

Title: Pandemic-Related Experiences and Psychosocial Risk Associations Among U.S. Medical Students

Author names: Nathaniel A. Jenkins¹, Damion J. Grasso¹

Degrees: Nathaniel A. Jenkins (B.S.); Damion J. Grasso (Ph.D.)

Affiliations: ¹ University of Connecticut School of Medicine, Departments of Psychiatry and Pediatrics, Farmington, Connecticut

About the author: Nathaniel A. Jenkins is currently a fourth year medical student of the University of Connecticut School of Medicine, Farmington, CT, USA of a four year program.

Acknowledgment: None

Financing: The research presented in this manuscript was funded by a University of Connecticut School of Medicine research stipend.

Conflict of interest statement by authors: No authors have any foreseen conflicts of interest to disclose.

Compliance with ethical standards: This study was approved on February 14th, 2021 by the University of Connecticut Health Center IRB.

Authors Contribution Statement: Mr. Jenkins (medical student) conceptualized and designed the study, conducted literature review, coordinated and facilitated data collection, drafted the initial manuscript, and edited the revised manuscript. Dr. Grasso assisted in research design, data analysis, data preparation, and reviewed and revised the manuscript. Mr. Jenkins is represented as Author 1 and Dr. Grasso is represented as Author 2 below.

Contributor Role	Role Definition	Authors					
		1	2	3	4	5	6
Conceptualization	Ideas; formulation or evolution of overarching research goals and aims.	X					
Data Curation	Management activities to annotate (produce metadata), scrub data and maintain research data (including software code, where it is necessary for interpreting the data itself) for initial use and later reuse.		X				
Formal Analysis	Application of statistical, mathematical, computational, or other formal techniques to analyze or synthesize study data.		X				
Funding Acquisition	Acquisition of the financial support for the project leading to this publication.		X				
Investigation	Conducting a research and investigation process, specifically performing the experiments, or data/evidence collection.		X				
Methodology	Development or design of methodology; creation of models	X	X				
Project Administration	Management and coordination responsibility for the research activity planning and execution.		X				
Resources	Provision of study materials, reagents, materials, patients, laboratory samples, animals, instrumentation, computing resources, or other analysis tools.	X					
Software	Programming, software development; designing computer programs; implementation of the computer code and supporting algorithms; testing of existing code components.		X				
Supervision	Oversight and leadership responsibility for the research activity planning and execution, including mentorship external to the core team.		X				
Validation	Verification, whether as a part of the activity or separate, of the overall replication/reproducibility of results/experiments and other research outputs.	X	X				
Visualization	Preparation, creation and/or presentation of the published work, specifically visualization/data presentation.		X				
Writing – Original Draft Preparation	Creation and/or presentation of the published work, specifically writing the initial draft (including substantive translation).	X					
Writing – Review & Editing	Preparation, creation and/or presentation of the published work by those from the original research group, specifically critical review, commentary or revision – including pre- or post-publication stages.	X	X				

Manuscript word count: 2494

Abstract word count: 216

Number of Figures and Tables: 5

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24

Personal, Professional, and Institutional Social Network accounts.

- **Facebook:** N/A
- **Twitter:** Nathaniel Jenkins (@nate__jenkins), Damion Grasso (@damiongrasso), UConn Health (@uconnhealth)

Discussion Points:

1. The COVID-19 pandemic appears to be associated with reports of worsening medical student anxiety, depression, and PTSD.
2. Variations in the experiences of medical students during the COVID-19 pandemic may be due, in part, to the differences in the clinical vs. pre-clinical curriculum.
3. There is a need for better understanding of the impact of the COVID-19 pandemic on medical student mental health.
4. Medical students are at greater risk for mental health issues than the general population.
5. Access to reduced cost on-campus mental health services and modification of the medical school curriculum during the COVID-19 pandemic may help improve the mental health outcomes of U.S. medical students.

Publisher's Disclosure: *This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our readers and authors we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.*

1 **ABSTRACT**

2
3 **Background:** Since the start of the COVID-19 global pandemic there has been a profound impact on the
4 psychosocial health of medical professionals, with heightened risk reported on measures of depression, anxiety,
5 and stress relative to non-healthcare professionals. However, there is limited data on the impact of COVID-19
6 on the psychosocial health of U.S. undergraduate medical students. The current cross-sectional study aims to
7 examine associations between pandemic-related experiences and psychosocial risk among a sample of
8 medical students attending a Northeastern U.S. allopathic medical school.
9

10 **Methods:** One-hundred and seventy-nine students (42.6% of the study body) completed an online survey
11 during the COVID-19 pandemic that included sociodemographic characteristics, the 30-item Brief Epidemic-
12 Pandemic Impacts Inventory (EPII-B), the 2-item Patient Health Questionnaire (PHQ-2), the 2-item Generalized
13 Anxiety Disorder (GAD-2), and the Primary Care PTSD Screen for DSM-5 (PC-PTSD-5).
14

15 **Results:** Rates of serious adverse pandemic-related experiences (e.g., increased conflict, less physical activity,
16 frequent substance use) were as high as 37.5%. Students with a greater number of adverse pandemic-related
17 experiences reported more time with COVID-19 positive patients and were more likely to screen positive for
18 depression, anxiety, and PTSD (r_s from 0.25 – 0.34, all $ps < 0.01$).
19

20 **Conclusion:** These findings suggest the need for other U.S. medical schools to evaluate and address medical
21 student mental health during the COVID-19 public health crisis.
22

23 **Key Words:** COVID-19, Medical education, Professional Burnout, Depression, Anxiety (Source: MeSH-NLM).
24
25

1 INTRODUCTION.

2
3 The World Health Organization declared COVID-19 a global pandemic on March 11, 2020.¹ Since then, many
4 aspects of daily life have drastically changed, with constraints on interpersonal relationships, work, home life,
5 and mobility as a result of occurrences such as social distancing, virtual activities, furlough, increased contact
6 with household members, less contact with extended family, forced quarantine, and government enforced
7 lockdowns. Several studies thus far have linked pandemic stress to heightened risk for psychosocial
8 impairment in the general population during this time.^{2,3} This effect seems to be pronounced for healthcare
9 workers on the 'front-line', which may be partially attributed to long working hours, shortages of personal-
10 protective equipment (PPE), emotional distress caring for COVID-19 patients, and the stigma associated with
11 chronic potential exposure to the virus.^{4,5}

12
13 Medical students are important members of the healthcare sector. Even before COVID-19, previous studies
14 have demonstrated that medical students tend to experience more mental health issues than the general
15 population, such as higher rates of depression, anxiety, and burnout.⁶ This is thought to be attributed, at least
16 in part, to the demanding curricula, pressure to pass exams, and emotional taxation.⁷ Despite medical
17 students having greater access to mental health services, often provided by their respective institutions,
18 research shows that they are less likely to access those services when compared to the general population,
19 perhaps due to increased mental health stigma.⁸

20
21 Since medical students serve dual roles as both students and healthcare providers, it is likely that medical
22 students may also have heightened risk for psychosocial impairment during this time. Special considerations
23 for this group include observation of human suffering, alterations to pre-clinical/clinical training, changes in
24 medical licensing exam policies, and the adjustment process into a high-risk workplace environment. One
25 recent U.S. study determined that when compared to previous studies, medical students were scoring 61%
26 higher on anxiety screenings (GAD-7) and 70% higher on depression screenings (PHQ-9) early in the
27 pandemic.⁹ These findings align with data in other countries where the prevalence of depression, anxiety, and
28 burnout of medical providers during the pandemic has been observed as significantly higher than prior to the
29 pandemic.^{10,11}

30
31 Despite these initial findings, the effect of COVID-19 on medical student mental health has not yet been
32 sufficiently studied in the United States. Additionally, no studies thus far have utilized an inventory of
33 pandemic-specific stressors to explore this topic in medical student samples. The current study employs a
34 novel instrument called the Brief Epidemic-Pandemic Impacts Inventory Brief (EPII-B) to examine specific
35 pandemic-related experiences across multiple domains of life (i.e. home life, work/environment, social
36 activities, emotional/physical health).¹² Recent studies have employed this tool and demonstrated its
37 usefulness in linking psychosocial experiences with the COVID-19 pandemic for employees that work in direct
38 patient care as well as for patients that frequent healthcare settings.^{13,14} By using this instrument, in
39 combination with other standardized screening tools for depression, anxiety, and posttraumatic stress, we
40 sought to further characterize how specific COVID-19 pandemic-related experiences among U.S. medical
41 students link to associated psychosocial risk.

1 MATERIALS OR PATIENTS AND METHODS

3 **Study Design**

4 During a 4-week period between February 23rd 2021 – March 23rd 2021, allopathic medical students from the
5 University of Connecticut School of Medicine were invited via email to complete an online survey for a chance
6 to win a \$25 gift card. Inclusion criteria for the study were to be a University of Connecticut School of Medicine
7 student, be actively studying in the curriculum, and to give informed consent. There were no exclusion criteria.
8 An email with the survey link was sent using a closed listserv only available to medical students at this school.
9 The email was sent a total of four times during this period. The survey was administered using Qualtrics
10 software in an anonymously. To prevent duplicate entries, participants were required to disclose any previous
11 survey engagement. Endorsement of previous engagement resulted in survey termination. Additionally,
12 students provided university issued email addresses. No email address was entered twice. At the completion
13 of the survey, participants who were interested in the gift card were redirected to a separate Qualtrics survey
14 that collected school-specific email addresses to ensure inclusion criteria. This data was kept separate from
15 the main survey data and could not be matched. The University of Connecticut Health Center Institutional
16 Review Board approved the study protocol (number 21X-148-2) prior to distribution of the survey. Passive
17 consent was obtained.

19 **Study Measures**

20 The survey began with confirmation that the participant had never taken the survey before, followed by a
21 series of sociodemographic questions (medical school year, preferred gender, age, and race). Sliding scales
22 were used to estimate what percent of students' time in medical school was spent with patients, and
23 specifically, pediatric, adult, geriatric, and COVID-19 positive patients.

25 The 30-item EPII-B assessed whether several pandemic-related experiences had occurred since the
26 beginning of the pandemic and instructed participants to rate the impact of these experiences on a 5-point
27 scale (0= "Did not happen", 1= "Happened but no impact on me or my family", 2= "Some impact on me or my
28 family", 3= "A lot of impact on me or my family", 4= "Extreme impact on me or my family"). A previous study
29 using the longer 92-item Epidemic-Pandemic Impacts Inventory (EPII) supports the validity of this tool in
30 characterizing pandemic-associated risk for depression, anxiety, and stress.¹³ A positive response (i.e.,
31 responding anything other than "Did not happen") was used to dichotomize each item for purposes of
32 determining rates of occurrence. In addition, ratings on EPII-B items were tallied as a measure of perceived
33 impact of positive experiences (2 items) and negative experiences (28 items).¹² Internal consistency reliability
34 was $\alpha = 0.70$ and 0.80 for the EPII "positive impact" and "negative impact", respectively.

36 The 2-item Patient Health Questionnaire-2 (PHQ-2) is a well validated screening tool for Major Depressive
37 Disorder (MDD).¹⁵ Likewise, the 2-item Generalized Anxiety Disorder-2 (GAD-2) is a well validated screening
38 tool for clinical anxiety.¹⁶ Additionally, the Primary Care PTSD Screen for DSM-5 (PC-PTSD-5) is a validated
39 screening tool for posttraumatic stress disorder (PTSD).¹⁷ Screening positive on any one of the three
40 screeners was examined as the primary outcome. As with all screening tests, a positive response indicates
41 the need for further evaluation by a health professional and could not be used to determine a diagnosis.

1 **Statistical Analysis**

2 Descriptive statistics were used to understand the sociodemographic characteristics of the sample. Rates on
3 EPII-B items were presented as the percent (%) of participants responding positively to each statement.
4 Screening positive on any one or more of the three screeners (i.e., PHQ-2, GAD-2, and PC-PTSD-5) was
5 examined as the primary outcome. Spearman correlations, chi-square goodness-of-fit tests, and multivariate
6 logistic regression were conducted using IBM SPSS software version 27.¹⁸ Bonferroni corrections were
7 applied as appropriate to adjust for multiple comparisons.

8
9
10
11
12

Accepted, in-press

1 RESULTS

2
3 The survey was completed by 179 students (42.6% of 420 total enrolled medical students). Of the total ($n =$
4 179), 68.7% ($n = 123$) were female, 30.7% ($n = 55$) were male, and 0.6% ($n = 1$) were non-binary. The
5 average age was 25.7 years old with a standard deviation of ± 2.9 years. The same was comprised of first
6 year (M1) ($n = 44$, 24.6%), second year (M2) ($n = 40$, 22.3%), third year (M3) ($n = 54$, 30.2%), and fourth year
7 (M4) ($n = 41$, 22.9%) medical students. As such, 92 participants (52.5%) were in pre-clinical education (M1,
8 M2) and 87 (47.5%) were in clinical education (M3, M4). Ethnic minorities represented 32.2% ($n = 57$) of the
9 sample. Of all survey respondents, 27.7% ($n = 41$) screened positive on the PHQ-2, 48.6% ($n = 72$) on the
10 GAD-2, and 24.3% ($n = 36$) on the PC-PTSD-5. A notable 53.4% ($n = 79$) of medical students screened
11 positive on one or more of the three mental health screening tools. This data is presented in **Table 1**.

12
13 Rates of adverse pandemic-related experiences among medical students were noteworthy. Several of these
14 were significantly associated with screening positive for depression, anxiety, and/or posttraumatic stress
15 (**Table 2**). Specifically, the strongest correlations (all $ps < 0.002$) included (a) increased verbal/physical
16 conflict among family and PTSD ($r_s = 0.26$), (b) not having the ability or resources to talk to or see
17 family/friends while separated and PTSD ($r_s = 0.27$), (c) more frequent or severe mental health, sleep, or
18 alcohol/substance use problems and depression ($r_s = 0.40$), anxiety ($r_s = 0.49$), and PTSD ($r_s = 0.52$), and (d)
19 getting less exercise, spending more time sitting down, or eating more junk food and depression ($r_s = 0.32$)
20 and PTSD ($r_s = 0.27$). Although not significant after Bonferroni correction, negative correlations were found
21 between the two positive items and these measures.

22
23 Correlations between EPII items and student-reported percentage of time spent with various patient
24 populations during the past year of medical school training are represented in **Table 3**. **Table 4** presents
25 correlations between the two EPII-B impact variables (i.e., average negative and positive impact), positive
26 screens, and estimated percentage of time spent with patients. Perceived negative impact across adverse
27 experiences was significantly associated (all $ps < 0.01$) with screening positive for depression ($r_s = 0.25$),
28 anxiety ($r_s = 0.31$), or PTSD ($r_s = 0.34$), and greater estimated time spent with COVID-19 positive patients ($r_s =$
29 0.29). Perceived positive impact across positive change experiences was significantly negatively correlated
30 with positive screens on depression ($r_s = 0.26$, $ps < 0.01$) and anxiety ($r_s = 0.18$, $ps < 0.01$).

31
32 **Table 5** presents results from a multivariate logistic regression testing whether perceived negative and
33 positive impact predict a positive screen on at least one of the three screens (depression, anxiety, PTSD),
34 controlling for age, sex, ethnic minority status, and estimated time spent with COVID-19 positive patients. In
35 the final step of the model, significant predictors included male sex, greater estimated time spent with COVID-
36 19 positive patients, and perceived negative impact of pandemic-related experiences. Perceived positive
37 impact was not significantly predictive of the outcome.

1 DISCUSSION

2
3 The current findings suggest that high rates of adverse pandemic-related experiences in medical students are
4 associated with indicators of psychosocial impairment. Nearly half of the sample screened positive for
5 depression, anxiety, or PTSD on validated screening instruments during the pandemic ($n = 79$, 53.4%).

6 Several experiences on the EPII-B were associated with increased risk of screening positive on one of these
7 screening tools. These included worsening sleep, less exercise, poor eating habits, and the inability to talk to
8 or see family/friends. Although not addressed in the current study, it is possible that these effects may be
9 influenced by government “lockdown” orders, quarantining, and the increase in online-learning during this
10 time. Poor sleep quality, physical activity, diet, and social isolation are important predictors of mental health in
11 young adults.^{19, 20} For example, a medical student in pre-clinical education using virtual-only learning methods
12 may have felt more isolated and unable to exercise, socialize, etc. In a recent study, online learning appears
13 to be an obstacle for medical students due to difficulty adapting to new learning styles, inaccessibility of
14 educators, and poor communication with other learners.²¹ Perhaps these challenges, combined with a sudden
15 shift in routine, may have contributed to the worsening mental health in this sample of students.

16
17 Students who screened positive for depression, anxiety, or PTSD were also more likely to screen positive for
18 at least one other disorder. Other studies using the PHQ-2 and GAD-2 pre-pandemic have reported rates of
19 positive depression and anxiety screens in medical students to be 16.4%²² and 25.7%²³, respectively. Using
20 the same screens during the pandemic, we found higher rates, with 27.7% of students screening positive for
21 depression and 48.6% screening positive for anxiety. Although it is not possible to attribute these higher rates
22 to the pandemic, associations between adverse pandemic-related experiences and these measures suggest
23 higher risk during this time.

24
25 Although few pandemic-related experiences were significantly associated with estimated time spent with
26 COVID-19 positive patients, average perceived negative impact across experiences was significantly
27 associated with time spent with COVID-19 positive patients (**Table 3**). This aligns with research highlighting
28 increased stress faced by healthcare providers during the pandemic. However, while perceived negative
29 impact was significantly associated with screening positive on at least one of the screeners, estimated time
30 spent with COVID-19 positive patients was not. It is plausible that the increased risk of infection associated
31 with physical proximity to COVID-19 positive patients and/or fear of infecting others exacerbates the
32 experience of stress among clinic-naïve medical students.

33
34 The experiences of medical students during the pandemic, however, was not uniform. Given that a small
35 percentage of participants with positive occurrences (i.e., spending more quality time with others or finding
36 greater meaning in school/work) appeared to have less depression and anxiety, this could be attributed to
37 additional factors. For example, certain psychosocial factors during the pandemic may have buffered
38 associated risk of mental health impairment for some medical students. It is difficult to determine from this
39 study what these protective factors may be and how they might buffer associated risk. Possible factors
40 contributing to this phenomenon may include a student’s living arrangement (i.e. residing with a parent vs.
41 roommate vs. significant other) and opportunities to continue to engage in activities and attending to personal

1 health during the pandemic. Several studies have demonstrated that certain behaviors such as increased
2 phone use, decreased physical activity, and reduced in-person social interaction among U.S. college students
3 during the pandemic are associated with higher rates of depression and anxiety.^{24,25} Although published
4 literature on these associations as it pertains specifically to medical students is limited, perhaps students who
5 were more physically active or spent more time with family during the transition to virtual-only learning fared
6 better than peers who did not.

7
8 These study findings should be interpreted in the context of several limitations. While the response rate was
9 moderate, it was likely influenced by responder bias. Notably, the survey was completed by a greater number
10 of female, rather than male or non-binary, students. In addition, it was conducted at a single U.S. allopathic
11 medical school and as such, the data may be less generalizable. As is inherent with quantitative survey
12 research, questionnaire design may have contributed to oversimplification of participant lived experience.
13 Another limitation was that our modest sample size prevented more sophisticated statistical analysis and
14 limited the number of comparisons possible; e.g., differential effects by class year and race. Finally, because
15 this is a cross-sectional study, associations are correlational and directionality cannot be determined. Given
16 the nature of the pandemic, no control group could be established and therefore external comparisons in this
17 special population are restricted.

18
19 This cross-sectional study demonstrates high rates of adverse pandemic-related experiences in medical
20 students during the COVID-19 pandemic. It joins the small but growing reports of worsening medical student
21 anxiety, depression, and PTSD during this time. To our knowledge, this is the first study to examine
22 pandemic-related experiences in a medical student population using a tool designed to assess specific
23 changes across life domains due to COVID-19. It underscores the need for medical school administrators to
24 be responsive and proactive in addressing the growing concern of psychosocial impairment among medical
25 students. Potential improvements might include free, or reduced cost, ready access on-campus mental health
26 services, adjustment in the medical curriculum to lower student stress, and encouragement of peer support.

1 **REFERENCES.**

- 2
- 3 1. Cucinotta D., Vanelli M. WHO Declares COVID-19 a Pandemic. *Acta Biomed.* 2020;91(1):157-160.
- 4
- 5 2. Wang C., Pan R., Wan X., Tan Y., Xu L., Ho C.S., et al. Immediate psychological responses and
6 associated factors during the initial stage of the 2019 coronavirus disease (COVID-19) epidemic among
7 the general population in China. *Int J Environ Res Public Health.* 2020;17(5):1729.
- 8
- 9 3. Bendau A., Plag J., Kunas S., Wyka S., Ströhle A., Petzold M.B. Longitudinal changes in anxiety and
10 psychological distress, and associated risk and protective factors during the first three months of the
11 COVID-19 pandemic in Germany. *Brain Behav.* 2020;11(2):e01964.
- 12
- 13 4. Spoorthy S.M., Pratapa K.S., Mahant S. Mental health problems faced by healthcare workers due to the
14 COVID-19 pandemic-A review. *Asian J Psychiatr.* 2020;51:102119.
- 15
- 16 5. Pappa S., Ntella V., Giannakas T., Giannakoulis V.G., Papoutsis E., Katsaounou P. Prevalence of
17 depression, anxiety, and insomnia among healthcare workers during the COVID-19 pandemic: A
18 systematic review and meta-analysis. *Brain Behav Immun.* 2020;88:901-907.
- 19
- 20 6. Bergmann C., Muth T., Loerbroks A. Medical students' perceptions of stress due to academic studies and
21 its interrelationships with other domains of life: a qualitative study. *Med Educ Online.* 2019;24(1):1603526.
- 22
- 23 7. Wolf T.M. Stress, coping and health: enhancing well-being during medical school. *Med Educ.*
24 1994;28(1):8-17.
- 25
- 26 8. Schwenk T.L., Davis L., Wimsatt L.A. Depression, stigma, and suicidal ideation in medical students.
27 *JAMA.* 2010;304(11):1181-1190.
- 28
- 29 9. Halperin S.J., Henderson M.N., Prenner S., Grauer J.N. Prevalence of Anxiety and Depression Among
30 Medical Students During the Covid-19 Pandemic: A Cross-Sectional Study. *J of Med Educ and Curric
31 Dev.* 2021;8:1-7.
- 32
- 33 10. Saraswathi, I., Saikarthik, J., Senthil Kumar, K., Madhan Srinivasan, K., Ardhanaari, M., Gunapriya, R.
34 Impact of COVID-19 outbreak on the mental health status of undergraduate medical students in a COVID-
35 19 treating medical college: a prospective longitudinal study. *PeerJ.* 2020;8:e10164.
- 36
- 37 11. Stacey A., D'Eon M., Madojemu G. Medical student stress and burnout: Before and after COVID-19. *Can
38 Med Educ J.* 2020;11(6):204-205.
- 39
- 40 12. Grasso D.J, Briggs-Gowen M.J., Ford J.D., Carter A.S. Epidemic-Pandemic Impacts Inventory. University
41 of Connecticut School of Medicine. 2020.

13. Grasso D.J., Briggs-Gowen M.J., Carter A.S., Goldstein B.L., Ford J.D. Profiling COVID-related experiences in the United States with the Epidemic-Pandemic Impacts Inventory: Linkages to psychosocial functioning. *Brain and Behav.* 2021;00:e02197.
14. Shah A., Darling M., Arstein-Kerslake O., Morgan T., Tovrea A.V., Young J., et al. Measuring the Impact of COVID-19 on Siyan Mental Health Patients Using the Epidemic-Pandemic Impacts Inventory: Survey Study. *JMIR Form Res.* 2021;5(7):e29952.
15. Kroenke K., Spitzer R.L., Williams J.B. The Patient Health Questionnaire-2: validity of a two-item depression screener. *Med Care.* 2003;41(11):1284-1292.
16. Kroenke K., Spitzer R.L., Williams J.B.W., Monahan P.O., Löwe B. Anxiety disorders in primary care: prevalence, impairment, comorbidity, and detection. *Ann Intern Med.* 2007;146(5):317-325.
17. Prins A., Bovin M.J., Smolenski D.J., Marx B.P., Kimerling R., Jenkins-Guarnieri M.A., et al. The Primary Care PTSD Screen for DSM-5 (CS-PTSD-5): Development and Evaluation Within a Veteran Primary Care Sample. *J Gen Intern Med.* 2016;31(10):1206-1211.
18. IBM Corp. Released 2020. IBM SPSS Statistics for Windows, Version 27.0. Armonk, NY: IBM Corp.
19. Wickham S.R., Amarasekara N.A., Bartonicek A., Conner T.S. The Big Three Health Behaviors and Mental Health and Well-Being Among Young Adults: A Cross-Sectional Investigation of Sleep, Exercise, and Diet. *Front Psychol.* 2020;11:3339.
20. Christiansen J., Qualter P., Friis K., Pedersen S.S., Lund R., Andersen C.M., et al. Associations of loneliness and social isolation with physical and mental health among adolescents and young adults. *Perspect Pub Health.* 2021;141(4):226-236.
21. Baticulon R.E., Sy J.J., Alberto N.R., Baron M.B., Mabulay R.E., Rizada L.G., et al. Barriers to Online Learning in the Time of COVID-19: A National Survey of Medical Students in the Philippines. *Med Sci Educ.* 2021;31:615–626.
22. Mousa O.Y., Dhamoon M.S., Lander S., Dhamoon A.S. The MD Blues: Under-Recognized Depression and Anxiety in Medical Trainees. *PLoS One.* 2016;11(6):e0156554.
23. MacLean L., Booza J., Balon R. The Impact of Medical School of Student Mental Health. *Acad Psychiatry.* 2016;40(1):89-91.
24. Huckins J.F., DaSilva A.W., Wang W., Hedlund E., Rogers C., Nepal S.K., et al. Mental Health and Behavior of College Students During the Early Phases of the COVID-19 Pandemic: Longitudinal Smartphone and Ecological Momentary Assessment Study. *J Med Internet Res.* 2020;22(6):e20185

- 1 25. Son C., Hegde E., Smith A., Wang X., Sasangohar F. Effects of COVID-19 on College Students' Mental
2 Health in the United States: Interview Survey Study. J Med Internet Res. 2020;22(9):e21279.
3

Accepted, in-press

1 **FIGURES AND TABLES.**

2

3 **Table 1.** Sample Characteristics

Characteristics	Missing No. (%)^a	Mean (SD)	Percent (%)^b
Age	2 (1.1)	25.7 (2.9)	100
Gender	0		100
Female			68.7
Male			30.7
Non-binary			0.6
Ethnic Minority ^c	2 (1.1)		32.2
Medical Student Year	0		100
First			24.6
Second			22.3
Third			30.2
Fourth			22.9
Percent Time Spent with Patients	0		100
Overall		33.0 (30.5)	96.0
Pediatrics		10.1 (19.8)	54.2
Adult		26.8 (28.4)	83.8
Geriatric		15.6 (20.7)	76.5
COVID+		3.9 (9.8)	33.5
PHQ-2 Depression Positive Screen	31 (17.3)		27.7
GAD-2 Anxiety Positive Screen	31 (17.3)		48.6
Primary Care PTSD Positive Screen	31 (17.3)		24.3
Any Positive Screen	31 (17.3)		53.4

4 **Legend:** A total of 179 medical students at a U.S. allopathic medical school in the Northeast responded to the
5 questionnaire. SD: Standard Deviation, No: number, COVID+: COVID-19 positive, PHQ-2: Patient Health
6 Questionnaire 2-item Depression Screen, GAD-2: Generalized Anxiety Disorder 2-item Screen, PTSD:
7 Posttraumatic Stress Disorder.

8 ^a The number and percentage of respondents that left a certain section of the questionnaire unanswered is
9 represented in this column.

10 ^b Percent of those who responded (eg, excluding missing). Percentages may not sum up to 100 as a result of
11 rounding.

12 ^c "Ethnic Minority" representing a term used to describe self-reported non-white ethnicity.

13

1 **Table 2.** EPII Base Rates and Correlation with Perceived Stress, Depression, Anxiety, and Posttraumatic Stress

	%	PHQ r_s	GAD r_s	PTS r_s
WORK, EDUCATION, AND TRAINING				
Had to work in close contact with people who might be infected	47.4	.16	.14	.20 *
Provided direct care or services to people who had COVID	16.1	.00	-.03	-.12
Had an increase in workload or work responsibilities	16.0	.19	.22 *	.09
Laid off, furloughed, had to close a business, or had reduced work hours	14.8	.03	.13	-.03
HOME LIFE				
Spent a lot more time taking care of a family member most days	6.1	.04	.17	.12
A child or teenager/young adult I care for could not go to school or needed home instruction	5.4	-.06	.01	-.08
Increase in verbal or physical conflict with a partner or spouse	5.3	.15	.12	.18
My family was unable to pay important large bills like rent or utilities	4.9	-.09	.04	-.06
Increase in verbal or physical conflict among other family in my home	4.8	.21 *	.15	.26 **
My family was unable to pay for or get enough food or clean water	2.8	.09	.09	.12
Had more conflict with or was harsher in disciplining my child or children	2.8	-.02	-.02	-.08
Childcare or babysitting was unavailable to me or someone in my home when needed	2.1	-.08	-.07	-.12
My family had to move, relocate, was evicted, or became homeless	2.1	-.01	.01	.01
My child[ren] had more frequent or severe behavioral problems or emotional problems	0.7	.06	.07	.00
EMOTIONAL, PHYSICAL, AND SOCIAL HEALTH				
Got less exercise, spent more time sitting down, or ate more junk food	37.5	.32 **	.24 *	.27 **
Had to cancel or not attend important celebrations, religious ceremonies, or funerals	35.9	.01	.00	.02
More frequent or severe mental health problems, sleep, or use of alcohol or substances	15.4	.40 **	.49 **	.52 **
Important medical procedures cancelled or unable to access care for serious condition	13.9	.11	.15	.01
Unable to access or was less satisfied with mental health treatment or therapy	7.8	.09	.11	.25 *
Could not get enough medication or medical treatment for a chronic illness or pain	5.2	.17	.14	.21 *
Trouble getting places due to less access to public transportation or concerns about safety	3.6	.13	.05	.07
Did not have the ability or resources to talk to or see family/friends while separated	3.2	.19	.07	.27 **
QUARANTINE AND INFECTION ISSUES				
Isolated or quarantined due to possible exposure to the disease, symptoms, or increased risk	31.0	.06	.13	.21 *

Limited physical closeness with my child or loved one due to concerns of infection	17.1	.08		.17	.26 *
Unable to be with family member hospitalized, in a nursing home, or in critical condition	11.9	-.07		-.01	.02
Harassed/blamed for COVID-19, or denied services/treatment for because of race/ethnicity	6.4	.03		.10	.01
A close friend or family member died from COVID-19 or related complications	2.4	.01		-.07	.04
I or someone in my home tested positive for COVID-19 and had severe symptoms	1.6	.02		-.01	.06
POSITIVE CHANGE					
More quality time together, paid more attention to personal health, or made new connections	19.0	-.25 *		-.17 *	-.19 *
Found greater meaning and was more effective in my work, school, or friendships than before	18.1	-.22 *		-.14	-.06

1

2 **Legend:** Percent of respondents experiencing each EBII-B item and the subsequent correlation of that item
3 with depression, anxiety, and PTSD screens. Item wording in some cases is abridged. PHQ: Patient Health
4 Questionnaire 2-item Depression Screen, GAD: Generalized Anxiety Disorder 2-item Screen, PTS: Primary
5 Care Posttraumatic Stress Disorder Screen, EPII: Epidemic-Pandemic Impacts Inventory.

6 * $p < .01$, ** $p < .002$ (Bonferroni Correction)

1 **Table 3.** EPII Correlation with Percent Time with Patients Across Types

	Overall	Pediatric	Adult	Geriatric	Covid+
WORK, EDUCATION, AND TRAINING					
Had to work in close contact with people who might be infected	.15	.15	.09	.10	.23 *
Provided direct care or services to people who had COVID	.30 **	.11	.22 *	.18 *	.45 **
Had an increase in workload or work responsibilities	-.03	-.06	-.11	-.04	.06
Laid off, furloughed, had to close a business, or had reduced work hours	.06	.02	.08	.01	.07
HOME LIFE					
Spent a lot more time taking care of a family member most days	-.03	-.03	-.06	.09	.08
A child or teenager/young adult I care for could not go to school or needed home instruction	.07	.07	.03	.03	-.06
Increase in verbal or physical conflict with a partner or spouse	.15	.05	.07	.07	.21 *
My family was unable to pay important large bills like rent or utilities	.10	.07	.05	.09	.18
Increase in verbal or physical conflict among other family in my home	.01	-.11	.01	.14	.11
My family was unable to pay for or get enough food or clean water	.02	-.01	.04	.07	.22 *
Had more conflict with or was harsher in disciplining my child or children	.09	.06	.09	.09	.12
Childcare or babysitting was unavailable to me or someone in my home when needed	.19	.16	.18	.11	.15
My family had to move, relocate, was evicted, or became homeless	.01	-.06	.06	.14	.14
My child[ren] had more frequent or severe behavioral problems or emotional problems	.11	.08	.08	.12	.14
EMOTIONAL, PHYSICAL, AND SOCIAL HEALTH					
Got less exercise, spent more time sitting down, or ate more junk food	-.05	-.06	.00	.01	.00
Had to cancel or not attend important celebrations, religious ceremonies, or funerals	.11	.06	.12	.165 *	.17
More frequent or severe mental health problems, sleep, or use of alcohol or substances	.00	-.03	.03	.14	.05
Important medical procedures cancelled or unable to access care for serious condition	-.05	-.12	-.05	.02	.05
Unable to access or was less satisfied with mental health treatment or therapy	.06	.03	.08	.11	.14
Could not get enough medication or medical treatment for a chronic illness or pain	.04	-.05	.07	.15	.22 *
Trouble getting places due to less access to public transportation or concerns about safety	.01	.08	.01	.02	.09

Did not have the ability or resources to talk to or see family/friends while separated	.00	-.04	.00	.167 *	.15
--	-----	------	-----	--------	-----

QUARANTINE AND INFECTION ISSUES

Isolated or quarantined due to possible exposure to the disease, symptoms, or increased risk	.01	.07	-.09	.02	.15
--	-----	-----	------	-----	-----

Limited physical closeness with my child or loved one due to concerns of infection	.08	-.05	-.04	.02	.04
--	-----	------	------	-----	-----

Unable to be with family member hospitalized, in a nursing home, or in critical condition	-.07	-.09	.01	.09	.13
---	------	------	-----	-----	-----

Harassed/blamed for COVID-19, or denied services/treatment for because of race/ethnicity	.19	.19	.16	.25 *	.23 *
--	-----	-----	-----	-------	-------

A close friend or family member died from COVID-19 or related complications	-.08	.03	.02	.09	.09
---	------	-----	-----	-----	-----

I or someone in my home tested positive for COVID-19 and had severe symptoms	-.11	-.02	-.06	.01	.06
--	------	------	------	-----	-----

POSITIVE CHANGE

More quality time together, paid more attention to personal health, or made new connections	-.07	.02	-.09	-.15	-.03
---	------	-----	------	------	------

Found greater meaning and was more effective in my work, school, or friendships than before	.06	.16	-.02	.01	.11
---	-----	-----	------	-----	-----

1

2 **Legend:** COVID+: COVID-19 positive, EPII: Epidemic-Pandemic Impacts Inventory.3 * $p < .01$, ** $p < .002$ (Bonferroni Correction)

4

1 **Table 4.** Correlation Matrix

	EPII Ave. Negative Impact	EPII Ave. Positive Impact	% Time w/ Patients	% Time w/ COVID Patients	PHQ-2 Positive Screen	GAD-2 Positive Screen
EPII Ave. Negative Impact (<i>r</i>)	--					
EPII Ave. Positive Impact (<i>r</i>)	.02	--				
% Time w/ Patients (<i>r</i>)	.07	-.02	--			
% Time w/ COVID Patients (<i>r</i>)	.29 **	.05	.55 **	--		
PHQ-2 Positive Screen (<i>r_s</i>)	.25 **	-.26 **	-.05	.03	--	
GAD-2 Positive Screen (<i>r_s</i>)	.31 **	-.18 *	-.01	-.11	.43 **	--
PC-PTSD Positive Screen (<i>r_s</i>)	.34 **	-.15	-.00	.01	.49 **	.39 **

2

3 **Legend:** Ave: Average, PHQ-2: Patient Health Questionnaire 2-item Depression Screen, GAD-2: Generalized
4 Anxiety Disorder 2-item Screen, PC-PTSD: Primary Care Posttraumatic Stress Disorder Screen.

5 *r_s* = Spearman Correlation

6 **p*<.05. ***p*<.01

7

Accepted, in-press

1 **Table 5.** Logistic Regression

	<i>B</i>	<i>SE</i>	<i>Wald</i>	<i>p-value</i>	<i>OR</i>	95% CI	
						Upper	Lower
STEP ONE							
Age	0.09	0.09	1.15	.283	1.10	0.92	1.30
Sex (Male)	-0.77	0.40	3.72	.054	0.47	0.21	1.01
Ethnic Minority	-0.33	0.40	0.66	.418	0.72	0.33	1.59
Time w/ COVID Pts.	-0.06	0.03	5.23	.022*	0.94	0.89	0.99
STEP TWO							
Age	0.12	0.09	1.49	.222	1.13	0.93	1.36
Sex (Male)	-0.99	0.44	5.13	.023*	0.37	0.16	0.88
Ethnic Minority	-0.53	0.44	1.47	.226	0.59	0.25	1.39
Time w/ COVID Pts.	-0.10	0.03	9.72	.002*	0.90	0.85	0.96
EPII Negative Impact	2.42	0.62	15.01	<.001**	11.24	3.31	38.23
STEP THREE							
Age	0.10	0.10	0.94	.333	1.10	0.91	1.33
Sex (Male)	-1.01	0.44	5.25	.022*	0.36	0.15	0.86
Ethnic Minority	-0.42	0.44	0.91	.340	0.66	0.28	1.56
Time w/ COVID Pts.	-0.09	0.03	8.22	.004*	0.91	0.86	0.97
EPII Negative Impact	2.44	0.63	3.66	<.001**	11.42	3.32	39.26
EPII Positive Impact	-0.36	0.19	3.66	.056	0.70	0.49	1.01

2 **Legend:** COVID Pts: COVID-19 patients, EPII: Epidemic-Pandemic Impacts Inventor, B: beta-coefficient, SE:
3 standard error, OR: Odds Ratio.

4 * $p < .05$. ** $p < .01$