complex phenomenon varying across time, place, and vaccine. Originally introduced in 2011, the “3 Cs” model is considered to be the most easily understood conceptual framework for designing surveys and interventions to counter vaccine hesitancy. There are three components to this approach; complacency, convenience, and confidence, and it can be applied locally or globally [4].

With universities being considered the hubs of transition of individuals from adolescents to young adults who have the onus of leading the generations to come, understanding the hesitancy this population stratum holds and addressing apprehensions that exist is of utmost importance. Previous articles have been published regarding attitudes of university students toward the COVID-19 vaccine worldwide. One of the earlier studies conducted was in Italy, where 86.1% of the participants were eager to get the vaccine [5]. However, a study conducted in the Czech Republic showed that 73.3% of university students were open to taking the vaccine, whereas, a similar study done in France, reported a vaccine acceptance percentage of only 58.0% [6, 7]. Within the MENA region, a study conducted at Qatar university reported that 62.6% of university students and employees of Qatar University were willing to vaccinate against COVID-19 [8].

It was observed that the most common sources of vaccine-related information for the students were the internet, doctor/healthcare provider, family, brochures and pamphlets, and friends/coworkers as reported in a 2021 study by Landowska et al. [9]. In a research study conducted in New England, the main cause of vaccine hesitancy among medical students was the fear of the unknown [10]. Furthermore, the recurrent themes in vaccine hesitancy were concerns about efficacy, safety, and lack of trust in the information presented by health experts, likely politicization of the vaccine, lack of transparency in the study process and vaccine development, and the quick rollout of the vaccine [11].

Therefore, it can be well concluded that conducting similar research in the UAE will help to determine the perception of educated youth toward the vaccine. With UAE being a multicultural country, analyzing the findings of university students from different nationalities and ethnic backgrounds would generate interest, help policymakers to come up with solutions overcoming any hesitancy, and pave the way for any future research on the topic.

Objective

This study aims to explore the attitude and hesitancy of students in UAE universities toward the COVID-19 vaccines along with comparing two particular demographics to see if there exists a difference in outcomes: medical and nonmedical students.

Materials and Methods

Design

After obtaining Ethical Committee approval for this survey-based cross-sectional study, students at various universities in the UAE were recruited using convenience sampling with snowballing technique and sent a link to the web-based self-administered questionnaire. The responses were collected between April 2021 and June 2021.

The sample size for this was calculated using OpenEpi version 3.01, using the total number of university students as 138,270 according to a statistics report in UAE for the academic year 2016–17. The equation assumed a confidence level of 95% and a margin of error of 5%, giving a required sample size of 385 students from all universities in the UAE [12].

Participants

The target population of this study were university students in the UAE; therefore, the inclusion criteria were:

- To be enrolled as a full-time student in a program with English as the language of instructions.
- To be enrolled at either a private or public higher education institution in the UAE.
To be at least 16 years old to independently give their informed consent for participation in the survey. Concurrently, the exclusion criteria were:
- To be above the age of 35 years old, to avoid any outliers.
- To be already graduated from a higher academic institution.
- To be unable to comprehend the English language.

The students were able to withdraw their participation at any time before submission of the response without the need for any justifications. The respondents were not given any financial reward or other compensations. Their participation was entirely voluntary.

**Instrument**

The web-based self-administered questionnaire, included 5-point Likert scale questions (strongly agree to strongly disagree), dichotomous questions (yes or no), and multiple-choice questions. Though a majority of the questions were adapted from previous studies conducted to assess COVID-19 vaccine hesitancy among the general population and university students, some self-made questions were also included [13–15]. The survey contained questions regarding general demographic data such as age, gender, nationality, their emirate of residence, and academic major at their respective university, followed by questions regarding their personal experience with COVID-19 and the vaccines available in the country for it. The questionnaire also included questions assessing motivational factors and refusal factors regarding the vaccine. Prior to distribution, 6 students from Dubai Medical College were invited to participate in the pilot survey and based on the feedback received, the questionnaire was modified for better understanding for the participants.

**Statistics**

All the statistical tests were performed using the Statistical Package for the Social Sciences version 28 [16]. Descriptive analyses were performed for the demographic variables. Inferential statistics were carried out to evaluate the difference in terms of demographic variables such as gender, nationality, and major of study and vaccine-related attitudes using Pearson’s Chi-squared ($\chi^2$) test and with a $p$ value of $\geq 0.05$ being considered as significant.

**Results**

**Demographic Characteristics**

The questionnaire was distributed to 415 students, however, only 385 (92.7%) filled the form completely and hence were included in the result analysis. Out of 385, 295 (76.6%) were females and 90 (23.4%) were males. The median age of all the participants was around 21 years old. There were 352 (91.4%) expatriates and 33 (8.6%) UAE Nationals, from the following emirates: Dubai (48.05%), followed by Sharjah (27.27%), Ajman (12.7%), Abu Dhabi (8.83%), Fujairah (2.07%), Ras Al Khaimah (0.05%), and Umm Al Quwain (0.02%). Students from Medical and Health Sciences were 226 (58.70%) whereas remaining participants were from the following majors-56 (14.54%) from Business and Accounting, 46 (11.9%) from Architecture, Engineering & Biotechnology, 32 (8.3%) from Computer Sciences, 13 (3.3%) from from Science, 3 (0.77%) each from Interior Design and Arts, 2 (0.51%) each from Mathematics and Law, and Social Sciences and 1 (0.25%) from Language and Education, each (shown in Table 1).

**Anamnestic Characteristics**

Out of 385 participants, 329 (85.45%) reported not having contracted COVID-19 infection at all whereas 52 (13.55%) reported having tested positive once, at least. In terms of vaccination rates, 257 (66.75%) students have gotten a COVID-19 vaccine whereas 128 (33.25%) have not gotten a vaccine yet.

As shown in Table 2, out of the 257 vaccinated participants, Sinopharm was the most commonly received vaccine with 181 (70.42%) participants followed by Ox-
ford-AstraZeneca (n = 38, 14.78%), Pfizer BioNTech (n = 33, 12.94%), Sputnik (n = 4, 1.55%), and Johnson & Johnson (n = 1, 0.38%). 146 (56.80%) of the respondents experienced side effects after taking the vaccine whereas, 111 (43.19%) did not report any symptoms at all. The most commonly encountered side effects were pain at the injection site (45.13%) followed by fever (24.90%), fatigue (24.90%), headache (22.17%), joint/muscle pain (18.67%), shivering and chills (12.06%), gastrointestinal symptoms (6.22%), and allergic reactions (1.16%). Figure 1 shows the adverse reactions based on the COVID-19 vaccine taken. It was also found that more than half of the participants reported experiencing adverse reactions.

| Variable                          | Outcome                                | N (%)          |
|----------------------------------|----------------------------------------|----------------|
| Name of the COVID-19 vaccine taken | Sinopharm                              | 181 (70.42)    |
|                                  | Oxford-Astra Zeneca                    | 38 (14.78)     |
|                                  | Pfizer BioNTech                        | 33 (12.84)     |
|                                  | Sputnik V                              | 4 (1.55)       |
|                                  | Johnson & Johnson                      | 1 (0.38)       |
| Had an adverse reaction after taking the COVID-19 vaccine | Yes                                    | 146 (56.80)    |
|                                  | No                                     | 111 (43.19)    |
| Adverse reaction                 | Pain at injection site                 | 116 (45.13)    |
|                                  | Fever                                  | 64 (24.90)     |
|                                  | Fatigue                                | 64 (24.90)     |
|                                  | Headache                               | 57 (22.17)     |
|                                  | Joint/muscle pains                     | 48 (18.67)     |
|                                  | Shivering/chills                       | 31 (12.06)     |
|                                  | Gastrointestinal symptoms              | 16 (6.22)      |
|                                  | Allergic reaction: swelling, hives, wheezing, etc. | 3 (1.16)   |

Table 2. COVID-19 vaccine-related characteristics of the participants (April–June 2021, n = 257)

![Adverse reactions according to COVID-19 vaccine taken](image-url)

Fig. 1. Adverse reactions according to COVID-19 vaccine taken.
Participants (213 out of 385, 55.32%) were asked by their universities to get vaccinated, whereas 172 (44.68%) denied being asked the same.

**COVID-19 Vaccines-Related Beliefs**

When asked whether vaccines provide complete protection from COVID-19 infection, females (59.32%) were more likely to disagree than males (45.55%) \((p = 0.001)\) (shown in Fig. 2a). Similarly, for the question on the belief that COVID-19 vaccines being administered are safe, UAE nationals (78.78%) were more likely to agree to it than the expatriates (55.11%) \((p = 0.031)\) as shown in Figure 2b.

**Sources of Information regarding Vaccines**

As shown in Table 3A, social media was the top source of information for various demographics (female [67.5%], male [61.1%], expatriates [67%], nonmedical students [65.4%]). However, among UAE Nationals, the most popular source of information was TV programs (63.6%), and among medical students, it was scientific journals (68.2%).

**Vaccine Hesitancy/Acceptance Factors**

**Refusal Factor**

Participants were more likely to reject the vaccines due to “concerns about their side effects” when discussing their vaccination concerns. It was observed that UAE na-
Table 3. COVID-19 vaccine-related sources of information, refusal factors, and motivating factors among the participants (April–June 2021, \(n = 385\))

|                         | N (%)       | \(\chi^2\) value | \(p\) value |
|-------------------------|-------------|-------------------|-------------|
| **A. Sources of information** |             |                   |             |
| Newspapers              |             |                   |             |
| Female                  | 132 (44.7)  | 0.003             | 1.000       |
| Male                    | 40 (44.4)   |                   |             |
| UAE National            | 11 (33.3)   | 1.879             | 0.202       |
| Expatriate              | 161 (45.7)  |                   |             |
| TV programs             |             |                   |             |
| Female                  | 58 (19.7)   | 0.570             | 0.458       |
| Male                    | 21 (23.3)   |                   |             |
| UAE National            | 21 (63.6)   | 0.638             | 0.506       |
| Expatriate              | 185 (52.5)  |                   |             |
| Scientific journals     |             |                   |             |
| Female                  | 156 (52.9)  | 0.198             | 0.718       |
| Male                    | 50 (55.6)   |                   |             |
| UAE National            | 5 (15.1)    | 1.489             | 0.274       |
| Expatriate              | 74 (21.0)   |                   |             |
| Magazines               |             |                   |             |
| Female                  | 19 (6.4)    | 2.160             | 0.170       |
| Male                    | 10 (11.1)   |                   |             |
| UAE National            | 0 (0.0)     | 2.940             | 0.157       |
| Expatriate              | 29 (8.2)    |                   |             |
| Social media            |             |                   |             |
| Female                  | 199 (67.5)  | 1.237             | 0.309       |
| Male                    | 55 (61.1)   |                   |             |
| UAE National            | 18 (54.5)   | 2.100             | 0.178       |
| Expatriate              | 236 (67.0)  |                   |             |
| Websites                |             |                   |             |
| Female                  | 1 (0.3)     | 0.306             | 1.000       |
| Male                    | 0 (0.0)     |                   |             |
| UAE National            | 0 (0.0)     | 0.094             | 1.000       |
| Expatriate              | 1 (28.0)    |                   |             |
| **B. Refusal factor**   |             |                   |             |
| Concerns over the side effects of the vaccine | 180 (61.0)  | 2.791             | 0.112       |
| Female                  | 46 (51.1)   |                   |             |
| Male                    | 10 (30.3)   | 12.007            | \(<0.001^*\) |
| UAE National            | 216 (61.3)  |                   |             |
| Expatriate              |             |                   |             |
| Concerns over the efficacy of the vaccine | 92 (31.1)   | 0.669             | 0.435       |
| Female                  | 24 (26.6)   |                   |             |
| Male                    | 6 (18.1)    | 2.448             | 0.164       |
| UAE National            | 110 (31.2)  |                   |             |
| Expatriate              |             |                   |             |
| Advised against taking the vaccine by medical professional (underlying health condition) | 45 (15.2)   | 0.329             | 0.621       |
| Female                  | 16 (17.7)   |                   |             |
| Male                    | 3 (9.1)     | 1.235             | 0.328       |
| UAE National            | 58 (16.4)   |                   |             |
| Expatriate              |             |                   |             |
| Belief in alternative medicine/therapy to prevent COVID-19 infection | 21 (7.1)    | 1.69               | 0.317       |
| Female                  | 3 (3.3)     |                   |             |
| Male                    | 2 (6.1)     | 0.002             | 1.000       |
| UAE National            | 22 (6.2)    |                   |             |
| Expatriate              |             |                   |             |
| Fear of needles         |             |                   |             |
| Female                  | 19 (6.4)    | 0.196             | 0.636       |
| Male                    | 7 (7.7)     |                   |             |
| UAE National            | 2 (6.1)     | 0.027             | 1.000       |
| Expatriate              | 24 (6.8)    |                   |             |
| Motivating factor | N (%) | χ² value | p value |
|-------------------|-------|----------|---------|
| Unsure of how to book an appointment for the vaccination | | | |
| Female | 21 (7.1) | 0.022 | 1.000 |
| Male | 6 (6.6) | 0.050 | 1.000 |
| UAE National | 2 (6.1) | | |
| Expatriate | 25 (7.1) | | |
| Lack of time to apply | | | |
| Female | 20 (6.7) | 1.027 | 0.360 |
| Male | 9 (10) | | |
| UAE National | 4 (12.1) | 1.091 | 0.296 |
| Expatriate | 25 (7.1) | | |
| Religious objections | | | |
| Female | 4 (1.3) | 0.032 | 1.000 |
| Male | 1 (1.1) | | |
| UAE National | 0 (0.0) | | |
| Expatriate | 5 (1.4) | 0.475 | 1.000 |
| **C. Motivating factor** | | | |
| Becomes a mandatory requirement by my university/employer/government | | | |
| Female | 145 (49.2) | 6.011 | 0.016* |
| Male | 31 (34.4) | | |
| UAE National | 9 (27.2) | 4.946 | 0.029* |
| Expatriate | 167 (47.4) | | |
| My colleagues/family members got vaccinated | | | |
| Female | 129 (43.7) | 1.411 | 0.273 |
| Male | 33 (36.7) | | |
| UAE National | 16 (48.4) | 0.608 | 0.464 |
| Expatriate | 146 (41.4) | | |
| A religious leader/political leader/celebrity advocates the vaccine | | | |
| Female | 16 (5.4) | 5.093 | 0.029* |
| Male | 0 (0.0) | | |
| UAE National | 5 (15.1) | 10.956 | 0.008* |
| Expatriate | 11 (3.1) | | |
| The studies on the vaccine prove better efficacy | | | |
| Female | 143 (48.5) | 9.156 | 0.003* |
| Male | 60 (66.7) | | |
| UAE National | 18 (54.5) | 0.048 | 0.857 |
| Expatriate | 185 (52.5) | | |
| The studies on the vaccine prove better safety with minimal possible side effects | | | |
| Female | 168 (56.9) | 0.788 | 0.395 |
| Male | 56 (62.2) | | |
| UAE National | 21 (63.6) | 0.441 | 0.582 |
| Expatriate | 203 (57.6) | | |
| The vaccine is free | | | |
| Female | 119 (40.3) | 2.065 | 0.180 |
| Male | 44 (48.9) | | |
| UAE National | 7 (21.2) | 6.598 | 0.010* |
| Expatriate | 156 (44.3) | | |
| If it’s a single-dose vaccine | | | |
| Female | 13 (4.4) | 1.591 | 0.274 |
| Male | 7 (7.8) | | |
| UAE National | 1 (3.0) | 0.343 | 1.000 |
| Expatriate | 19 (5.3) | | |

* p < 0.05 is considered to be significant.
tionals (30.3%) were likely to refuse the vaccine for this reason as opposed to the non-UAE nationals (61.1%) and hence nationality seemed to have an association with this refusal factor \( (p < 0.001) \). The other factors that were brought up by the participants over refusing the vaccine are shown in Table 3B.

Acceptance Factors
The most common motivating factor seen across all demographics was “if the studies proved better safety with minimal possible side effects” with 56.9% of females, 62.2% of males; 63.3% of UAE Nationals, 57.6% of expatriates; and 58% of medical students and 58.5% of nonmedical students choosing it (shown in Table 3C). Females (49.2%) and Expatriates (47.4%) \( (p = 0.016, 0.029) \) were more likely to consider taking the vaccine if it were a mandatory requirement by their university/employer/government than males (34.4%) and UAE nationals (27.2%). Furthermore, females (5.4%) and UAE nationals (19.2%) were significantly more likely to accept the vaccine if a religious/political leader or a celebrity endorses the vaccine \( (p = 0.029, 0.008) \) as opposed to males (0%) and expatriates (3.1%). It was also observed that males (66.7%) are more likely to consider the vaccine \( (p = 0.003) \) than females (48.5%) if the studies show better efficacy of vaccines and expatriates (44.3%) are more likely to get vaccinated than UAE Nationals (21.2%) if the cost of the vaccine is minimal/free \( (p = 0.010) \).

Comparison between Outcomes of Medical and Nonmedical Students
COVID-19 Vaccine-Related Beliefs
Medical students (62.38%) were more likely than nonmedical students (47.16%) to disagree with the belief of complete protection from COVID-19 after vaccination \( (p = 0.012) \), as shown in Figure 2a.

Sources of Information
It was deduced that medical students were more likely to use scientific journals (62.8%) to get knowledge on COVID-19 vaccines \( (p < 0.001) \) and less likely to use newspapers (63.7%) as a source \( (p < 0.001) \) than nonmedical students (shown in Table 4A).

Vaccine Refusal/Accepting Factors
In our study, there were no significant associations between refusal factors and study major-medical or not. However, nonmedical students (52.2%) were more likely to accept the vaccine if it is made a mandatory requirement by the university/employer/government than medical students (36.5%) \( (p = 0.003) \) (shown in Table 4A, B).

Discussion
In the history of humanity, vaccinations are without a doubt the most significant advancement in medicine. Since the 20th century, several historically fatal diseases have been reduced by almost 92%–100%, such as smallpox, polio, measles, etc. [17]. A growing list of theories linking vaccines to a variety of medical conditions is raised by vocal opponents of vaccination, despite the achievements of vaccines and the extensive efforts of public health officials to guarantee their safety.

As a long-term strategy against COVID-19, an effective and safe global vaccination program should be implemented, with substantial benefits for clinical and economic outcomes. Thus, providing equal access to safe and effective vaccines is crucial to fighting the COVID-19 pandemic. However, those who argue against the necessity of vaccines have questioned the basic theory of mass vaccination. COVID-19 has raised concerns about the global issue of vaccine hesitancy, which has been a problem for decades. Several considerations about the COVID-19 vaccination have been thoroughly doubted, both within the scientific community and among the general public.

As one of the most multicultural and touristic countries in the world, the UAE presents a different challenge. UAE has taken steps to ensure that vaccines are available all over the country. In this regard, the current survey-based cross-sectional study was intended to explore students' attitudes and hesitancy toward COVID-19 vaccines in UAE universities.

Despite the COVID-19 vaccine being available to UAE residents over the age of 18 for a long time prior to data collection (April 2021–June 2021), the percentage of vaccinated university students (66.7%) was relatively lower compared to a national average of 73.6% (as of July 5, 2021) [18]. One possible explanation for the disparity in vaccination rates is that young people believe they are not at risk of COVID-19 complications [19]. The most common reasons for vaccine hesitancy were found to be concerns over the side effects and concerns over the efficacy of the vaccines, which is consistent with previous research in the UAE, and among other university students worldwide [10, 20–22], but in contrast to a low-income country like that of Afghanistan, where a study found that the ma-
Table 4. Comparison between medical and nonmedical students regarding outcomes related to COVID-19 vaccines (April–June 2021, n = 385)

| Sources of Information for the COVID-19 Vaccine | N (%) | χ² value | p value |
|-----------------------------------------------|-------|----------|--------|
| Newspapers Medical | 82 (36.3) | 15.593 | <0.001* |
| Newspapers Nonmedical | 90 (56.6) | | |
| TV programs Medical | 43 (19.0) | 0.748 | 0.442 |
| TV programs Nonmedical | 36 (22.6) | | |
| Scientific journals Medical | 142 (68.2) | 19.13 | <0.001* |
| Scientific journals Nonmedical | 64 (40.3) | | |
| Magazines Medical | 12 (5.3) | 3.882 | 0.053 |
| Magazines Nonmedical | 17 (10.7) | | |
| Social media Medical | 150 (66.4) | 0.039 | 0.913 |
| Social media Nonmedical | 104 (65.4) | | |
| Websites Medical | 1 (0.4) | 0.705 | 1.000 |
| Websites Nonmedical | 0 (0.0) | | |

| Refusal Factors for the COVID-19 Vaccine | N (%) | χ² value | p value |
|----------------------------------------|-------|----------|--------|
| Concerns over the side effects of the vaccine Medical | 133 (58.8) | 0.005 | 1.000 |
| Concerns over the side effects of the vaccine Nonmedical | 93 (58.5) | | |
| Concerns over the efficacy of the vaccine Medical | 73 (32.3) | 1.225 | 0.310 |
| Concerns over the efficacy of the vaccine Nonmedical | 43 (27.0) | | |
| Advised against taking the vaccine by medical professional (underlying health condition) Medical | 31 (13.7) | 1.857 | 0.202 |
| Advised against taking the vaccine by medical professional (underlying health condition) Nonmedical | 30 (18.9) | | |
| Belief in alternative medicine/therapy to prevent COVID-19 infection Medical | 14 (6.2) | 0.001 | 1.000 |
| Belief in alternative medicine/therapy to prevent COVID-19 infection Nonmedical | 10 (6.3) | | |
| Fear of needles Medical | 11 (4.9) | 3.091 | 0.099 |
| Fear of needles Nonmedical | 15 (9.4) | | |
| Unsure of how to book an appointment for the vaccination Medical | 16 (7.1) | 0.004 | 1.000 |
| Unsure of how to book an appointment for the vaccination Nonmedical | 11 (6.9) | | |
| Lack of time to apply Medical | 16 (7.1) | 0.161 | 0.699 |
| Lack of time to apply Nonmedical | 13 (8.2) | | |
| Religious objections Medical | 3 (1.3) | 0.004 | 1.000 |
| Religious objections Nonmedical | 2 (1.3) | | |

| Motivating Factors for the COVID-19 Vaccine | N (%) | χ² value | p value |
|--------------------------------------------|-------|----------|--------|
| Becomes a mandatory requirement by my university/employer/government Medical | 118 (52.2) | 9.311 | 0.003* |
| Becomes a mandatory requirement by my university/employer/government Nonmedical | 58 (36.5) | | |
| My colleagues/family members got vaccinated Medical | 91 (40.3) | 0.738 | 0.403 |
| My colleagues/family members got vaccinated Nonmedical | 71 (44.7) | | |
| A religious leader/political leader/celebrity advocates the vaccine Medical | 12 (5.3) | 1.829 | 0.204 |
| A religious leader/political leader/celebrity advocates the vaccine Nonmedical | 4 (2.5) | | |
Major reason for hesitancy among the general population for taking the COVID-19 vaccine was their belief that the COVID-19 vaccine, which will be provided for low-income countries, might be of low quality [23]. Similarly, in Ethiopia, people who live in rural areas were more likely to be hesitant to take the vaccine [24]. This indicates that though vaccine hesitancy is a global issue, the reasons for hesitancy may vary according to the region and its economic status, which is further observed in a global study of potential acceptance of COVID-19 vaccines conducted by Lazarus et al. [25] in October 2020.

An element of our research findings not anticipated was the spectrum on which vaccine hesitancy exists among people since many of the participants who took the vaccine remained skeptical; contrary to other studies, which targeted only non-vaccinated people [6, 7]. This discrepancy can be explained by a number of factors, for example, students may have been more hesitant to take only certain vaccines, and therefore chose the one they believed would give a more favorable outcome. Additionally, almost half of the participants in our study (55.3%) were asked to take the vaccine by their universities, but only 44.9% of them cited that as a motivating factor to take the vaccine. In other words, despite reservations about the vaccine, students may have nevertheless taken it as a university requirement. Although our results revealed this valuable insight, stratifying the responses into three groups such as vaccine-accepting, hesitant and resistant individuals as done in other studies, may help tailor counseling to people who are vaccine hesitant and resistant more specifically, and we believe such an approach would have enhanced our findings substantially [6, 7].

Social media was the most commonly reported resource in our study to obtain information about the vaccine, which is in line with the common preference of current youth to use social media. To keep up, government and health-based agencies have also turned to social media to spread updates about the disease and provide further information; however, in some countries, people are less likely to trust the government which can be observed from a study conducted in Brazil showed that information provided by governments, the pharmaceutical industry, and the press were the items that caused most vaccine hesitancy [26].

Another point to be considered is that there are also plenty of social media accounts that spread misinformation. In a study conducted in Saudi, 74.6% of participants agreed that social media carries wrong information about vaccines [27]. This is further invigorated by various reports on conspiracy theories that have circulated on social media regarding vaccines such as it being linked to nanoparticle insertion [15, 28]. This shows the duality of social media that is very subjective to use, i.e., to obtain the right information or misinformation.

Furthermore, a 2020 study by Stecula et al. [29] found that people who were exposed to vaccine-related information on social media were more likely to be misinformed and become vaccine hesitant. Hence, more active efforts should be made by social media companies to remove posts of misinformation and health agencies to pick up the pace with their social media platforms, to capture the attention of youth toward the correct information.

It can be theorized that medical students, owing to their greater knowledge from a medical standpoint, would have less vaccine hesitancy than their nonmedical

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**Table 4 (continued)**

|                                    | N (%) | \( \chi^2 \) value | \( p \) value |
|------------------------------------|-------|---------------------|--------------|
| The studies on the vaccine prove better efficacy |       |                     |              |
| Medical                            | 118 (52.2) | 0.058               | 0.836        |
| Nonmedical                         | 85 (53.5)  |                     |              |
| The studies on the vaccine prove better safety with minimal possible side effects |       |                     |              |
| Medical                            | 131 (58.0) | 0.011               | 1.000        |
| Nonmedical                         | 93 (58.5)  |                     |              |
| The vaccine is free                 |       |                     |              |
| Medical                            | 90 (39.8)  | 1.417               | 0.250        |
| Nonmedical                         | 73 (45.9)  |                     |              |
| If it is a single-dose vaccine      |       |                     |              |
| Medical                            | 9 (4.0)    | 1.634               | 0.245        |
| Nonmedical                         | 11 (6.9)   |                     |              |

*\( p < 0.05 \) is considered to be significant.
counterparts as reported by a 2021 Pakistani study as well as a 2021 Lebanon study [21, 30]. The aforementioned has also speculated that another study conducted by Barello et al. [5] in the earlier days of the pandemic, reported that there were no significant differences between medical and nonmedical students regarding vaccine hesitancy due to the ambiguity surrounding the vaccine during those times. However, interestingly, our study also reports similar findings as that of the Italian study. Therefore, one can speculate that the timeline of the study, while important in some studies, may not have been the most important contributing factor. Rather, sociodemographic and contextual factors may have played a more significant role [31].

Additionally, our study reports that medical students tend to read scientific journals more readily than nonmedical students; a similar pattern was found in previous research [21]. They were also less likely to believe that vaccines offer complete protection against COVID-19, which is in line with the current understanding of how the vaccine works – the COVID-19 vaccine offers protection against only the most severe manifestations of the infection.

Limitations
The sampling procedure and snowballing technique obtained a disproportionately higher number of female and medical & health sciences students, hence limiting the generalizability of the study findings and creating selection bias. Some of the p values were borderline significant and could have been prevented with a larger sample size, potentially leading to different outcomes with a positive or negative association. The study was conducted when not all COVID-19 vaccines were available easily and it is possible that the increased availability of the various vaccines will alter the acceptance rate. Moreover, with the sample size being quite small, i.e., 0.2% of the total student population, and the study primarily focused on the respondent’s gender, nationality, the emirate of residence, and educational background, further studies must be conducted to understand the role of other sociodemographic factors such as ethnicity, family income, marital status, and family size.

Conclusion
COVID-19 vaccination rates among university students in UAE are lower than the national average, demonstrating the importance of integrating a specific awareness program for this group. Preparing medical students for the future is a beneficial long-term strategy, and hence, further research regarding vaccine hesitancy must be done focusing primarily on them to ensure their future patients receive the best vaccine-related recommendations.

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Statement of Ethics
Study approval statement: The research protocol was fully reviewed and approved by the Ethics Committee of Dubai Medical College Ref. No.: 327-ANizam-2021 on March 27, 2021. Consent to participate statement: All participants provided their informed consent digitally before filling in the questionnaire. No responses were recorded until the “submit” button was clicked by the participants confirming their willingness to send out their answers. No personal identifying data were collected from the participants.

Conflict of Interest Statement
The authors have no conflicts of interest to declare.

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Author Contributions
A.N., T.I., H.M., and E.E.N. were responsible for the conceptualization, data analysis, and writing the draft of this paper. All authors contributed to the design of the study, data collection, review of the draft manuscript, and subsequent modifications. All authors reviewed the manuscript before submission and approved the final version.

Data Availability Statement
The data that support the findings of this study are not publicly available as it contains information that could compromise the privacy of research participants but are available from the corresponding author [A.N.] upon reasonable request.
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