

Medical student mental health during the COVID-19 pandemic

Madison Jupina¹  | Meg Wright Sidle²  | Cathryn J. Rehmeyer Caudill³ 

¹University of Pikeville Kentucky College of Osteopathic Medicine, Pikeville, Kentucky, USA

²Institutional Research and Effectiveness, University of Pikeville, Pikeville, Kentucky, USA

³Pathology, University of Pikeville Kentucky College of Osteopathic Medicine, Pikeville, Kentucky, USA

Correspondence

Dr. Cathryn J. Rehmeyer Caudill, Professor of Pathology, University of Pikeville Kentucky College of Osteopathic Medicine, 147 Sycamore St, Pikeville, KY 41501-9118, USA.

Email: cathycaudill@upike.edu

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Abstract

Background: Prior to the COVID-19 pandemic, medical students exhibited poorer mental health relative to the general population and other students. This research aimed to assess American medical student mental health during the pandemic's height, while also identifying stressors and vulnerable populations.

Methods: In this cross-sectional study, 960 US allopathic and osteopathic medical students completed a mental health survey screening for depression, anxiety, burnout, suicidal ideation and increased substance use during the height of the COVID-19 pandemic. Potential relationships were explored between these mental health indicators and demographic and environmental factors, such as COVID-19 exposure.

Findings: Of the 960 medical students surveyed, 25.1% (n = 241) screened positive for depression, 40.4% (n = 388) screened positive for anxiety, 21.3% (n = 201) met criteria for at least one dimension of burnout, 19.0% (n = 182) started or increased substance use and 7.2% (n = 69) experienced thoughts of self-harm or suicide. Significant differences ($p \leq 0.01$) in measures of mental health were associated with those who had accessed mental health care, had a personal COVID-19 diagnosis, knew someone who died of COVID-19 or were female.

Conclusions: Although rates of anxiety and substance use among medical students in our study were higher than previously reported, rates of burnout and thoughts of self-harm or suicide were surprisingly lower. These results indicate that some aspects of remote learning imposed by the pandemic could be protective, warranting additional study for post-pandemic medical education. Meanwhile, medical schools and clerkships should offer additional resources to students particularly vulnerable to stressors, including females and those with personal pandemic impacts.

1 | BACKGROUND

In the wake of the COVID-19 pandemic, Americans across the country endured a mental health crisis, exemplified by increased symptoms of anxiety, depression, substance use and suicidal ideation.^{1,2} Undergraduate and graduate student populations have been particularly vulnerable to pandemic-related stressors, with studies finding increased anxiety, depression and suicidal ideation.^{3,4}

Prior to the pandemic, medical students demonstrated higher rates of depression and anxiety compared with the general

population.^{5,6} Medical students have at least twice the rates of depression and of suicidal ideation as their US age-matched peers⁶ and higher rates of emotional exhaustion, burnout, depression and fatigue compared with other US graduates.⁷

Medical students may be particularly vulnerable to pandemic-related stress, given their unique position as both students and future physicians on the front line of this and other pandemics to come. Two years into the COVID-19 pandemic, there is surprisingly little research about its impacts to the mental health of US medical students, and only general rates of depression and anxiety early in the pandemic are

described.^{2,8,9} It is vital to understand the full scope of impacts to medical student mental health, including risk factors that predict poorer mental health outcomes, but these data are lacking.

The aim of our study was to thoroughly document the impact of the pandemic on US medical student mental health through a survey assessing depression, anxiety, burnout, substance use and self-harm/suicidal ideation. Additionally, we analysed these mental health measures relative to demographic variables, which also included COVID-19 experiences, access to mental health resources and educational programme data. In doing so, we hoped to learn which mental health dimensions should be targeted for interventions by medical schools and clinical clerkship programmes and identify specific pandemic-associated stressors that could help identify students most in need of mental health services.

2 | METHODS

2.1 | Study design

In this cross-sectional study, we distributed an anonymous, online survey to US allopathic and osteopathic medical students between 14 December 2020 and 10 January 2021. This time period corresponded to the greatest peak of COVID-19 deaths during the US pandemic to date.¹⁰ The complete survey is available as Appendix S1. The survey was developed and piloted with students at the Kentucky College of Osteopathic Medicine (KYCOM) from 6 November 2020 to 15 November 2020; pilot data were not included in this study due to changes made to survey questions. Administrators from each American medical school were contacted via email and requested to forward the survey link to students at their respective schools. Student Osteopathic Medicine Association student representatives at each osteopathic school were sent this same recruitment email, and a shareable flyer was posted on Instagram with a link to the survey. Because we advertised the survey in this way, we have no way of knowing how many medical students received the survey and, thus, a response rate could not be generated; however, the geographic diversity of participants was assessed through an optional question about participant zip codes.

Ethical approval for this study was waived by the University of Pikeville Institutional Review Board on 30 October 2020 because all student data were de-identified. Informed consent was collected electronically from all participants before beginning the survey. Upon completion of the survey, students had the opportunity to follow a link to another site to enter their email for a chance to win a \$100 gift card.

2.2 | Study measures

Survey measures included basic demographic data, including the zip code in which the student had primarily been living in since March 2020 (optional) and their year in education. Students were also asked

questions related to COVID-19, including their exposure to patients in an educational or voluntary setting and direct or indirect personal experiences with COVID-19 infections or illness/death. We also asked questions about their educational programme and medical school curriculum.

Depression and anxiety were assessed with the Patient Health Questionnaire-4 (PHQ-4), which consists of a self-report two-item depression scale from the PHQ-2 and a two-item anxiety scale from the Generalised Anxiety Disorder-2 (GAD-2).¹¹ Participants were asked how often they have been bothered in the last 2 weeks by four different measures of anxiety and depression with 'not at all', 'several days', 'more than half the days' or 'nearly every day'. These responses were scored with 0 points, 1 point, 2 points and 3 points, respectively. A score greater than or equal to 3 on the PHQ-2 was considered a probable case of depression, and a score greater than or equal to 3 on the GAD-2 was considered a probable case of anxiety.

We assessed burnout using an adjusted Burnout Clinical Subtypes Questionnaire (BCSQ-12), which evaluates burnout in three dimensions: Overload, Lack of Development and Neglect.¹² The original BCSQ-12 is geared towards working professionals. Based on student feedback from the pilot study, questions were adjusted to be more meaningful to a student population. For example, one of the BCSQ-12 items states, 'I give up in response to difficulties in my work.' In our survey, this item was changed to, 'I give up in response to difficulties in my academic tasks.' We did not anticipate that these minor changes would have a meaningful impact on reliability or validity.¹³ Participants were asked to indicate their degree of agreement with 12 statements on a scale of 1 (*totally disagree*) to 7 (*totally agree*). A score greater than or equal to 17 points in each dimension was considered as the cut-off for that dimension of burnout.

Additionally, students were asked about suicidal ideation and/or thoughts of self-harm since March 2020 and whether they had started or increased substance use since March 2020. Students were also asked if they had access to, or if they had utilised a mental health care professional, both prior to and during the pandemic.

2.3 | Statistical analysis

All statistical tests were performed using Statistical Package for the Social Sciences (IBM), Version 26. Independent t-tests were used to compare means of the dependent variables of depression and anxiety scores, as well as the 12 burnout item scores between the various independent variables of ethnicity, gender, access to mental health services, COVID-19 experiences, curriculum, programme and location where the student spent the most time since March 2020. Analysis of variance (ANOVA) tests were used to compare these same dependent variables between the independent variable of worry level. Chi-squared (χ^2) tests were used to compare proportional differences in the dependent variables of depression and anxiety items, the burnout items, the suicidal ideation item and the substance use item between all of these same independent variables. To reduce the risk of

TABLE 1 Characteristics of the study sample, American medical students, December 2020–January 2021, during the COVID-19 pandemic (n = 960)

	%
Gender	
Male (n = 377)	39.3
Female (n = 575)	59.9
Non-binary (n = 8)	0.8
Ethnicity	
White (n = 605)	63.0
Asian (n = 210)	21.9
Hispanic (n = 35)	3.6
Black (n = 24)	2.5
Native American, Alaskan Native, Native Hawaiian or Pacific Islander (n = 0)	0.0
Two or more (n = 52)	5.4
Other (n = 34)	3.5
Location since March 2020	
Rural (n = 160)	18.9
Urban (n = 685)	81.1
Geographic region	
West (n = 301)	31.4
Southeast (n = 214)	22.3
Northeast (n = 130)	13.5
Midwest (n = 128)	13.3
Southwest (n = 72)	7.5
Unreported (n = 115)	12.0
Medical school type	
Allopathic (MD) (n = 306)	31.9
Osteopathic (DO) (n = 654)	68.1
Stage of training	
Didactics (n = 605)	63.7
Clinicals (n = 345)	35.3
Personal COVID diagnosis (n = 80)	8.3
Loved one diagnosed with COVID (n = 581)	60.5
Know someone who died of COVID (n = 237)	24.7
Contact with COVID patients	
Educational basis (n = 236)	24.6
Volunteer basis (n = 91)	9.5
No (n = 633)	65.9
Level of worry about contracting COVID	
Not worried at all (n = 191)	19.9
Somewhat worried (n = 436)	45.4
Very worried (n = 333)	34.7
Probable case of depression (n = 241)	25.1
Probable case of anxiety (n = 388)	40.4
Burnout	
Overload dimension (n = 150)	15.9
Lack of development dimension (n = 61)	6.5
Neglect dimension (n = 113)	12.0

(Continues)

TABLE 1 (Continued)

	%
Met criteria for any dimension (n = 201)	21.3
Thoughts of self-harm or suicide since March 2020 (n = 68)	7.2
Started or increased substance use since March 2020 (n = 179)	19.0
Accessed mental health care resources	
Never accessed (n = 451)	47.9
Accessed only prior to March 2020 (n = 192)	20.4
Accessed only after March 2020 (n = 110)	11.7
Accessed before and after March 2020 (n = 188)	20.0

reporting that our findings were significant when in fact they occurred by chance (Type I error), $p \leq 0.01$ was considered statistically significant.

3 | FINDINGS

Our survey was completed by 1002 medical students, of which 960 had submitted complete data to meet criteria as participants. Table 1 provides a breakdown of demographics, stage in medical school, COVID-19 exposures and measures of mental health in our participants. The full dataset is available in Appendix S2.

Tables 2 through 5 report the between-group comparisons in mental health measures that reached statistical significance. Notably, students who personally knew someone who died of COVID-19 had higher rates of every mental health measure, except for the lack of development and overload burnout dimensions (Table 2). Also, students with a personal COVID-19 diagnosis were almost twice as likely to have started or increased substance use (Table 2), and participants who worried most about contracting COVID-19 infection were more likely to screen positive for depression or anxiety (Table 3). Those who had ever accessed mental health care, either pre-pandemic or during the pandemic, had worse measures in every dimension of mental health that was measured (Table 4). Students who had ever accessed mental health care were twice as likely to have started or increased substance use and almost four times as likely to have seriously considered suicide or self-harm. Finally, female students (Table 5) were more likely to screen positive for anxiety and depression.

Students with a personal COVID-19 diagnosis were almost twice as likely to have started or increased substance use.

There were no significant differences in mental health measures between students in clinical clerkship or didactic programmes, by rural or urban location, or between osteopathic and allopathic students. In a sub-analysis of only didactic students participating in the survey, there were no differences in mental health outcomes based on virtual, in-person or hybrid form of curriculum delivery.

4 | DISCUSSION

4.1 | Principal findings

Other studies conducted during the summer and fall of 2020 indicated increased rates of depression in medical students.^{8,9} By the time our survey closed in mid-January 2021, COVID-19 deaths were at their highest peak to date. Despite this, the rate of positive screens for depression in our sample (25.1%) was similar to that reported in a meta-analysis of medical students prior to COVID-19 (27.2%)⁶ and in a study conducted early (April 2020) in the COVID-19 pandemic (24.3%),² indicating that rates of depression flattened over time. However, this rate is still 8%–15% higher than that seen in other graduate students,¹¹ adding to the evidence that medical students are particularly vulnerable to depression.

The rate of anxiety in our study was similar to that previously reported for undergraduate and graduate students during the COVID-19 pandemic¹⁴ but higher than rates among the American public¹ and the medical student population early in the pandemic.² Female medical students showed higher rates of depression and anxiety compared with males, a finding consistent with data prior to COVID-19.¹⁵

Female medical students showed higher rates of depression and anxiety compared with males.

TABLE 2 Mental health comparison between medical students with various measures of COVID-19 exposure from December 2020 to January 2021

	Do not know someone who has died of COVID (n = 723)	Know someone who has died of COVID (n = 237)
^a Probable case of depression (%)	22.3	33.8
^a Probable case of anxiety (%)	37.9	48.1
Overload dimension (%)	14.2	21.2
Lack of development dimension (%)	5.9	8.2
^a Neglect dimension (%)	10.3	17.3
^a Thoughts of self-harm or suicide (%)	5.9	11.4
^a Substance use (%)	16.7	26.2
	No personal COVID diagnosis (n = 880)	Personal COVID diagnosis (n = 80)
Probable case of depression (%)	25.0	26.3
Probable case of anxiety (%)	40.5	40.0
Overload dimension (%)	15.5	20.0
Lack of development dimension (%)	6.4	7.5
Neglect dimension (%)	11.8	13.8
Thoughts of self-harm or suicide (%)	7.1	8.8
^a Substance use (%)	17.8	32.5

^aSignificant difference at $p \leq 0.01$.

Medical students have higher rates of burnout compared with undergraduates and the general population.⁷ Our study found lower rates of burnout (21.3%) when compared with a meta-analysis of studies using the Maslach Burnout Inventory (MBI) conducted prior to the pandemic (39.3%–52.3%).¹⁶ Although our study utilised the BCSQ-12, a less extensive burnout screening tool, in an effort to keep our survey brief, this tool has been validated and its overall score can be compared generally with the MBI.^{12,13} This unanticipated impact to burnout during the pandemic may result from some students transitioning to online rotations or studied at home, which may have been less of a daily burden compared with in-person rotations or classes.

This study found lower rates in thoughts of self-harm and suicide (7.2%) than previously reported in a meta-analysis reporting only suicidal ideation among medical students (11.1%).⁶ In our survey, we phrased the suicidal ideation question as, ‘Since March 2020, have you seriously considered harming yourself and/or taking your life?’ We chose to phrase this question similar to how it is phrased in the PHQ-9. It is possible, however, that students may have interpreted this question to also include self-harm without the intent to die. However, if this were the case, we would expect a higher rate of ‘yes’ answers to the question if it included all of those students who had considered self-harm and/or suicide.

According to the Centers for Disease Control, 13.3% of Americans started or increased substance use to cope with the pandemic.¹ The present study found a rate of increased substance use that was 43% higher in medical students compared with the general

population. This may indicate the need for interventions promoting more positive coping mechanisms among medical students.

Fortunately, the use of mental health resources was much more prevalent among our participants compared with a previous report, which found that only 7% of medical students were currently receiving mental health care.⁸ The use of mental health resources by current medical students is reassuring and could be a reason for the lower rates of burnout and suicidal ideation during this time. Those who had ever accessed a mental health professional, either pre-pandemic or during the pandemic, had significantly worse measures of mental health compared with those who did not, suggesting that students who need mental health care the most are the ones receiving this care.

A primary strength of this study is that it probed the many ways that student mental health could be impacted by COVID-19. Previous studies have only asked if students had a friend or relative diagnosed with COVID-19, which was found to be associated with a higher median GAD-7 score, but not PHQ-9.² Our study probed the potential influence of COVID-19 more deeply, revealing nuances of its relationship with mental health. Participants who personally knew someone who died of COVID-19 had statistically worse mental health measures in nearly every aspect compared with those who did not. Of note, students who knew someone that died from COVID-19 were almost twice as likely and over 1.5 times as likely to consider suicide/self-harm or increase substance use, respectively. As COVID-19 has a variety of presentations ranging from asymptomatic to acute respiratory failure and death, it is likely that experiences with death are the most impactful.

TABLE 3 Mental health comparison of medical students between various levels of worry about contracting COVID-19, December 2020–January 2021

	Not worried (n = 191)	Somewhat worried (n = 436)	Very worried (n = 333)
^a Probable case of depression (%)	19.9	22.7	31.2
^a Probable case of anxiety (%)	29.3	37.2	51.1
Overload dimension (%)	9.7	16.7	18.4
Lack of development dimension (%)	4.9	5.6	8.6
Neglect dimension (%)	10.3	12.0	12.9
Thoughts of self-harm or suicide (%)	9.7	7.2	5.9
Substance use (%)	17.8	20.4	17.9

^aSignificant difference between not worried and very worried at $p \leq 0.01$.

TABLE 4 Mental health comparison between medical students who have accessed and medical students who have not accessed mental health care, December 2020–January 2021, during the COVID-19 pandemic

	Never accessed mental health care (n = 451)	Accessed mental health care (n = 490)
^a Probable case of depression (%)	15.7	33.5
^a Probable case of anxiety (%)	29.7	49.8
^a Overload dimension (%)	12.0	19.2
^a Lack of development dimension (%)	4.2	8.6
^a Neglect dimension (%)	6.7	16.9
^a Thoughts of self-harm or suicide (%)	2.9	11.2
^a Substance use (%)	12.2	25.3

^aSignificant difference at $p \leq 0.01$.

Participants who personally knew someone who died of COVID-19 had statistically worse mental health measures in nearly every aspect.

We postulated that students in different stages of medical school might be affected by COVID-19 in different ways. For example, the transition to online classes and virtual rotations may have had an

TABLE 5 Mental health comparison between male and female medical students, December 2020–January 2021, during the COVID-19 pandemic

	Male (n = 377)	Female (n = 575)
^a Probable case of depression (%)	20.4	27.8
^a Probable case of anxiety (%)	30.8	46.6
Overload dimension (%)	15.9	15.2
Lack of development dimension (%)	6.2	6.2
Neglect dimension (%)	11.9	11.9
Thoughts of self-harm or suicide (%)	6.0	7.8
Substance use (%)	16.0	20.4

^aSignificant difference at $p \leq 0.01$.

impact on student mental health. Despite these differences, measures of mental health were similar regardless of educational level, rural or urban location or whether students participated virtually, in-person or a combination thereof. As a study early in the pandemic found increased anxiety among didactic students,² our findings are reassuring as they suggest with time, students and institutions had better adapted to pandemic-induced changes to education.

Our findings are reassuring as they suggest with time, students and institutions had better adapted to pandemic-induced changes.

4.2 | Recommendations

We hope that this research serves to fill the gap in data about American medical student mental health during the COVID-19

pandemic and predictors of vulnerability within this population. Medical schools and clerkship programmes should prioritise additional mental health resources to those most likely to suffer from pandemic stressors, which we identified as students who were female and those with personal pandemic impacts, such as infection or loss of a loved one. Mental health resources should not only be clearly advertised to these students, but time should be set aside for students to access them. These students are likely to benefit the most from peer support groups and advocacy targeted to their unique needs. It is also important to note that students with a history of mental health resource utilisation need our continued support; these students were almost four times as likely to self-harm or consider suicide and over twice as likely to use substances to cope with stress.

This research serves to fill the gap in data about American medical student mental health during the COVID-19 pandemic.

4.3 | Limitations

Although the number of survey responses we received is similar to that acquired by previously published research,^{2,8,9} we recognise that our results may be influenced by response/non-response bias. We are reassured by the high degree of alignment between our results with previously published research.

We recruited medical students via email invitation, but many medical school administrators were not willing to forward our survey to their students, citing ‘survey fatigue’ and student burnout. Measures of burnout may therefore have been underrepresented because we were denied access to these students’ responses. Because we are an osteopathic medical school with more direct connections to other osteopathic medical school administrators and student representatives, it is not surprising that we received greater participation from osteopathic medical students. We did not find any significant differences in between-group comparisons for these programmes.

Although this study focused on medical student mental health during the COVID-19 pandemic, the current mental health status of medical students cannot be attributed to the pandemic alone. There were many other stressful events occurring during the time of data collection, including racial tensions during Black Lives Matter protests, a presidential election and a domestic attack on the US Capitol building. Each of these events could have contributed to medical student mental health during this time.

5 | CONCLUSIONS

Our survey results shed light on dimensions of mental health most impacted during the peak of the pandemic, indicating that medical students might benefit most from resources targeting substance use and anxiety as we continue to experience and recover from this pandemic. Further, our research suggests that mental health resources, such as peer support groups, might be targeted to the most vulnerable populations, including females and those students with direct and personal impacts from the pandemic. We hope that these findings provide valuable insight to medical schools and clinical clerkship programmes as they endeavour to better support medical student mental health programming and services.

Medical students might benefit most from resources targeting substance use and anxiety.

We were surprised to find that rates of medical student burnout and self-harm/suicidal ideation were lower than pre-pandemic estimates, especially given the mental health crisis among the general public during the pandemic.¹ This paradox deserves additional study, especially given that the American Medical Association has prioritised the study of medical student, resident and physician suicide¹⁷ and that these rates are not tied to burnout.¹⁸ Most of the students in our study were attending either virtual or hybrid medical school/clerkship programmes, an environmental and community structure completely different than experienced by students prior to the pandemic. It is possible that factors within this structure created a more supportive environment for students that influenced mental health, variables worth exploring as we seek to better understand and support medical student mental health in a post-pandemic world.

We were surprised to find that rates of medical student burnout and self-harm/suicidal ideation were lower than pre-pandemic estimates.

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The authors have no acknowledgement to disclose.

CONFLICT OF INTEREST

The authors have no conflict of interest to disclose.

ETHICAL APPROVAL

Ethical approval for this study was waived by the University of Pikeville Institutional Review Board on 30 October 2020 because all data were de-identified and there was no potential harm to participants.

All participants gave electronic informed consent prior to participation in the survey.

ORCID

Madison Jupina  <https://orcid.org/0000-0003-4452-0051>

Meg Wright Sidle  <https://orcid.org/0000-0002-0542-7412>

Cathryn J. Rehmeier Caudill  <https://orcid.org/0000-0001-8267-8795>

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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