Depression Among Medical Students in the United States During the COVID-19 Pandemic: The role of Communication Between Universities and Their Students

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Abstract

Objective: Medical students are vulnerable to stress and depression during medical school and the COVID-19 pandemic may have exacerbated these issues. This study examined whether the risk of depression was associated with COVID-19 pandemic-related medical school communication.
Methods: A 144 - item pilot cross-sectional online survey of medical students in the US, was carried out between September 1, 2020 and December 31, 2020. Items on stress, depression, and communication between students and their medical schools were included. This study examined associations of student perceptions of universities' communication efforts and pandemic response with risk of developing depression.
Results: The sample included 212 students from 22 US states. Almost 50% (48.6%) were at risk of developing depression. Students felt medical schools transitioned well to online platforms, while the curriculum was just as rigorous as in-person courses. Students at risk of developing depression reported communication was poor more frequently compared to students at average risk. Students at risk of depression were also more than 3 times more likely to report their universities' communication about scholarships or other funding was poor in adjusted analyses.
Conclusion: Universities communicated well with medical students during the pandemic. However, this study also highlights the need for ongoing efforts to address student mental health by medical schools.

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The COVID-19 pandemic disrupted education globally, contributing to poor mental health among medical students.[1–5] This disruption affected classes and clinical rotations as medical students were not allowed to have clinical contact with patients.[5,6] Medical schools in the US transitioned to online curriculums in the months of March and April, 2020 to decrease potential exposure to the SARS CoV-2 virus. This rapid transition required extensive coordination and communication, as well as adapting the curricula to new platforms while ensuring education was as rigorous as in-person instruction. The numerous adjustments early in the pandemic contributed to the stress and isolation among students.[3]

Medical students are vulnerable to stress and depression during medical school in the US.[7,8] Internal and external pressure to perform at a high level despite events occurring locally, nationally, or globally contribute to rates of depression and suicide that exceed that of the general US population.[8,9] Personal sources of stress, such as tuition funding, having inadequate time to participate in stress-reducing activities, and coping with a fast-paced curriculum designed to quickly impart basic medical knowledge and skills in a limited time period, all contribute to an increased level of stress, anxiety, and depression.[10] Understanding the effects of a sudden change in curriculum, and communication about these changes during a pandemic or any other disaster on the mental health of students is critical to planning for future disaster events that affect this vulnerable population.

The purpose of this study was to examine medical student perception of their institutions' communication efforts during the COVID-19 pandemic, and the association of pandemic-related curriculum changes and communication with depression in the Fall of 2020, among students enrolled in a US medical school during the previous (2019 - 2020) school year.

Methods

This convenience sample of medical students using an online REDCap survey recruited students through social media and email from participating medical schools. The survey was open from

September 1, 2020 to December 31, 2020. Study methods were approved by the University of Texas Medical Branch Institutional Review Board (IRB), and data analyses were approved by the Baylor College of Medicine IRB.

Students who did not give their consent were exited from the survey, while those who enrolled from 2019 - 2020 were excluded. There were 144 multiple-choice or free-text questions. Participants were not compensated for participation.

Depression Measure

The Center for Epidemiological Studies-Depression (CESD-10) is a 10-item measure of depressive symptoms during the past week. Responses ranged from 0 = "Rarely or none of the time (less than 1 day)" to 3 = "Most or all of the time (5 - 7 days)". To develop a dichotomous risk of depression outcome, a standardized cutoff of 10 was used to determine elevated risk of depression (≥ 10, "at risk") compared to no elevated risk of depression (< 10, "average" risk).

Medical School Communication and Response

A total of 10 questions about medical school communication had Likert scale responses that were collapsed into "Very poor/ poor," "Fair," and "Well/ Very well." Of the remaining questions, 17 were about medical schools' preparedness, and they had 5-point Likert scale responses ranging from "Strongly disagree" to "Strongly agree." Also, 11 questions characterized how concerned students felt their medical schools were with respect to the well-being of students, student ability to access facilities and services, how well online classes prepared them, and passing courses. They had 5-point Likert scale responses, ranging from "Not concerned at all," to "Very concerned." These survey questions were pilot tested by 10 medical students and 3 medical school educators, and included written and verbal feedback.

Exposure to SARS-CoV-2 Virus and Vaccination

Students were asked about personal testing or hospitalization for the virus and whether any of their family or friends had tested positive, been hospitalized, or had passed away due to the SARS-CoV-2 virus. They were also asked about their intention to get vaccinated if a vaccine was approved by the FDA (as this survey was administered before vaccine approval). Those who answered "Maybe I will get it" were further asked what would encourage them to get vaccinated.

Statistical Analyses

Bivariate analyses were conducted using Chi-Square tests. Logistic regression was then used to determine the odds of depression risk after ensuring that all significant variables had been controlled. All analyses were conducted using SAS Statistical Software version 9.4 (Cary, NC).

Results

A total of 145 medical schools were contacted; of these, 76 (52.4%) responded, and 26 (34.2%) emailed advertisements to their students. Also, among the 367 medical students who accessed the survey, 22 did not consent, and 133 did not complete it for a sample size of 212. Respondents lived in 22 US states and represented 28 medical schools. This study was estimated to have a 6.7% margin of error in a population of approximately 75000 medical students.

At least 48.6% of respondents were at risk of developing depression, with 61% of first year students at risk. Demographics were similar between students at high risk compared with average risk students, (Table 1) except for their year in medical school. A large proportion (98%) reported communication from their universities occurred via email, 55.6% reported university announcements, 43.1% reported online announcements, and 36.6% reported communication through their faculty. Some (16.7%) mentioned other methods of communication in free-text responses. Virtual town hall meetings were considered particularly helpful methods of communication by those reporting this method.

A majority of students were willing to get a COVID vaccine (163/212; 76.9%), or would consider it (48/212; 22.6%). Among the 114 students tested for the SARS CoV-2 virus, 5.3% (6/114) tested positive. Close to 46% of students (97/212) reported a family member or friend had tested positive for SARS CoV-2. Among those, 23.7% (23/97) reported hospitalization and 10.3% (10/97) reported a related death among their family or friends.

There were differences in schools' communication about online learning by depression risk (Table 2). Students at risk of developing depression reported communication was poor at a higher frequency compared to average risk students. After controlling for variables associated with the risk of developing depression in bivariate analyses, students had lower odds of being at risk for depression if they felt their universities did a good job communicating: the transition to online learning, test dates and times by administration, plans to return to classes in the Fall, and new or changing curriculum requirements. Students who felt communication about scholarships or other funding was poor had more than 3 times the odds of being at the risk of depression in adjusted analyses.

Most students felt universities transitioned quickly to online learning, and that the curriculum was rigorous (47.2%) or were neutral (22.2% ; Table 3). They also felt communication could have been done differently to be more effective (50.5%). In adjusted analyses, students were more than 3 times the odds of being at risk for developing depression if they disagreed that: their university had a good infrastructure for communication and course preparation in place, that plans for preceptorships or clinical experience were well done, or that communication about plans for research practicums or other research experiences were well done. Students had more than 2 times the odds of being at risk for developing depression if they disagreed that: plans for the remainder of the semester were well understood or that their professors were well-prepared for online teaching. Students who disagreed that their universities took longer to post grades during online learning had lower odds of being at risk for depression. Students who agreed that faculty were readily available for questions or that administration staff were readily available for questions had lower odds of being at risk of developing depression.

Discussion

A substantial proportion of medical students who participated in this survey were at risk of developing depression. Depression among US medical students ranges from 21.7% to 59.1% according to studies with a cutoff score of ≥16 on the CESD-20.[11] Among the medical students sampled early in the pandemic, 24% were found to be depressed.[3] Although the observed rate of 48.6% falls within previously reported limits, it is still problematic as close to 50% of medical students in this sample were at risk of developing depression. These students need resources and guidance to address the

Table 1. Characteristics of medical student sample by risk of developing depressive disorder, N = 212

	Total n (column %)	Average risk n (row %)*	At risk n (row %)*	P -value
Race/ ethnicity				0.3
White	156 (73.2)	84 (54.6)	70 (45.4)	
Hispanic	16 (7.5)	5 (35.7)	9 (64.3)	
Other	41 (19.3)	19 (46.3)	22 (53.7)	
Missing	3			
Gender				0.55
Male	68 (31.5)	37 (54.4)	31 (45.6)	
Female	148 (68.5)	72 (50.0)	72 (50.0)	
Marital status				0.98
Married/ domestic partnership	64 (29.6)	33 (51.6)	31 (48.4)	
Single/ divorced/ widowed	149 (69.0)	76 (51.4)	72 (48.6)	
Year in medical school during 2019-2020				0.03
MS1	77 (35.7)	30 (39.0)	47 (61.0)	
MS2	49 (22.7)	31 (63.3)	18 (36.7)	
MS3	73 (33.8)	39 (53.4)	34 (46.6)	
MS4	13 (6.0)	9 (69.2)	4 (30.8)	
Education before medical school				0.49
Bachelor's degree	186 (87.7)	94 (50.5)	92 (49.5)	
Master or doctorate degree	26 (12.3)	15 (57.7)	11 (42.3)	
Moved after switch to online instruction				0.71
No	129 (60.8)	65 (50.4)	64 (49.6)	
Yes	83 (39.2)	44 (53.0)	39 (47.0)	
Number of people living with respondent				0.85
alone or 1 person	121 (57.1)	61 (50.4)	60 (49.6)	
2-4 people	70 (33.0)	36 (51.4)	34 (48.6)	
5+ people	21 (9.9)	12 (57.4)	9 (42.9)	
Report of change in depression symptoms from Spring 2020 to Fall 2020 semester*				<0.001
Improved	44 (20.8)	32 (72.7)	12 (27.3)	
Stayed the same	59 (27.8)	46 (78.0)	13 (22.0)	
Worse	109 (51.4)	31 (28.4)	78 (75.7)	
Change in residence after medical school changed to online-only instruction				
Moved in with family	62 (28.7)			
Moved in with friends	5 (2.31)			
Moved to be with spouse/ partner	8 (3.7)			
Moved to a different state	22 (10.2)			
Moved to a different country	2 (0.9)			
Moved within 50 miles of campus	5 (2.3)			
Moved more than 50 miles from campus	49 (22.7)			
Communication with university during SARS CoV-2 pandemic**				
email	211 (97.7)			
Online announcement	93 (43.1)			
Blackboard	34 (15.7)			
Automated phone message	3 (1.4)			
Text	9 (4.2)			
Focused online messages	24 (11.1)			
Messages relayed through faculty	79 (36.6)			
University announcements	120 (55.6)			
Other	36 (16.7)			
Townhall meetings (virtual)				
Zoom or WebEx meetings				
Canvas notifications				
Student government				
Intranet website				

(*Continued*)

Table 1. (*Continued*)

	Total n (column %)	Average risk n (row %)*	At risk n (row %)*	*P* -value
Zoom office hours				
Video messages				

*Center for Epidemiological Studies of Depression, short-form (CESD-10), contained 10 questions with responses ranging from 0 to 3. The "average risk" score was <10 and the "at risk" score was ≥ 10. This cutoff of depressive symptomology for this measure is established in the literature.
**Medical students responded to a question about whether their ability to cope with events surrounding the SARS CoV-2 pandemic period had changed since the beginning of the pandemic.
***Medical students responded to a question about whether their feelings related to the 10 depression symptoms changed since the Fall of 2019.

distress they are feeling. A particularly high rate of first year students were at the risk of depression (61%) during the 2019 - 2020 academic year. These students may have been particularly vulnerable, as previous research found students had the lowest physical, emotional, and overall health at the end of year 1, and at the time of this survey, many participants would have been in the first part of their second year.[12] The addition of physical isolation from their fellow students may have exacerbated the stress encountered by these first year students. Inclusion of virtual meetups organized by student societies or by universities may help, but depressed students may have difficulty utilizing such opportunities. Facilitating the process of moving back in with their families may offer more support if remote education becomes necessary again in the future. Universities may need to proactively push for federal policies that can fund and make allowances available for medical students to participate in medical education across state or country borders during periods of time when remote education is the only way to maintain student health and safety.

Students who felt that communication about scholarships or other funding was poor or very poor had more than 3 times the odds of being at risk of developing depression. Students who depended on loans or external funding, such as scholarships for higher education, were more likely to experience anxiety and stress that could lead to depression.[13–15] This study indicates it is important for medical schools to communicate regularly with students who rely on scholarships or other funding. It is also possible that students who felt more depressed were more likely to need financial assistance with tuition, or were more likely to perceive their universities' communication about scholarships and other funding as poor. Regardless, these results indicate the importance of strong communication with students about funding. Although it may be difficult to provide individualized communication with students, messages about funding, providing reassurance to students on a regular basis with general information and acknowledgment of the administrations' awareness about the importance of this issue could help alleviate some student anxiety. Future research could focus on the development of solutions to this issue of communication and evaluate the optimum intervals between information offerings to improve reassurance without causing a communication burn-out for students.

Most communication between medical schools and their students took place via email, however, in situations that cause stress, medical schools may consider utilizing a variety of methods for communication with students. College students who used computer mediated communication in a previous study preferred synchronous and interactive methods of online communication such as instant messaging, and social networks.[16] These previous findings, combined with students freely reporting satisfaction in this study with remote town halls, suggest future paths for strengthening communication to alleviate communication - related anxiety among medical students during times of uncertainty or in emergency situations.[16] Town halls may provide a forum for students to ask questions or provide suggestions to improve communication and how the curriculum is offered or adjusted in a way that is appropriate for each university's program, enabling them to feel more empowered in the decisions related to their future. Furthermore, using these opportunities to discuss how to identify stress and depression, how to address it with classmates or family, share experiences with mental health struggles, and understand what services are available may assist with the normalization of discussing mental health issues, and thereby encourage help-seeking.[17] Training faculty preceptors or facilitators to recognize and address mental health in small group settings, such as problem-based learning groups could also help to identify and normalize help-seeking among students.

There is evidence that even short programs aimed at reducing stress through group stress management and self-care workshops for medical students can decrease stress and increase mindfulness.[18] Similar programs that enhance communication between medical students and their universities could be developed and adapted for remote access, as well as in-person access. As medical students are at a heightened risk of experiencing poor mental health, it is important that interventions are not temporary, as it is apparent that medical students need mental health services, especially during disaster events.

In general, most students felt that their universities communicated well regarding the changes in curriculum during the COVID-19 pandemic. In particular, good communication about curriculum expectations and anticipated changes was associated with lower odds of having an elevated risk of developing depression. As concerns about the learning environment and academic performance are associated with increased anxiety and stress among students, it is reassuring that good communication about these issues is associated with lowered odds of being at risk for depression.[10]

This study was developed with direct input from medical students. The concern they felt about the curriculum and communication was reflected in the questions, as well as their response to the survey. Future research should focus on the quantity and quality of communication between medical schools and students, as well as mental health among medical students with methodology informed by both medical students and medical school administration. In addition, future research should evaluate how the COVID-19 pandemic affects the cohort of students that were represented by this survey. Maintaining the well-being and health of these future healthcare providers is critical to ensuring the continuity of a quality healthcare system.

Limitations

The strength of this study lies in the national recruitment in the US, with students being eligible to participate even if their universities did not send email invitations. Several universities were

Table 2. Description of how well medical school communicated with students by risk of developing depressive disorder (N = 212)

	Total n (%)	Average risk* n (%)	At risk* n (%)	p-value[a]	aOR (95% CI)[b]
Academic standard ratings during pandemic				0.007	
Far below/ below standards	38 (17.9)	11 (29.0)	27 (71.0)		2.47 (0.97 −6.28)
Meets standards	126 (59.4)	69 (54.8)	57 (45.2)		Reference
Above/ far above standards	48 (22.6)	29 (60.4)	19 (39.6)		0.70 (0.31 −1.59)
Communication about transition to online learning during pandemic				0.007	
Very poor/ poor	29 (14.2)	11 (37.9)	18 (62.1)		0.83 (0.27 −2.54)
Fair	55 (26.8)	21 (38.2)	34 (61.8)		Reference
Well/ very well	121 (59.0)	73 (60.3)	48 (39.7)		**0.34 (0.15 −0.78)**
Communication about how long medical school expected to utilize new learning methods				0.001	
Very poor/ poor	65 (31.6)	24 (36.9)	41 (63.1)		1.77 (0.76 −4.12)
Fair	64 (31.1)	31 (48.4)	33 (51.6)		Reference
Well/ very well	77 (37.4)	52 (67.5)	25 (32.5)		0.53 (0.23 −1.21)
Communication about test dates and times by administration				0.06	
Very poor/ poor	32 (15.8)	12 (37.5)	20 (62.5)		0.95 (0.32 −2.88)
Fair	47 (23.2)	20 (42.6)	27 (57.5)		Reference
Well/ very well	124 (61.1)	71 (68.9)	53 (42.7)		**0.43 (0.19 −0.99)**
Communication about summer research, practicums, or other curriculum				0.007	
Very poor/ poor	51 (26.2)	17 (33.3)	34 (66.7)		1.97 (0.76 −5.10)
Fair	59 (30.3)	30 (50.8)	29 (49.2)		Reference
Well/ very well	85 (43.6)	52 (61.2)	33 (38.8)		0.52 (0.23 −1.22)
Communication about return to classes in the Fall				<0.001	
Very poor/ poor	54 (27.0)	24 (44.4)	30 (55.6)		0.44 (0.16 −1.22)
Fair	51 (25.5)	14 (27.4)	37 (72.6)		Reference
Well/ very well	95 (47.5)	62 (65.3)	33 (34.7)		**0.21 (0.08 −0.52)**
Communication of new or changing curriculum requirements				<0.001	
Very poor/ poor	47 (22.8)	16 (34.0)	31 (66.0)		0.78 (0.28 −2.18)
Fair	48 (23.3)	16 (33.3)	32 (66.7)		Reference
Well/ very well	111 (53.9)	73 (65.8)	38 (34.2)		**0.26 (0.11 −0.62)**
Communication about delays or cancellations in national tests				0.04	
Very poor/ poor	59 (35.1)	25 (42.4)	34 (57.6)		0.63 (0.22 −1.80)
Fair	37 (22.0)	15 (40.5)	22 (59.5)		Reference
Well/ very well	72 (42.9)	44 (61.1)	28 (38.9)		0.46 (0.16 −1.29)
Communication of information about changes to school fees				0.005	
Very poor/ poor	94 (48.7)	37 (39.4)	57 (60.6)		2.12 (0.87 −5.16)
Fair	43 (22.3)	28 (65.1)	15 (34.9)		Reference
Well/ very well	56 (29.0)	34 (60.7)	22 (39.3)		0.86 (0.32 −2.34)
Communication about scholarships or other funding				0.001	
Very poor/ poor	59 (33.0)	19 (32.2)	40 (67.8)		**3.37 (1.30 −8.71)**
Fair	53 (29.6)	30 (56.6)	23 (43.4)		Reference
Well/ very well	67 (37.4)	43 (64.2)	24 (35.8)		0.55 (0.22 −1.39)
Communication about eligibility for CARES Act grant funds				0.3	
Very poor/ poor	76 (41.3)	35 (46.1)	41 (54.0)		0.95 (0.37 −2.42)
Fair	41 (22.3)	19 (46.3)	22 (53.7)		Reference
Well/ very well	67 (36.4)	39 (58.2)	28 (41.8)		0.75 (0.29 −1.94)

aOR= adjusted odds ratios; 95% CI = 95% confidence interval

*Center for Epidemiological Studies of Depression, short-form (CESD-10), contained 10 questions with responses ranging from 0 to 3. The "average risk" score was < 10 and the "at risk" score was ≥ 10. This cutoff of depressive symptomology for this measure is established in the literature.

[a]Chi-Square test p-value for unadjusted bivariate analyses.

[b]aOR adjusted for year in medical school, change in coping, and change in depressive symptoms.

Bold odds ratios indicate significance at $P < 0.05$.

Table 3. Student agreement or disagreement with statements about their medical school's communication and response during the SARS CoV-2 pandemic period by risk of developing depressive disorder (N = 212)

	Total n (%)	Average risk* n (%)	At risk* n (%)	p-value[a]	aOR (95% CI)[b]
Transitioned to online learning quickly				0.42	
Strongly disagree/ disagree	16 (7.6)	9 (56.2)	7 (43.8)		0.22 (0.40 - 1.23)
Neither agree or disagree	21 (9.9)	8 (38.1)	13 (61.9)		Reference
Agree/ strongly agree	175 (82.5)	92 (52.6)	83 (47.4)		0.41 (0.12 - 1.45)
Had a good infrastructure related to communication and course preparation in place.				0.002	
Strongly disagree/ disagree	46 (21.7)	13 (28.3)	33 (71.7)		**2.94 (1.00 - 8.67)**
Neither agree or disagree	43 (20.3)	19 (44.2)	24 (55.8)		Reference
Agree/ strongly agree	123 (58.0)	77 (62.6)	46 (37.4)		0.56 (0.24 - 1.31)
Communicating plans for preceptorships or clinical experience was well done.				0.002	
Strongly disagree/ disagree	65 (30.7)	23 (35.4)	42 (64.6)		**2.87 (1.18 - 7.02)**
Neither agree or disagree	59 (27.8)	30 (50.8)	29 (49.2)		Reference
Agree/ strongly agree	88 (41.5)	56 (63.6)	32 (36.4)		0.77 (0.35 - 1.71)
Communicating plans for research practicums or other research experiences was well done.				0.007	
Strongly disagree/ disagree	61 (28.8)	21 (34.4)	40 (65.6)		**2.59 (1.06 - 6.36)**
Neither agree or disagree	91 (42.9)	53 (58.2)	38 (41.8)		Reference
Agree/ strongly agree	60 (28.3)	35 (58.3)	25 (41.7)		0.97 (0.45 - 2.12)
It took longer for grades to be posted compared to when classes were conducted in person.				0.01	
Strongly disagree/ disagree	103 (48.6)	62 (60.2)	41 (39.8)		**0.44 (0.20 - 1.00)**
Neither agree or disagree	58 (27.4)	29 (50.0)	29 (50.0)		Reference
Agree/ strongly agree	51 (24.0)	18 (35.3)	33 (64.7)		1.18 (0.47 - 2.98)
Plans for the remainder of the semester were well understood.				0.02	
Strongly disagree/ disagree	81 (38.2)	32 (39.5)	49 (60.5)		**2.39 (1.00 - 5.71)**
Neither agree or disagree	47 (22.2)	29 (61.7)	18 (38.3)		Reference
Agree/ strongly agree	84 (39.6)	48 (57.1)	36 (42.9)		1.12 (0.47 - 2.67)
Communication between [medical school] and me could have been done differently to be more effective				0.1	
Strongly disagree/ disagree	55 (25.9)	35 (63.6)	20 (36.4)		0.65 (0.25 - 1.67)
Neither agree or disagree	50 (23.6)	25 (50.0)	25 (50.0)		Reference
Agree/ strongly agree	107 (50.5)	49 (45.6)	58 (27.4)		1.32 (0.58 - 3.02)
The objectives related to the content of tests was made clear to me.				0.01	
Strongly disagree/ disagree	33 (15.6)	9 (27.3)	24 (72.7)		1.43 (0.47 - 4.33)
Neither agree or disagree	52 (24.5)	28 (53.9)	24 (46.2)		Reference
Agree/ strongly agree	127 (59.9)	72 (56.7)	55 (43.3)		0.62 (0.28 - 1.37)
Faculty were readily available for questions.				0.004	
Strongly disagree/ disagree	20 (9.4)	8 (40.0)	12 (60.0)		0.23 (0.05 - 1.08)
Neither agree or disagree	28 (13.2)	7 (25.0)	21 (75.0)		Reference
Agree/ strongly agree	164 (77.4)	94 (57.3)	70 (42.7)		**0.16 (0.05 - 0.49)**
Administration were readily available for questions.				0.006	
Strongly disagree/ disagree	34 (16.0)	12 (35.3)	22 (64.7)		0.63 (0.20 - 2.00)
Neither agree or disagree	42 (19.8)	16 (38.1)	26 (61.9)		Reference
Agree/ strongly agree	136 (64.2)	81 (59.6)	55 (40.4)		**0.36 (0.15 - 0.85)**
Curriculum was just as rigorous as it was when classes were conducted in person.				0.25	
Strongly disagree/ disagree	65 (30.7)	30 (46.2)	35 (53.8)		1.68 (0.68 - 4.16)
Neither agree or disagree	47 (22.2)	29 (61.7)	18 (38.3)		Reference
Agree/ strongly agree	100 (47.2)	50 (50.0)	50 (50.0)		0.85 (0.34 - 2.11)

(Continued)

Table 3. (*Continued*)

	Total n (%)	Average risk* n (%)	At risk* n (%)	p-value[a]	aOR (95% CI)[b]
I am as well-prepared for the next courses as I would have been before online-only courses were implemented.				0.008	
Strongly disagree/ disagree	73 (34.4)	28 (38.4)	45 (61.6)		1.14 (0.51 - 2.57)
Neither agree or disagree	62 (29.2)	32 (51.6)	30 (48.4)		Reference
Agree/ strongly agree	77 (36.3)	49 (63.6)	28 (36.4)		0.56 (0.24 - 1.25)
My professors were well-prepared for online teaching.				0.007	
Strongly disagree/ disagree	86 (40.6)	33 (38.4)	53 (61.6)		**2.26 (1.01 - 5.06)**
Neither agree or disagree	65 (30.7)	40 (61.5)	25 (38.4)		Reference
Agree/ strongly agree	61 (28.8)	36 (59.0)	25 (42.0)		1.02 (0.44 - 2.38)
I was well-prepared for the changes in how the curriculum was presented.				<0.001	
Strongly disagree/ disagree	60 (28.3)	19 (31.7)	41 (68.3)		2.16 (0.88 - 5.32)
Neither agree or disagree	58 (27.4)	30 (51.7)	28 (48.3)		Reference
Agree/ strongly agree	94 (44.3)	60 (63.8)	34 (36.2)		0.86 (0.34 - 1.93)
I got a lot of information from other students before official announcements were made.				0.13	
Strongly disagree/ disagree	80 (37.7)	48 (60.0)	32 (40.0)		0.50 (0.20 - 1.27)
Neither agree or disagree	40 (18.9)	20 (50.0)	20 (50.0)		Reference
Agree/ strongly agree	92 (43.4)	41 (44.6)	51 (55.4)		0.70 (0.28 - 1.74)
Communication about changes was done in a timely manner.				0.01	
Strongly disagree/ disagree	73 (34.4)	29 (39.7)	44 (60.3)		1.43 (0.60 - 3.39)
Neither agree or disagree	53 (25.0)	26 (49.1)	27 (50.9)		Reference
Agree/ strongly agree	86 (40.6)	54 (62.8)	32 (37.2)		0.61 (0.26- 1.42)
I needed to put extra effort into finding out information critical to my success as a student.				0.003	
Strongly disagree/ disagree	66 (31.1)	45 (68.2)	21 (31.8)		0.38 (0.14 - 1.06)
Neither agree or disagree	40 (18.9)	20 (50.0)	20 (50.0)		Reference
Agree/ strongly agree	106 (50.0)	44 (41.5)	62 (58.5)		1.13 (0.45 - 2.85)

aOR= adjusted odds ratios; 95% CI = 95% Confidence Interval
*Center for Epidemiological Studies of Depression, short-form (CESD-10), contained 10 questions with responses ranging from 0 to 3. The "average risk" score was < 10 and the "at risk" score was ≥ 10. This cutoff of depressive symptomology for this measure is established in the literature.
[a]Chi-Square test p-value for unadjusted bivariate analyses.
[b]aOR adjusted for year in medical school, change in coping, and change in depressive symptoms.
Bold odds ratios indicate significance at $P < 0.05$.

represented, but the results of this study may not have reflected the experience of all medical schools. Although the sample is small, it may be representative of a significant population of medical students. Biases may have existed within the sample as participants who felt that there were issues with their medical school's communication may have been more likely to participate than those who felt that their institutions responded well to the pandemic. The sample had a high proportion of first and second year students, so the experiences of more advanced medical students may not have been adequately captured.

Conclusion

In conclusion, universities appeared to do a good job communicating with their students during the pandemic. However, this study also highlights the need for ongoing efforts to address mental health by medical schools, and to better understand the effects of disasters, not just the COVID-19 pandemic, on their well-being.

Improving communication on this issue through normalizing help-seeking behavior, offering more interactive forms of communication, particularly during disasters, and ensuring that communication about funding is clear may assist medical students in feeling less stress related to their education, and begin to address high rates of depressive symptoms in this population.

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