Which Volunteering Settings Do Medical Students Prefer During a Novel Respiratory Virus Pandemic? A Cross-Sectional Study of Multiple Colleges in Central Saudi Arabia During the COVID-19 Pandemic

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Purpose: Novel respiratory virus outbreaks are a recurring public health concern. Volunteering medical students can be a valuable asset during such times. This study investigated the willingness of medical students to volunteer during the coronavirus disease of 2019 (COVID-19) pandemic and the barriers to doing so, considering the possibility of exposure to COVID-19 and mode of contact.

Patients and methods: This cross-sectional study was conducted using a self-administered online questionnaire adapted from the literature. The questionnaire comprised four parts: demographic variables, COVID-19-related variables, willingness scale, and barrier scale. The target population was medical students at four different colleges in Riyadh, Saudi Arabia.

Results: A total of 802 students participated in the study. A small proportion of students (10.6%) were willing to participate in volunteering activities that could involve contact with patients with COVID-19 as compared to other settings (39.4–43.4%). More than one-quarter of students (26.8%) had risk factors for severe COVID-19. The main barrier to volunteering was the concern of transmitting the infection to family members (76.8%). Registration to receive the COVID-19 vaccine was positively associated with more willingness to volunteer ($\beta=0.17, p <0.001$), whereas residing in a household with an elderly person was negatively associated ($\beta=-0.13, p <0.001$). Female sex was positively associated with higher barrier score ($\beta=0.12, p <0.001$).

Conclusion: Medical students were more willing to volunteer in activities that did not involve direct contact with patients with COVID-19. A considerable proportion of participants had risk factors for severe illness. Sharing a household with an elderly person or child was associated with lower willingness to volunteer. Organizers of volunteering activities should offer various volunteering options considering the risk of infection; and be mindful of barriers to volunteering, especially risk factors for severe illness and eldercare and childcare responsibilities.

Keywords: medical students, volunteerism, health workforce, disaster, pandemic, COVID-19

Introduction

Volunteering can be defined as “any activity in which time is given freely to benefit another person, group, or organization”. Volunteers, especially medical students, are an asset for healthcare systems and the community under normal circumstances, as well as during pandemics and other public health emergencies. Volunteering is a professionally and morally rewarding experience for medical students as it fosters their professional identity.
Medical students are motivated by multiple factors, such as altruism, community service, sense of duty, and professional development.

Students’ volunteering options include a wide array of activities that can involve direct contact with patients, such as patient care and clinical assistance; contact with persons in the community setting outside healthcare facilities through food and medicine delivery; and activities that can be performed without direct contact, such as attending phone helplines and raising awareness through social media. Nevertheless, multiple barriers to volunteering in general, including a negative impact on academic performance and lack of confidence and necessary skills, exist. Some barriers, such as concerns over personal or family safety, apply specifically to public health emergencies, especially with the risk of respiratory transmission.

Since March 2020, the world has been in a pandemic caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), a novel respiratory virus and the causative agent of COVID-19, which spreads rapidly and is associated with significant morbidity and mortality. Most countries have implemented restrictions, including movement restriction, mask use, and social distancing, to mitigate transmission of the virus. In Saudi Arabia, similar measures were implemented to control the transmission. Additionally, volunteers were an essential part of the healthcare workforce to face the increasing demand during the pandemic. For example, volunteers answered 20% of the calls to the nationwide hotline for medical inquiries (937) during the pandemic. However, the concern of infection and imposed restrictions and precautions may discourage and limit volunteering by medical students in traditional settings requiring direct contact. Therefore, virtual platforms, such as telehealth and health promotion through social media, have been suggested as alternative venues for medical students to volunteer during the COVID-19 pandemic.

Several demographic factors specific to Middle Eastern countries are additional barriers to volunteering by medical students during the pandemic. For instance, the average size of households (≥5) is larger than that of other countries, except those in Africa. Therefore, medical students often live with elderly individuals or children. Additionally, Middle Eastern countries have an increasing population of elderly individuals, who are particularly vulnerable to severe COVID-19 disease.

Although multiple studies have explored the willingness of medical students to engage in volunteering activities and the barriers to doing so before and during the COVID-19 pandemic they have not considered different settings and modes of contact that could lead to exposure to COVID-19. Additionally, because of cultural and demographic particularities of Middle Eastern countries, specific barriers to volunteering among medical students in this region should be identified to optimize this resource both generally and during public health emergencies for the benefit of the healthcare system, patients, and community. Furthermore, demographic factors that are associated with increased willingness or barriers to volunteer should be explored. This multicenter study investigated these factors using an online questionnaire targeting medical students in Riyadh, Saudi Arabia.

**Methods**

**Study Design and Setting**

This cross-sectional study used a self-administered online questionnaire adapted from the literature, targeting medical students at four of the eight colleges of medicine located in Riyadh, the capital of the Kingdom of Saudi Arabia. These are the Colleges of Medicine at King Saud University (KSU), Imam Muhammad Ibn Saud Islamic University (IMISIU), the women-only Princess Nourah Bint Abdulrahman University (PNU), and AlMaarefa University (MU). KSU, IMISIU, and PNU are public universities, whereas MU is a private university. First to fifth year medical students were included in the study, whereas foundation year students, interns, and withdrawn students were excluded. A total of 3609 medical students attended the aforementioned colleges (KSU=1466, IMISIU=1005, MU=746, and PNU=392). Of the 3609 medical students, 1839 and 1770 students were female and male students, respectively. Among them, 1570 students were in the basic sciences stage, 717 students were in the preclinical stage, and 1322 students were in the clinical stage. The minimum sample size required to detect a 57.4% proportion of medical students willing to volunteer with a 95% confidence level and a 5% margin of error was determined as 341 students. Responses were collected during January and February 2021. At the time, due to COVID-19 precautions, lectures were provided...
online at KSU and PNU. However, at IMISIU, basic sciences level lectures were a hybrid of the online and in-person modes. For the clinical level at MU, lectures were taught in-person on campus. In all universities, practical sessions were conducted with limited numbers in laboratories and clinical settings.

**Study Instrument**

The questionnaire was divided into four parts. The first part consisted of the following demographic variables: sex, marital status, grade point average (GPA), study year, persons with whom participants live, and elderly and children in the household. GPA was categorized as excellent (≥ 90%), very good (90–75%), good (75–55%), and pass (<55%). The number of study years was categorized as stages based on the type of courses in that stage: first and second year, basic science stage; third year, preclinical stage; and fourth and fifth years, clinical stage. Elderly persons were defined as those aged ≥65 years. The second part included questions related to COVID-19, such as history of close contact with infected patients or confirmed personal infection, COVID-19 vaccination registration status, and presence of risk factors for severe COVID-19 infection. Risk factors for severe COVID-19 infection included the following: Asthma or any other chronic respiratory diseases, obesity, smoking, cardiovascular diseases including hypertension, recent admission to the hospital, pregnancy, and sickle cell disease or thalassemia. Obesity was defined as having a body mass index (BMI) ≥30 kg/m², and recent admission was defined as being admitted to a hospital in the past 6 months.

The third part of the questionnaire was a 4-item willingness scale developed to assess students’ willingness to volunteer in different settings based on the possibility of contact with patients with COVID-19, site of volunteering (inside healthcare facilities or in the community), and the nature of contact with persons (direct or distant). Willingness to participate in these settings was measured using a 5-point Likert scale (not willing=0, somewhat not willing=1, undecided=2, somewhat willing=3, willing=4). The fourth part was the barrier scale consisting of 11 barriers adapted from the literature. Agreement with these barriers was measured on a 5-point Likert scale (strongly disagree=0, disagree=1, neutral=2, agree=3, strongly agree=4). Participants were required to complete all items, except the optional items on elderly persons and children in the household, to be able to submit the questionnaire.

A pilot study to test the questionnaire was conducted with 30 first-year medical students to ensure that the questions were comprehensible, even to the most junior students. No issues were reported regarding questionnaire access, content, and time required for completion, which averaged 5 minutes.

**Data Collection**

KSU, IMISIU, and MU students were classified into 10 groups based on sex and study year, whereas PNU students were classified into five groups. Data collectors contacted group leaders to send the invitation link to a Google Forms page (Google, Mountain View, CA, USA), containing the informed consent form and questionnaire. Links were sent to student electronic messaging groups where students receive course announcements and information about extracurricular activities, such as volunteering. The initial invitation was followed with two weekly reminders to encourage participation. If two or more responses were identical in responses to all items and had the same time stamp, they were labelled as duplicates.

**Statistical Analysis**

Spreadsheets of questionnaire responses were imported from Google Forms and coded using Excel v16.0 (Microsoft, Redmond, WA, USA). The coded data were analyzed using SPSS v24.0 (IBM, Armonk, NY, USA). Descriptive statistics (mean, standard deviation, frequencies, and percentages) were used to describe quantitative and categorical variables. Total willingness scale score was calculated by summing the scores of the four items pertaining to willingness to volunteer in different settings (minimum=0, maximum=16). A total barrier scale score was calculated by summing the scores of 11 barrier items (minimum=0, maximum=44). Cronbach’s alpha was used to measure the internal consistency of willingness and barrier scales. Differences in mean willingness and barrier scores between categories of demographic variables were assessed using the independent samples t test or one-way analysis of variance. Associations between willingness or barriers scores and continuous or ordinal variables were evaluated with Pearson’s correlation and Spearman correlation, respectively. Multiple linear regression was used to assess the association between demographic...
and COVID-19-related variable and willingness and barrier scale scores. The stepwise method applied a 0.05 probability of F for entry and 0.1 for removal, and missing cases were excluded pairwise. Associations between willingness to volunteer in different settings as a dependent variable and level of agreement with barriers were determined using Somers’ d. A p-value <0.05 and 95% confidence interval were used to report the statistical significance and precision of the results, respectively.

**Ethical Considerations**

Ethics approval (number E-21-5669) was obtained from the institutional review board at KSU College of Medicine. Participation was voluntary, and data were collected for research purposes only. The questionnaire page contained the informed consent form at the top to be viewed prior to voluntary participation. It included the purpose of the study, assurance that responses would be treated confidentially, and the contact information, if the participant had further inquiries. Self-identifying information, such as name, university number, phone number, and email, were not collected. Data were stored on the principal investigator’s computer, which was password-protected.

**Results**

**Participant Characteristics**

Overall, 805 responses (22.3% response rate) were received; three of these responses were duplicates. Therefore, 802 responses were included in the analysis. The response rates varied among different colleges; 365 students from KSU (24.9%), 156 students from IMISIU (15.5%), 149 students from PNU (38%), and 130 students from MU (17.4%) provided responses. The response rate was slightly higher for males (24%) than for females (20.5%). In addition, preclinical stage students had the highest response rate (36.1%), followed by basic sciences students (20.4%), and finally the clinical stage students (16.9%). Almost all (98.6%) of the participants were single, and most (92.4%) participants were living with their families. More than one-quarter of participants (28.1%) were living with elderly persons, and 53.1% were living in a household with children. The highest proportion of participants was in the basic sciences stage (39.9%); 53.4% had an excellent GPA and 58.7% had previously volunteered at least once. Table 1 shows the demographic characteristics of the study participants.

**COVID-19-Relevant Characteristics**

One-third of participants (33.5%) had a history of close contact with a patient with COVID-19; 10.5% were previously diagnosed with COVID-19, and 62.3% were not registered to be vaccinated (Table 2). More than one-quarter (26.8%) of participants had risk factors for severe COVID-19 disease with chronic respiratory illness, obesity, and smoking being the most prevalent (Figure 1).

**Willingness to Volunteer in Different Settings**

Only 10.6% of students were willing to volunteer in activities that could involve direct contact with suspected or confirmed cases of COVID-19; higher proportions of students were willing to volunteer in other settings (39.4–43.4%) (Figure 2). The willingness scale showed acceptable internal consistency with a Cronbach’s alpha of 0.735. The mean willingness scale score was 9.32±4.3 (58.3% of the maximum willingness scale score), and the median score was 10 (interquartile range=7–12). Willingness scale means differed significantly across categories of the following demographic variables: sex, living with elderly persons or children, study stage, GPA, and number of previous volunteering activities (Table 1). Mean willingness scale scores differed significantly across the following COVID-19-related variables: history of close contact with COVID-19 patients, COVID-19 vaccine registration status, and having risk factors for severe COVID-19 disease (Table 2). Multiple linear regression model showed that living with elderly persons or children and having a risk factor for severe COVID-19 disease were significantly associated with lower total willingness scale score. Additionally, a higher GPA, higher number of previous volunteering activities, history of a close contact with a patient with COVID-19, and registration to receive the COVID-19 vaccine were significantly associated with higher total willingness scale scores (Table 3).
Table 1 Sociodemographic Characteristics of the Study Participants (n=802)

| Variable                | Category                        | Number of Students (%) | Mean Willingness Scale Score (Out of 16)±SD, p value† | Mean Barrier Scale Score (Out of 44)±SD, p value† |
|-------------------------|---------------------------------|------------------------|--------------------------------------------------------|--------------------------------------------------|
| Type of University      | Public                          | 671 (83.7)             | 9.38±4.17                                              | 22.1±7.89                                        |
|                         | Private                         | 131 (16.3)             | 9.05±4.92                                              | 23.27±9.56                                       |
|                         |                                 |                        | p=0.484                                                | p=0.194                                          |
| Sex                     | Female                          | 377 (47)               | 9.8±4.3                                                | 23.22±8.1                                        |
|                         | Male                            | 425 (53)               | 8.9±4.26                                               | 21.49±8.18                                       |
|                         |                                 |                        | p=0.003                                                | p=0.003                                          |
| Marital status          | Single                          | 791 (98.6)             | 9.4±4.3                                                | 22.34±8.2                                        |
|                         | Married                         | 11 (1.4)               | 6.9±3.67                                               | 19.36±6.56                                       |
|                         |                                 |                        | p=0.61                                                 | p=0.23                                           |
| Currently living with   | Her/his family                  | 741 (92.4)             | 9.38±4.21                                              | 22.6±8.1                                         |
|                         | Alone or with her/his colleagues| 61 (7.6)               | 8.64±5.23                                              | 22.82±9.17                                       |
|                         |                                 |                        | p=0.286                                                | p=0.61                                           |
| Elderly living in the house | Yes                          | 225 (28.1)             | 8.56±4.32                                              | 22.31±7.57                                       |
|                         | No                              | 571 (71.2)             | 9.62±4.27                                              | 22.33±8.46                                       |
|                         |                                 |                        | p=0.002                                                | p=0.972                                          |
| Children living in the house | Yes                          | 431 (53.1)             | 9.03±4.18                                              | 22.66±8.55                                       |
|                         | No                              | 325 (40.5)             | 9.76±4.18                                              | 21.62±7.61                                       |
|                         |                                 |                        | p=0.02                                                 | p=0.077                                          |
| Study stage             | Basic sciences                  | 320 (39.9)             | 9.89±4.18                                              | 23.03±8.01                                       |
|                         | Preclinical                     | 259 (32.3)             | 8.44±4.64                                              | 22.41±8.88                                       |
|                         | Clinical                        | 223 (27.8)             | 9.54±3.9                                               | 21.15±7.47                                       |
|                         |                                 |                        | p<0.001                                                | p<0.03                                           |
| Spearman correlation    |                                 |                        | r_s=−0.058                                             | r_s=−0.102                                        |
|                         |                                 |                        | p=0.1                                                  | p=0.004                                          |
| GPA                     | Excellent                       | 428 (53.4)             | 9.72±4.06                                              | 22.67±8.27                                       |
|                         | Very good                       | 309 (38.5)             | 9.06±4.54                                              | 21.76±8.35                                       |
|                         | Good                            | 54 (6.7)               | 8.02±4.48                                              | 22.28±7                                          |
|                         | Pass                            | 11 (1.4)               | 7.73±4.1                                               | 23.45±5.16                                       |
|                         |                                 |                        | p=0.01                                                 | p=0.491                                          |
| Spearman correlation    |                                 |                        | r_s=0.109                                              | r_s=0.041                                        |
|                         |                                 |                        | p=0.002                                                | p=0.245                                          |

(Continued)
Barriers to Volunteering

The barrier scale showed good internal consistency with a Cronbach’s alpha of 0.795. The mean barrier scale score was 22.31±8.2 (50.7% of the maximum barrier scale score) and the median barrier score was 22 (interquartile range=17–28). The major barrier was the concern of transmitting COVID-19 to other family members (76.8%), followed by discouragement by their parents or other family members (42.8%) and increased levels of stress (42%). Figure 3 shows students’ agreement with the effect of different barriers on their willingness to volunteer. Bivariate analysis of demographic variables and barrier scale scores revealed significant differences among means of the following variables: sex, study stage, and number of previous volunteering activities (Table 1). Multiple linear regression analysis showed that female sex was significantly associated with higher barrier scale score, whereas higher number of previous volunteering activities was associated with lower barrier scale score.

Table 1 (Continued).

| Variable | Category | Number of Students (%) | Mean Willingness Scale Score (Out of 16)±SD, p value† | Mean Barrier Scale Score (Out of 44)±SD, p value† |
|----------|----------|------------------------|------------------------------------------------------|--------------------------------------------------|
|         |          |                        |                                                      |                                                  |
| Number of previous volunteering activities | 0        | 331 (41.3)             | 8.73±4.56                                            | 23.01±8.47                                        |
|         | 1 or 2   | 173 (21.6)             | 9.69±4.01                                            | 21.55±8.34                                        |
|         | 3–5      | 168 (20.9)             | 9.67±4.06                                            | 22.71±7.5                                         |
|         | 6 or more | 130 (16.2)            | 9.89±4.17                                            | 20.81±7.9                                         |
| Pearson's correlation | r=0.098  |                       | r=−0.113                                             | p=0.006                                           |
|         |          |                        |                                                      |                                                  |

Note: †t-test or analysis of variance (ANOVA).
Abbreviations: GPA, grade point average; SD, standard deviation.

Table 2 Frequency of COVID-19–Related Characteristics of Study Participants (n=802)

| Variable | Category | Number of Students (%) | Mean Willingness Scale Score (Out of 16)±SD, p value† |
|----------|----------|------------------------|------------------------------------------------------|
| History of close contact with a patient with COVID-19 | Yes | 269 (33.5) | 9.89±4.56 |
|          | No       | 533 (66.5)             | 9.04±4.14                                             | p=0.008                                           |
| Previously diagnosed with COVID-19 | Yes | 84 (10.5) | 9.12±4.95 |
|          | No       | 718 (89.5)             | 9.35±4.22                                             | p=0.687                                           |
| Registered to receive COVID-19 vaccine | Yes | 299 (37.7) | 10.09±3.8 |
|          | No       | 500 (62.3)             | 8.86±4.52                                             | p<0.001                                           |
| Have 1 or more risk factor(s) for severe COVID-19 illness | Yes | 215 (26.8) | 8.74±4.57 |
|          | No       | 587 (73.2)             | 9.54±4.18                                             | p=0.02                                            |

Note: †t-test or analysis of variance (ANOVA).
Abbreviations: COVID-19, coronavirus disease of 2019; SD, standard deviation.
Figure 1 Bar chart of risk factors for severe COVID-19 disease (n=215).

Figure 2 Bar charts of students’ willingness to volunteer in different settings (n=802).
activities was significantly associated with lower barrier scale score (Table 4). When the mean score for each barrier was tested for differences between females and males, the following barriers had a significantly higher mean score among females than males: acquiring the infection, inadequate pre-volunteering training, insufficient personal protective equipment (PPE), and inadequate supervision during training. However, males had a higher mean score for eldercare responsibility than females (Table 5).

**Association Between Barriers to Volunteering and Willingness to Volunteer in Different Settings**

A weak negative correlation was identified between students’ concern of acquiring COVID-19 and their willingness to volunteer in activities that could involve direct contact with patients with COVID-19 in healthcare facilities (\(d=-0.168, \ p<0.001\)), with a smaller correlation for activities that could involve direct contact with patients without COVID-19 (\(d=-0.083, \ p=0.066\)). However, no significant correlation was identified for activities that could involve direct contact with the community (\(d=-0.036, \ p=0.211\)). A very weak positive correlation with activities that do not involve direct contact with persons was recorded (\(d=0.087, \ p=0.004\)). Additionally, a weak positive correlation existed between students’ concern of transmitting COVID-19 to other family members and their willingness to volunteer in the three other settings that may not involve direct contact with patients with COVID-19 (\(d=0.18-0.272, \ p<0.001\)). A weak positive correlation was recorded between discouragement by parents or other family members and students’ willingness to volunteer in activities that do not involve direct contact with persons (\(d=0.166, \ p<0.001\)) (Table 6).

**Discussion**

Considerable differences existed in students’ willingness to volunteer in activities that could involve contact with patients with COVID-19 compared to other settings (10.6% vs 39.4–43.4%). Fear of being infected may partly explain this difference, as there was a weak negative correlation between this barrier and willingness to volunteer in activities that could involve contact with patients with COVID-19. This explanation is supported by the fact that willingness to volunteer in other settings was comparable despite differences in the location (healthcare facility or community) and

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**Table 3 Multiple Linear Regression Results of Significant Demographic Characteristics for Total Willingness Scale Score**

| Total Willingness Score | Level | B    | 95.0% CI for B | \(\beta\) | \(p\) value |
|-------------------------|-------|------|----------------|----------|------------|
|                         |       |      | LL            | UL       |
| Model*                  |       | 8.07 | 5.36          | 10.79    |            |
| (Constant)              |       | 8.07 | 5.36          | 10.79    |            |
| Registered to receive COVID-19 vaccine | Yes | 1.52 | 0.89          | 2.14     | 0.17       | <0.001     |
| Elderly persons living in the house | Yes | −1.24 | −1.91        | −0.56    | −0.13      | <0.001     |
| History of close contact with a COVID-19 patient | Yes | 1.1  | 0.47          | 1.73     | 0.12       | 0.001      |
| Number of previous volunteering activities (0) | I-Level increase | 0.47 | 0.19          | 0.74     | 0.12       | 0.001      |
| GPA (pass)              | I-Level increase | 0.6  | 0.15          | 1.05     | 0.1        | 0.009      |
| Children living in the house | Yes | −0.84 | −1.44        | −0.23    | −0.1       | 0.007      |
| Has a risk factor for severe COVID-19 disease | Yes | −0.9 | −0.09         | −1.58    | −0.23      | 0.009      |
| Study stage (Basic sciences) | I-Stage increase | −0.45 | −0.83        | −0.06    | −0.09      | 0.023      |

**Note:** Excluded variable: Sex. \(^* R^2=0.093, \ \Delta R^2=0.083, \ F=9.56, \ p<0.001\).

**Abbreviations:** \(\beta\), standardized coefficient; B, unstandardized regression coefficient; CI, confidence interval; LL, lower limit; \(R^2\)=coefficient of determination; \(\Delta R^2\)=adjusted \(R^2\); UL, upper limit.
mode of contact (direct or distant). Moreover, this is consistent with the previous finding that personal health and safety concerns were an especially large barrier to volunteering when respiratory pathogens were involved.\textsuperscript{5,8,9,28,29} Registration to receive the COVID-19 vaccine had the highest positive association with willingness to volunteer. Prosocial motives might explain the previous finding, as research showed that it is associated with volunteerism and vaccination intentions.\textsuperscript{32,33}

Although we found that female sex was associated with higher barrier score, no difference existed between sexes with respect to willingness to volunteer, consistent with previous findings.\textsuperscript{26} However, most studies have reported less willingness to volunteer among females than males.\textsuperscript{29,30,34} This finding can be explained by the fact that female students

Figure 3 Bar charts of students’ agreement with the effect of different barriers on their willingness to volunteer (n=802).
in our study had higher agreement with the following concerns as barriers: acquiring COVID-19 infection, inadequate pre-volunteering training, insufficient PPE, and inadequate supervision during training.

Eldercare and childcare were previously reported as barriers for healthcare workers to respond during disasters. However, an important finding of our study was that even living in a household with elderly persons or children reduced students' willingness to volunteer. First, students had less willingness because of the concern of transmitting COVID-19 to these family members who were perceived as being more vulnerable to severe illness. Second, they perceived that volunteering could negatively affect the care that they would be able to provide to these family members. Our results diverge from those of a study of Indonesian medical students that found no difference in willingness to volunteer between those who lived in a household with children or elderly persons and those who did not. This discrepancy may be attributable to a difference in the assessment of willingness, which was based on a single item in the Indonesian study, as compared to four items covering different settings and the possibility of contact with patients with COVID-19 in our study.

Table 4 Multiple Linear Regression Results of Significant Demographic Characteristics for Total Barrier Scale Score

| Total Barrier Score | Level | B   | 95.0% CI for B | β     | p value |
|---------------------|-------|------|---------------|-------|---------|
|                     |       |      | LL            | UL    |         |
| Modela              |       | 20.15| 18.38         | 21.92 |         |
| (Constant)          |       | 20.15| 18.38         | 21.92 |         |
| Sex                 | Female| 2.03 | 0.89          | 3.18  | 0.12    | 0.001   |
| Number of previous volunteering activities (0) | I-level increase | -0.739 | -1.25 | -0.23 | -0.1 | 0.005 |

Note: Excluded variable: Study stage. R²=0.021, ΔR²=0.019, F=8.56, p<0.001.

Abbreviations: β, standardized coefficient; B, unstandardized regression coefficient; CI, confidence interval; LL, lower limit; R², coefficient of determination; ΔR², adjusted R²; UL, upper limit.

Table 5 Mean Barrier Scores for the Study Participants (n=802)

| Barrier                                      | Mean Barrier Score±SD | p value† |
|----------------------------------------------|------------------------|---------|
|                                              | Female                 | Male    |         |
| Concern of acquiring the infection           | 2.22±1.28              | 1.92±1.31 | 0.001 |
| Concern of transmitting infection to other family members | 3.25±1.16              | 3.16±1.22 | 0.240 |
| Discouraged by parents or other family members | 2.15±1.36              | 2.18±1.32 | 0.728 |
| Increased levels of stress                   | 2.03±1.28              | 2.18±1.36 | 0.111 |
| Negative effect on grades                    | 2.17±1.37              | 2.06±1.27 | 0.237 |
| Inadequate pre-volunteering training         | 2.22±1.27              | 1.97±1.25 | 0.006 |
| Eldercare responsibility                      | 1.75±1.44              | 2.03±1.3 | 0.004 |
| Childcare responsibility                      | 1.66±1.4               | 1.68±1.3 | 0.776 |
| Insufficient PPE                             | 2.06±1.39              | 1.67±1.24 | 0.001 |
| Inadequate supervision during volunteering    | 2.04±1.2               | 1.81±1.18 | 0.008 |
| Transportation difficulties                   | 1.52±1.35              | 0.99±1.21 | <0.001 |

Note: †Independent sample t test.

Abbreviations: PPE, personal protective equipment; SD, standard deviation.
Family opinion is an important determinant in students’ decision to volunteer. Among Polish medical students, 59.2% indicated that they consulted their parents before volunteering. Likewise, 43.2% of students in our study agreed that discouragement by parents or other family members was a barrier. In addition, concern of increased stress was reported by 42% of students in our study as a barrier to volunteering. In a large study from Brazil (10,433 students), lower proportion of students (34.6%) agreed that they felt stressed at the hospital during the pandemic. Ensuring access to psychological support is important for the volunteers. For instance, in a study on volunteering health sciences students, 61.4% of students reported that they did not have access to supportive psychological services when needed.

| Table 6 Association Between Barriers and Willingness to Volunteer in Different Settings (n=802) |
|-----------------------------------------------|-------------------------------------------------|-------------------------------------------------|-------------------------------------------------|-------------------------------------------------|
| Setting                                      | Might Involve Direct Contact with Suspected/Confirmed Patients with COVID-19 in Healthcare Facilities | Might Involve Direct Contact with Non-COVID-19 Patients in Healthcare Facilities | Might Involve Direct Contact with People in the Community (Outside Healthcare Facilities) | Does not Involve Direct Contact with People (Through Phone or Any Virtual Platform) |
| Barrier                                       | Somers’ d                                         | Somers’ d                                         | Somers’ d                                         | Somers’ d                                         |
| Concern of acquiring the infection           | −0.168***                                         | −0.083**                                         | −0.036                                         | 0.087***                                         |
| Concern of transmitting infection to other family members | −0.067                                           | 0.18***                                         | 0.205***                                         | 0.272***                                         |
| Discouraged by parents or other family members | 0.039                                           | 0.061*                                         | 0.08**                                         | 0.166***                                         |
| Increased levels of stress                   | −0.058*                                         | −0.024                                         | −0.031                                         | 0.049                                           |
| Negative effect on grades                    | −0.03                                           | 0.016                                           | 0.03                                           | 0.023                                           |
| Inadequate pre-volunteering training         | 0.069**                                         | 0.046                                           | 0.032                                           | 0.11***                                         |
| Elderly care responsibility                  | 0.084**                                         | 0.077**                                         | 0.052                                           | 0.105***                                         |
| Childcare responsibility                      | 0.063*                                         | 0.059**                                         | 0.069**                                         | 0.062                                           |
| Insufficient PPE                             | 0.047                                           | 0.024                                           | 0.019                                           | 0.09**                                          |
| Inadequate supervision during volunteering   | 0.023                                           | 0.002                                           | 0.006                                           | 0.049                                           |
| Transportation difficulties                  | 0.036                                           | −0.055                                         | −0.028                                         | 0.032                                           |

Note: *p <0.05. **p <0.01. ***p <0.001.
Abbreviation: PPE, personal protective equipment.
Supervision during volunteering has been reported in multiple studies. Less than half (46.8%) of the Brazilian medical students agreed that the supervision they received during practice was good. Michno et al surveyed medical students from multiple countries and found that an inadequate level of supervision was a concern for less than two-thirds (60.4%) of students. However, this was the case for less than one-third (30.1%) of students in our study. Differences in item phrasing might have contributed to this variance, as Michno et al added to the item the inability to safely perform clinical duty as a consequence of inadequate supervision.

Distinction between the first and subsequent waves of COVID-19 regarding extracurricular participation in clinical and community work by medical students has been a matter of debate. During the first wave, medical students had more free time, which was not the case in subsequent waves when clinical training had fully resumed. Therefore, volunteering during times of full academic requirements in a setting of public health emergency may excessively burden medical students and their essential role as learners, which is typically measured by grades. Our study was conducted during the beginning of the second wave in Saudi Arabia, and 40.8% of medical students agreed that a negative effect on their grades is a concern when they consider volunteering, which is consistent with the aforementioned viewpoint.

Although medical students may be assumed to have few risk factors for severe COVID-19 illness, our data revealed the opposite, with one-quarter of participants having at least one risk factor. Few medical students (10.6%) had chronic medical illnesses in an international study. However, they did not inquire about obesity and smoking, which might explain the lower proportion. In our study, having a risk factor for severe illness was associated with lower willingness to volunteer. This association was observed for activities involving direct contact with patients with and without COVID-19 but not for activities in the community or that were performed at a distance. Having a risk factor for severe illness could explain the lower willingness to volunteer in settings with higher probability of COVID-19 transmission.

Strengths and Limitations
This study involved medical students from multiple colleges with a large sample size and comparable response rate between sexes. Additionally, it assessed students’ willingness to volunteer in four different settings during a local and global surge of the COVID-19 pandemic (Winter 2021). However, the study was limited by convenience sampling, low response rate, variability of response rate based on university attended and study stage, and the fact that data were obtained through self-report and did not actually measure volunteering activities.

Conclusion
During the COVID-19 pandemic, medical students were more willing to volunteer in activities that do not involve direct contact with probable patients with COVID-19. Notably, medical students are not without risk factors of severe illness. No significant difference in willingness existed between sexes; however, female students indicated higher agreement with barriers to volunteering. Sharing a household with and an elderly person or child was associated with lower willingness to volunteer. Recommendations for organizers of volunteering activities include considering various volunteering options in light of the risk of infection, paying attention to barriers to volunteering, especially having risk factors for severe illness, and responsibility for eldercare and childcare.

Abbreviations
BMI, body mass index; COVID-19, coronavirus disease of 2019; GPA, grade point average; IMISIU, Imam Muhammad Ibn Saud Islamic University; IQR, interquartile range; KSU, King Saud University; MU, ALMaarefa University; PNU, Princess Nourah Bint Abdulrahman University; PPE, personal protective equipment; SARS-Cov-2, severe acute respiratory syndrome coronavirus 2.

Acknowledgments
The authors thank the College of Medicine Research Center, Deanship of Scientific Research, King Saud University, Saudi Arabia for their support. Also, we thank the participating medical students, the Deanship of Scientific Research and the Researcher Support and Services Unit at King Saud University for their technical support, the peer reviewers for their
The authors report no conflicts of interest in this work.

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