

**Unspoken Truths: Mental Health Among Academic Surgeons**

Reagan A Collins, BA<sup>1,2,3</sup>, Tianna Herman, MPH<sup>2</sup>, Rebecca A Snyder, MD MPH<sup>3</sup>, Krista L Haines, MD MA<sup>5</sup>, Anne Stey, MD MSc<sup>6</sup>, Tania K Arora, MD<sup>7</sup>, Sunil K Geevarghese, MD MSCI<sup>8</sup>, Joseph D Phillips, MD<sup>9</sup>, Diego Vicente, MD<sup>10</sup>, Cornelia L Griggs, MD<sup>11</sup>, Imani E McElroy, MD MPH<sup>1</sup>, Anji E Wall, MD<sup>12</sup>, Tasha M Hughes, MD MPH<sup>13</sup>, Srijan Sen, MD PhD<sup>14</sup>, Jaber Valinejad, PhD<sup>2</sup>, Andres Alban, PhD<sup>2</sup>, J. Shannon Swan, MD<sup>2</sup>, Nathaniel Mercaldo, PhD<sup>2</sup>, Mohammad S Jalali, PhD<sup>2</sup>, Jagpreet Chhatwal, PhD<sup>2</sup>, G. Scott Gazelle, MD MPH PhD<sup>2</sup>, Erika Rangel, MD MS<sup>1</sup>, Chi-Fu Jeffrey Yang, MD<sup>15</sup>, Karen Donelan, ScD EdM<sup>2</sup>, Jessica A Gold, MD MS<sup>16</sup>, Colin P West, MD PhD<sup>17</sup>, Carrie Cunningham, MD MPH<sup>1,2</sup>

<sup>1</sup>Department of Surgery, Massachusetts General Hospital, Boston, MA, USA

<sup>2</sup>Institute for Technology Assessment, Massachusetts General Hospital, Boston, MA, USA

<sup>3</sup>School of Medicine, Texas Tech University Health Sciences Center, Lubbock, TX, USA

<sup>4</sup>Department of Surgical Oncology, The University of Texas MD Anderson Cancer Center,

Houston, TX, USA

<sup>5</sup>Department of Surgery, Duke University, Durham, North Carolina, USA

<sup>6</sup>Department of Surgery, Feinberg School of Medicine, Northwestern University, Chicago, IL, USA

<sup>7</sup>Department of Surgery, Augusta University at the Medical College of Georgia, Augusta, GA, USA

<sup>8</sup>Department of Surgery, Vanderbilt University Medical Center, Nashville, TN, USA

<sup>9</sup>Thoracic Surgery, Dartmouth-Hitchcock Medical Center, Lebanon, NH, USA

<sup>10</sup>Department of Surgery, Uniformed Services University of the Health Sciences, Bethesda, MD, USA

<sup>11</sup>Department of Pediatric Surgery, Massachusetts General Hospital, Boston, MA, USA

<sup>12</sup>Department of Surgery, Baylor University Medical Center, Dallas, TX, USA

<sup>13</sup>Department of Surgery, University of Michigan, Ann Arbor, MI, USA

<sup>14</sup>Department of Psychiatry, University of Michigan, Ann Arbor, MI, USA

<sup>15</sup>Division of Thoracic Surgery, Massachusetts General Hospital, Boston, MA, USA

<sup>16</sup>Department of Psychiatry, Washington University in St Louis, St Louis, MO, USA

<sup>17</sup>Department of Medicine, Mayo Clinic, Rochester, MN, USA

**Corresponding Author:**

Reagan A Collins, BA

Massachusetts General Hospital Institute for Technology Assessment

101 Merrimac Street, Ste 1010

Boston, MA 02114

Telephone: 617-480-1505

Fax: 617-724-3895

Email: reagan.collins@ttuhsc.edu

**Conflicts of Interest and Source of Funding:** None

**Short Running Head:** Mental Health Among Academic Surgeons

**Mini-Abstract**

This is a cross-sectional survey study assessing the current state of mental health among academic surgeons in the United States. Of 622 participants, 16% screened positive for current depression, 18% for anxiety, 17% for post-traumatic stress disorder, 11% for hazardous alcohol consumption, and nearly 1 in 7 respondents reported suicidal ideation in the past year. The results suggest that mental illness and suicidal ideation among the US surgical community is prevalent.

**Abstract**

**Objective:** To characterize the current state of mental health within the surgical workforce in the United States (US).

**Summary Background Data:** Mental illness and suicide is a growing concern in the medical community; however, the current state is largely unknown.

**Methods:** Cross-sectional survey of the academic surgery community assessing mental health, medical error, and suicidal ideation. The odds of suicidal ideation adjusting for sex, prior mental health diagnosis, and validated scales screening for depression, anxiety, post-traumatic stress disorder (PTSD), and alcohol use disorder were assessed.

**Results:** Of 622 participating medical students, trainees, and surgeons (estimated response rate = 11.4-14.0%), 26.1% (141/539) reported a previous mental health diagnosis. 15.9% (83/523) of respondents screened positive for current depression, 18.4% (98/533) for anxiety, 11.0% (56/510) for alcohol use disorder, and 17.3% (36/208) for PTSD. Medical error was associated with depression (30.7% vs. 13.3%,  $p<0.001$ ), anxiety (31.6% vs. 16.2%,  $p=0.001$ ), PTSD (12.8% vs. 5.6%,  $p=0.018$ ), and hazardous alcohol consumption (18.7% vs. 9.7%,  $p=0.022$ ). 13.2% (73/551) of respondents reported suicidal ideation in the past year and 9.6% (51/533) in the past two weeks. On adjusted analysis, a previous history of a mental health disorder (aOR: 1.97, 95% CI: 1.04-3.65,  $p=0.033$ ), and screening positive for depression (aOR: 4.30, 95% CI: 2.21-8.29,  $p<0.001$ ) or PTSD (aOR: 3.93, 95% CI: 1.61-9.44,  $p=0.002$ ) were associated with increased odds of suicidal ideation over the past 12 months.

**Conclusions:** Nearly 1 in 7 respondents reported suicidal ideation in the past year. Mental illness and suicidal ideation are significant problems among the surgical workforce in the US.

**Keywords:** mental health; suicidal ideation; surgeon; depression; anxiety; PTSD; alcohol use disorder

## Introduction

Mental illness among physicians is a growing problem worldwide, exacerbated by the COVID-19 pandemic.<sup>1</sup> Workplace traumatic exposures and the increasingly strenuous workload, coupled with a culture that stigmatizes seeking help, have contributed to high rates of diagnosable mental health disorders (depression, anxiety, post-traumatic stress disorder [PTSD], substance abuse) and suicidal ideation among medical professionals.<sup>2-5</sup> Stigma and fear of job security create tremendous barriers to reporting and seeking help.<sup>6,7</sup>

Increasing rates of untreated mental illness and substance use disorders, both risk factors for suicidal ideation, likely perpetuate 300 physician deaths by suicide each year in the United States (US).<sup>8,9</sup> Surgeons have one of the highest suicide rates among physicians.<sup>10</sup> In a 2008 survey of members of the American College of Surgeons, 1 in 16 surgeons reported thoughts of suicide in the previous 12 months.<sup>11</sup> More recent surveys of physicians in all medical specialties, of which 3% were surgeons, suggest that the mental health crisis is worsening.<sup>12,13</sup>

The COVID-19 pandemic greatly exacerbated mental illness. Among the general US population, the prevalence of anxiety and depression symptoms increased 3-fold, and the rate of suicidal ideation increased 2-fold to nearly 12%.<sup>14</sup> It is not known if these increased rates have been sustained post-pandemic. Given the unprecedented workload, social isolation (frequently from their own families) and uncertainty in clinical care during the COVID-19 pandemic, there is significant concern about similar worsening trends among the surgical workforce.<sup>15</sup> Recent international reports and studies from subspecialty surgical societies assessing surgeon mental health have confirmed the declining psychological health of surgeons since the COVID-19 pandemic.<sup>16-18</sup>

Given that it has been over a decade since a broad mental health survey was conducted among surgeons in the US,<sup>11</sup> the current state of mental health among surgeons is largely unknown. We aimed to assess the extent of mental health symptoms and conditions that surgeons experience and to identify potential modifiable risk factors.

## **Methods**

### *Study Participants*

This is a cross-sectional survey study of the academic surgery workforce. Individuals were invited to participate in an English language survey. Eligible individuals included those registered for the annual Academic Surgical Congress (ASC) 2023 meeting and any Association for Academic Surgery (AAS), Society of University Surgeons (SUS), or Association of Program Directors in Surgery (APDS) members not attending the meeting. The ASC, one of the largest surgical meetings in the US, is a particularly broad cross-section from medical students applying to surgery residency programs, surgical trainees, through surgical department chairs in all surgical subspecialties. Medical students were included as they are part of the future surgical workforce and it has been shown that high rates of mental illness and barriers to seeking help start as early as medical school.<sup>7, 19</sup>

### *Survey Distribution*

An invitation email with a link to an anonymous REDCap (Research Electronic Data Capture) survey was distributed to members of the APDS (N=1,032), AAS (N=3,527), SUS (N=358), AAS/SUS dual members (N=1,066), and non-member registrants of the ASC (N=651). Although we were unable to determine the exact number of APDS members that are also AAS or SUS members, they are highly likely to be members of one or both societies. As anonymity was required for IRB approval, we are not able to calculate an exact response rate. Thus, an

estimated response rate range was calculated based on two separate assumptions: 1) all APDS members were members of the AAS or SUS, or 2) there were no overlapping members. The response rate was calculated with email send and click metrics using American Association for Public Opinion Research response rate 3.<sup>20</sup> The survey link was active from November 11<sup>th</sup>, 2022, through February 10<sup>th</sup>, 2023.

This study was approved by the Mass General Brigham Institutional Review Board. As required by our Institutional Review Board, survey responses were anonymous and participants were given the option “prefer not to disclose” for all questions that did not come from previously validated scales. Participation was voluntary and confidential with no remuneration for respondents. Participants were considered to have consented to participate if they completed the survey in part or in whole.

### *Survey Demographics and Instruments*

Study design, implementation, and survey content were iteratively discussed and vetted by a collective group of surgeons, psychiatrists, survey experts, and statistician as well as experts in mental health and well-being research. The survey is comprised of 112 items capturing demographics, health history, mental health, suicidal ideation, and medical errors; see Supplement 1, Supplemental Digital Content 1, <http://links.lww.com/SLA/E948>. Four validated and commonly utilized screening instruments for depression, anxiety, PTSD, and alcohol use disorder were applied. Specific surveys were chosen to balance parsimony while assessing key factors affecting the mental health of medical students, surgical trainees, and surgeons.

Demographics collected included age, sex, ethnicity, race, training level, years of practice, practice setting, military status, marital status, parent or legal guardian status, and household composition. Health history included previous mental health disorder diagnosis information, mental health treatment history, and mental health hospitalization history. Suicidal ideation was assessed by asking: “During the past 12 months have you had thoughts of taking your own life or wish that you were dead?”<sup>21</sup> Medical errors were assessed by asking: “Are you concerned that you made a major medical error in the past three months?”<sup>22</sup>

### *Screening for Depression*

Four surveys were used to assess respondents’ current mental health. Depression symptoms **over the past two weeks** were assessed using the validated nine-item Patient Health Questionnaire – 9 (PHQ-9) depression scale.<sup>23</sup> Each item is scored from 0-3 and summed to provide a severity score from 0-27.<sup>23</sup> Cut-points of 5, 10, 15, and 20 were used to represent mild, moderate, moderately severe, and severe levels of depression.<sup>23</sup> A severity score of 10 or greater was used to indicate a respondent screened positive for major depression, with a sensitivity and specificity of 88% and 88%, respectively.<sup>23</sup>

### *Screening for Anxiety*

The validated seven-item Generalized Anxiety Disorder – 7 scale was used to assess symptoms of anxiety **over the past two weeks**.<sup>24</sup> Each item is scored from 0-3 and summed to provide an overall severity score ranging from 0-21. Cut-points of 5, 10, and 15 were used to represent mild, moderate, and severe anxiety.<sup>24</sup> Respondents with a severity score of 10 or greater were considered to screen positive for GAD, with a previously reported sensitivity and specificity of 89% and 82%, respectively.<sup>24</sup>



### *Screening for PTSD*

Probable cases of PTSD were identified using the validated five-item Primary Care PTSD Screen for DSM-5 (PC-PTSD-5).<sup>25</sup> If the respondent reports “yes” to experiencing a traumatic event, they are prompted to answer the 5-item scale with a total score ranging from 0-5 assessing PTSD symptoms **over the past month**. A cut-point of 3 was used to identify a possible PTSD diagnosis with a sensitivity and specificity of 100% and 87% for men and 83% and 83% for women, respectively.<sup>25</sup>

### *Screening for Alcohol Use Disorders*

The ten-item Alcohol Use Disorders Identification Test (AUDIT) was used to assess hazardous and harmful alcohol consumption.<sup>26</sup> Responses are aggregated to obtain a severity score ranging from 0 (abstainer)-40. Cut-points of 1, 8, and 15 were used to represent low-risk consumption, hazardous or harmful consumption, and alcohol dependence based on World Health Organization guidelines. A score of 8 or greater was used to indicate a respondent screened positive for an alcohol use disorder.<sup>27</sup>

### *Data Analysis*

Frequency (percentage) was used to summarize categorical variables. Variables with responses of “prefer not to disclose” were excluded from analyses involving those variables. Percentages were calculated out of the total number of respondents answering the question, excluding those who responded: “prefer not to disclose”. There was no statistical difference in demographics, mental health assessment scores, suicidal ideation, or medical errors among respondents with missing compared to no missing data (Supplement 2, Supplemental Digital Content 1, <http://links.lww.com/SLA/E948>), and survey participants with missing data were excluded from

multivariable analysis. Chi-square tests were used to compare differences in the distributions of mental illness (PHQ-9, GAD-7, PC-PTSD-5, AUDIT) based on a self-reported medical error. Univariate and multivariable logistic regression were used to assess demographic and mental health factors associated with suicidal ideation. Univariate models included partial and complete survey responses. Spearman correlation analysis found a moderate correlation between PHQ-9 screen and GAD-7 screen (Coeff = 0.56), thus GAD-7 was excluded from the multivariable model (Supplement 3, Supplemental Digital Content 1, <http://links.lww.com/SLA/E948>). Variables for the multivariable model were selected from univariate models with a p-value < 0.2. The independent variables included in the multivariable model included sex, prior mental health disorder diagnosis, PHQ-9 screen, PC-PTSD-5 screen, and AUDIT screen. All analyses and data visualization were performed using R version 4.2.2 with a p-value < 0.05 denoting *a priori* statistical significance.

## **Results**

### *Respondent Demographics*

Of approximately 4,500-5,532 eligible surgeons, surgical trainees, and medical students who received the link to the survey, 629 responded (11.4-14.0% response rate). Of these, 7 were excluded as they were undergraduate or graduate students. Table 1 shows respondent demographics and clinical practice characteristics. There was an approximately equal distribution of male (48.7%) and female (50.7%) respondents, similar to the general surgeon population in the US.<sup>28</sup> A majority of respondents were White (68.2%) followed by Asian (19.3%), Hispanic or Latino (6.6%), and Black/African American (5.1%). For comparison, the race/ethnicity distribution among all general surgeons in the US is approximately 77% White,

13% Asian, 5% Hispanic or Latino, and 2% Black/African American.<sup>28</sup> 22.5% of the respondents were trainees, 23.5% were assistant professors, 18.3% associated professors, and 25.1% were full professors (including 10.6% which were departmental heads). A majority of respondents practice in academic or hybrid settings (94.1%) compared to private or community practice (2.2%). There were 20 respondents (4.2%) who serve in the military. 81.1% reported living with someone, 67.8% were married/engaged/living with their partner, and 53.2% reported being a parent or legal guardian.

### *Health History*

A total of 26.1% (141/539) of respondents reported ever having a clinical diagnosis of a mental health disorder, 29.1% (157/539) of respondents had received any treatment (i.e., therapy, medication) for a mental health disorder, and 24.4% (133/544) had been prescribed a medication for their mental health disorder (excluding for sleep/insomnia). 2.7% (15/549) of respondents had been hospitalized for a mental health disorder and 6.0% (33/547) reported taking a prescription medication not prescribed to them for a mental health disorder or sleep. Survey participants identified their own mental health diagnoses: 19.1% (103/539) reported a prior clinical diagnosis of depression, 14.1% (76/539) reported anxiety, 0.2% (1/539) reported bipolar disorder, 0.7% (4/539) reported substance abuse disorder, and 3.7% (20/539) reported other, not listed.

### *Mental Health Scales*

Using the PHQ-9, GAD-7, and PC-PTSD-5, 15.9% (83/523) of respondents screened positive for depression, 18.4% (98/533) for anxiety, and 11.0% (56/510) for alcohol use disorder (Figure 1).

When assessing the last item of the PHQ-9, suicidal ideation in the **past two weeks** was reported by 9.6% (51/533) of participants. Of the 39.5% (208/527) of individuals who reported experiencing a traumatic event, 17.3% (36/208) screened positive for current PTSD symptoms. Of those who reported that the traumatic event occurred before medical school/training, 14.7% (14/95) screened positive for PTSD (Figure 2). Comparatively, 19.6% (21/107) of respondents who reported that the traumatic event occurred during or after training screened positive for PTSD.

#### *Mental Health Disorders and Perceived Medical Errors*

A total of 559 individuals responded to the question assessing medical errors, of whom 16.9% (81) reported a perceived medical error over the past three months (Table 2). A higher proportion of respondents who reported a perceived medical error screened positive for anxiety (31.6% vs. 16.2%,  $p=0.001$ ), moderate to severe depression (30.7% vs. 13.3%,  $p<0.001$ ), PTSD (12.8% vs. 5.6%,  $p=0.018$ ), and hazardous alcohol consumption (18.7% vs. 9.7%,  $p=0.022$ ) compared to those who did not report a medical error. Respondent demographics associated with a perceived medical error are shown in Supplement 4, Supplemental Digital Content 1, <http://links.lww.com/SLA/E948>. Subgroup analysis excluding medical student respondents is shown in Supplement 5, Supplemental Digital Content 1, <http://links.lww.com/SLA/E948>.

#### *Factors Associated with Suicidal Ideation*

A total of 551 individuals responded to the question assessing suicidal ideation. Of these, 13.2% (73) reported suicidal ideation over the **past 12 months** (Table 3). Reports of suicidal ideation varied with sex and level of training (Table 3). Suicidal ideation was reported in 25.2% (35) of

respondents with a previous mental health disorder compared to 9.0% (35) without. When assessing validated scales, 40.5% (32) of those who screened positive for moderate to severe depression, 29.3% (27) of those who screened positive for anxiety, 42.9% (15) of those who screened positive for PTSD, and 29.1% (16) of those who screened positive for hazardous alcohol consumption reported suicidal ideation. A previous history of a mental health disorder (aOR: 1.97, 95% CI: 1.04-3.65,  $p=0.033$ ), screening positive for moderate to severe depression (aOR: 4.30, 95% CI: 2.21-8.29,  $p<0.001$ ), and screening positive for PTSD (aOR: 3.93, 95% CI: 1.61-9.44,  $p=0.002$ ) were associated with increased odds of suicidal ideation over the past 12 months when adjusted for sex, mental health disorder diagnosis, PHQ9, PC-PTSD-5, and AUDIT (Table 3). Univariate and multivariable models excluding medical student respondents are shown in Supplement 6, Supplemental Digital Content 1, <http://links.lww.com/SLA/E948>.

## **Discussion**

This national study of over 600 members of the AAS, SUS, APDS, and registrants of the ASC assessed the current state of mental illness in medical students, surgical trainees, and practicing surgeons in the US. 26% of respondents reported a previous mental health disorder diagnosis. Using validated screening tools, 16% of respondents screened positive for current depression, 18% for anxiety, 17% for PTSD, and 11% for hazardous alcohol consumption. Nearly 1 in 7 respondents reported suicidal ideation in the past year. A self-reported medical error in the past 3 months was associated with higher rates of depression, anxiety, PTSD, and hazardous alcohol consumption while a prior history of mental illness and screening positive for depression or PTSD was associated with suicidal ideation.

Physicians, particularly surgeons, are at a higher risk of mental illness and suicidal ideation than the general US population.<sup>11, 29, 30</sup> This has been amplified by the increasing workload for general

surgeons and stressors related to the COVID-19 pandemic.<sup>2,3</sup> In this study, the rate of suicidal ideation was 2-fold higher than observed in national surveys of surgeons prior to the COVID-19 pandemic.<sup>11,30</sup> In a recently published 2023 Medscape survey of over 9,000 physicians, of which 270 (3%) were surgeons, the lifetime suicidal ideation rate was approximately 10% among general surgeons, which is congruent with our results.<sup>13</sup> Notably, full professors endorsed the lowest rate of suicidal ideation; similar trends have been reported in other professional fields which may be due to factors such as job security at the highest level of the profession, a well-established support system, and more control over their schedule. We found that the overall state of mental illness (depression, anxiety, PTSD, alcohol use disorder) was largely similar to previous literature and in some cases improving,<sup>11, 16, 17, 29, 31-33</sup> suggesting the high rate of suicidal ideation may be due to additional risk factors beyond a mental health disorder diagnosis. Loneliness and social isolation heightened during the COVID-19 pandemic may be other components contributing to the increase in suicidal ideation, emphasizing the importance of rebuilding interpersonal connections within the surgical community.<sup>15, 34</sup>

Workplace trauma, including medical errors and complications, witnessing critical injuries and death, workplace violence, and hazardous clinical exposures (e.g., COVID-19), are unavoidable in medical practice.<sup>5</sup> Although unavoidable, these can often have a long-term psychological impact on medical students, trainees, and surgeons.<sup>5</sup> It is known that physicians experience guilt, sadness, and anxiety after a traumatic clinical event.<sup>35</sup> Among our respondents who experienced a traumatic event during or after medical school or training, nearly 20% screened positive for PTSD, a rate comparable or even higher to rates seen in war veterans.<sup>36, 37</sup> Unexpected traumatic events caused by medical errors can also have a severe psychological impact on surgeons. For example, among our respondents who reported a perceived medical error in the past three

months, rates of depression, anxiety, PTSD, and alcohol abuse were two-fold higher compared to those who did not report a medical error. Although data suggests bidirectionality in these associations,<sup>21, 38</sup> our results reinforce the potentially detrimental impact that an error may have on surgeon well-being and health. Whether a medical error or other traumatic workplace exposure, institutional- and individual-level support for trainees and surgeons is critical to mitigating harmful long-term mental health effects.

Targeted initiatives are necessary to address the overall high rates of mental health disorders and rising suicidal ideation among our respondents. This is particularly critical given the intersection between a physician's mental health and their ability to provide quality patient care.<sup>39</sup> However, little is known about which interventions are effective in promoting large-scale change. Policies such as the Lorna Breen Health Care Provider Protection Act represent a positive step towards dismantling barriers to accessing care and destigmatizing mental health disorders.<sup>40</sup> The Lorna Breen Heroes' Foundation has also made it their goal to change the invasive and stigmatizing mental health questions on state licensure and credentialing applications that currently create significant barriers to physicians reporting and seeking help.<sup>41</sup> Additionally, some interventions at the individual level, including peer support groups and psychological first-aid training, have also shown incremental benefits.<sup>42-45</sup> Other proposed interventions include opt-out programs for surgical trainees at high-risk or regular screening to proactively identify and support individuals sooner. Over the past decade, several national organizations including the American Medical Association, Association of American Medical Colleges, Accreditation Council for Graduate Medical Education, and the Association for Academic Surgery have promoted physician health and well-being as a national priority.<sup>46</sup> However, despite their calls to action, little federal funding is currently allocated toward research related to clinician well-being.<sup>47</sup> Federal

investment in research dedicated to physician well-being and health is a crucial next step toward addressing the high rates of mental health disorders and suicidal ideation plaguing the surgical profession.

This study is subject to limitations, chief among them the response rate, although low response rates are common in survey studies of surgeons.<sup>16, 48</sup> Anonymity (and therefore unknowable exact response rate) was required by our Institutional Review Board given the subject matter.

The importance of ensuring anonymity precludes us from calculating an exact response rate and the results may be subject to coverage bias and non-response bias. Moreover, we were unable to track whether emails went to an institutional or individual's spam folder; likely this is an underestimate of the true response rate. An *a priori* decision was made to sample individuals from various surgical societies and the ASC to capture a diverse sample of practicing surgeons, surgical trainees, and medical students with an interest in pursuing surgery. The sample is representative of racial and ethnic demographics of the general US surgical population and captures individuals from all surgical subspecialty types. Furthermore, these lists were used to help identify and target academic surgeons; more widely available and standard physician sample sources may have more accurate contact information but lack current detail on type of practice or presence/absence of academic practice. While a non-random response bias could result in participants with mental illness being more likely to respond, thereby inflating reported prevalence, participants with mental illness might alternatively be less likely to respond for fear of being found out, reprisal, or as a manifestation of their disease (i.e., apathy, isolation).

Furthermore, the results should also be understood in the context of the inherent limitations of utilizing validated instruments to screen for mental health disorders. Although validated instruments can indicate a probable diagnosis with reasonable sensitivity and specificity, only a



licensed medical professional can make these definitive diagnoses. Most respondents are surgeons at academic institutions; thus, the results may not extrapolate to community surgeons. However, many stressors such as moral injury from complications and increasing work responsibilities may be similar across both academic and community surgical settings. Despite these limitations, this is the first national study across all surgical specialties to assess the mental health of students, trainees, and surgeons in the post-COVID-19 era.

In conclusion, mental health disorders and suicidal ideation remain significant problems afflicting the surgical workforce. Nearly 1 in 7 respondents reported suicidal ideation in the past year, substantially higher than previous reports. Moreover, surgeons are a subset of the larger U.S. health care work force highlighted in the National Academy of Medicine's National Plan for Health Workforce Well-Being initiative and the U.S. Surgeon General's Framework for Mental Health and Well-Being in the Workplace.<sup>49, 50</sup> It is crucial to engage leaders, researchers, and policymakers in the discussion about surgeon mental health to collaboratively address this growing crisis. Future studies should provide assurance of anonymity, capture the broadest audience of surgeons, and identify evidence-based interventions that can promote large-scale change. This effort will require funding, destigmatization, and collaboration of department leaders and national organizations.

**Data Availability:** The datasets generated during and/or analyzed during the current study are not publicly available, but are available from the corresponding author on reasonable request.

## References:

1. Li Y, Scherer N, Felix L, et al. Prevalence of depression, anxiety and post-traumatic stress disorder in health care workers during the COVID-19 pandemic: A systematic review and meta-analysis. *PLoS One* 2021; 16(3):e0246454.
2. Amsalem D, Lazarov A, Markowitz JC, et al. Psychiatric symptoms and moral injury among US healthcare workers in the COVID-19 era. *BMC Psychiatry* 2021; 21(1):546.
3. Liu JH, Etzioni DA, O'Connell JB, et al. The Increasing Workload of General Surgery. *Archives of Surgery* 2004; 139(4):423-428.
4. Brower KJ. Professional Stigma of Mental Health Issues: Physicians Are Both the Cause and Solution. *Academic Medicine* 2021; 96(5):635-640.
5. Morganstein J, West J, Ursano R. Work Associated Trauma. 2017.
6. Gold KJ, Andrew LB, Goldman EB, et al. "I would never want to have a mental health diagnosis on my record": A survey of female physicians on mental health diagnosis, treatment, and reporting. *Gen Hosp Psychiatry* 2016; 43:51-57.
7. Dyrbye LN, Eacker A, Durning SJ, et al. The Impact of Stigma and Personal Experiences on the Help-Seeking Behaviors of Medical Students With Burnout. *Acad Med* 2015; 90(7):961-9.
8. Kalmoe MC, Chapman MB, Gold JA, et al. Physician Suicide: A Call to Action. *Mo Med* 2019; 116(3):211-216.
9. Harvey SB, Epstein RM, Glozier N, et al. Mental illness and suicide among physicians. *Lancet* 2021; 398(10303):920-930.
10. Dutheil F, Aubert C, Pereira B, et al. Suicide among physicians and health-care workers: A systematic review and meta-analysis. *PloS one* 2019; 14(12):e0226361.
11. Shanafelt TD, Balch CM, Dyrbye L, et al. Special report: suicidal ideation among American surgeons. *Archives of surgery* 2011; 146(1):54-62.
12. Kane L. 'I Cry but No One Cares': Physician Burnout & Depression Report 2023 2023. Available at: <https://www.medscape.com/slideshow/2023-lifestyle-burnout-6016058?faf=1#21>. Accessed March 17, 2023.
13. McKenna J. Doctors' Burden: Medscape Physician Suicide Report 2023 2023. Available at: <https://www.medscape.com/slideshow/2023-physician-suicide-report-6016243#6>. Accessed MARCH 17, 2023.
14. Czeisler MÉ, Lane RI, Wiley JF, et al. Follow-up Survey of US Adult Reports of Mental Health, Substance Use, and Suicidal Ideation During the COVID-19 Pandemic, September 2020. *JAMA Network Open* 2021; 4(2):e2037665-e2037665.
15. O'Sullivan R, Burns A, Leavey G, et al. Impact of the COVID-19 Pandemic on Loneliness and Social Isolation: A Multi-Country Study. *Int J Environ Res Public Health* 2021; 18(19).
16. Johnson AP, Wohlaer MV, Mouawad NJ, et al. The Impact of the COVID-19 Pandemic on Vascular Surgery Trainees in the United States. *Ann Vasc Surg* 2021; 72:182-190.
17. Shalhub S, Mouawad NJ, Malgor RD, et al. Global vascular surgeons' experience, stressors, and coping during the coronavirus disease 2019 pandemic. *J Vasc Surg* 2021; 73(3):762-771.e4.
18. Tan YQ, Wang Z, Yap QV, et al. Psychological Health of Surgeons in a Time of COVID-19: A Global Survey. *Annals of Surgery* 2023; 277(1):50-56.

19. Schwenk TL, Davis L, Wimsatt LA. Depression, Stigma, and Suicidal Ideation in Medical Students. *JAMA* 2010; 304(11):1181-1190.
20. Research AAFPO. Response Rates - An Overview. Available at: <https://www-archive.aapor.org/education-resources/for-researchers/poll-survey-faq/response-rates-an-overview.aspx>. Accessed March 22, 2023.
21. Menon NK, Shanafelt TD, Sinsky CA, et al. Association of physician burnout with suicidal ideation and medical errors. *JAMA network open* 2020; 3(12):e2028780-e2028780.
22. Shanafelt TD, Balch CM, Bechamps G, et al. Burnout and medical errors among American surgeons. *Ann Surg* 2010; 251(6):995-1000.
23. Kroenke K, Spitzer RL, Williams JB. The PHQ-9: validity of a brief depression severity measure. *J Gen Intern Med* 2001; 16(9):606-13.
24. Spitzer RL, Kroenke K, Williams JBW, et al. A Brief Measure for Assessing Generalized Anxiety Disorder: The GAD-7. *Archives of Internal Medicine* 2006; 166(10):1092-1097.
25. Freedy JR, Steenkamp MM, Magruder KM, et al. Post-traumatic stress disorder screening test performance in civilian primary care. *Fam Pract* 2010; 27(6):615-24.
26. Saunders JB, Aasland OG, Babor TF, et al. Development of the Alcohol Use Disorders Identification Test (AUDIT): WHO Collaborative Project on Early Detection of Persons with Harmful Alcohol Consumption--II. *Addiction* 1993; 88(6):791-804.
27. Conigrave KM, Hall WD, Saunders JB. The AUDIT questionnaire: choosing a cut-off score. Alcohol Use Disorder Identification Test. *Addiction* 1995; 90(10):1349-56.
28. General Surgeon Demographics and Statistics in the US. Available at: <https://www.zippia.com/general-surgeon-jobs/demographics/>. Accessed March 2, 2023.
29. Oreskovich MR, Kaups KL, Balch CM, et al. Prevalence of alcohol use disorders among American surgeons. *Arch Surg* 2012; 147(2):168-74.
30. Shanafelt TD, Dyrbye LN, West CP, et al. Suicidal ideation and attitudes regarding help seeking in US physicians relative to the US working population. *Mayo Clinic Proceedings*, Vol. 96: Elsevier, 2021. pp. 2067-2080.
31. James MK, Robitsek RJ, McKenzie K, et al. COVID-19 induced PTSD: Stressors for trauma and acute care surgeons. *American Journal of Surgery* 2022; 224(3):843-848.
32. Joseph B, Pandit V, Hadeed G, et al. Unveiling posttraumatic stress disorder in trauma surgeons: a national survey. *Journal of Trauma and Acute Care Surgery* 2014; 77(1):148-154.
33. Hughes TM, Waljee JF, Fang Y, et al. New-Onset Depression Among Surgical Interns. *JAMA Surg* 2022; 157(6):543-545.
34. Pietrabissa G, Simpson SG. Psychological Consequences of Social Isolation During COVID-19 Outbreak. *Frontiers in Psychology* 2020; 11.
35. Marmon LM, Heiss K. Improving surgeon wellness: The second victim syndrome and quality of care. *Seminars in Pediatric Surgery* 2015; 24(6):315-318.
36. Lawson NR. Posttraumatic stress disorder in combat veterans. *JAAPA* 2014; 27(5).
37. Ghaffarzagdegan N, Ebrahimvandi A, Jalali MS. A Dynamic Model of Post-Traumatic Stress Disorder for Military Personnel and Veterans. *PLOS ONE* 2016; 11(10):e0161405.
38. Pereira-Lima K, Mata DA, Loureiro SR, et al. Association between physician depressive symptoms and medical errors: a systematic review and meta-analysis. *JAMA network open* 2019; 2(11):e1916097-e1916097.

39. West CP, Dyrbye LN, Shanafelt TD. Physician burnout: contributors, consequences and solutions. *Journal of internal medicine* 2018; 283(6):516-529.
40. H.R.1667 - Dr. Lorna Breen Health Care Provider Protection Act. Available at: <https://www.congress.gov/bill/117th-congress/house-bill/1667>.
41. Remove Intrusive Mental Health Questions from Licensure and Credentialing Applications. Available at: <https://drlornabreen.org/removebarriers/>. Accessed March 17, 2023.
42. Geevarghese SK, Pomfret EA. Peer support networks: A local approach to the global issue of moral injury in surgical training and practice. *Canadian Urological Association Journal* 2021; 15(6 Suppl 1):S33.
43. Rock LK, Rudolph JW, Fey MK, et al. "Circle Up": Workflow adaptation and psychological support via briefing, debriefing, and peer support. *Nejm Catalyst Innovations in Care Delivery* 2020; 1(5).
44. Lillemoe HA, Geevarghese SK. Stopping the progression of moral injury: a priority during surgical training. *Annals of surgery* 2021; 274(6):e643-e645.
45. Malik M, Peirce J, Wert MV, et al. Psychological First Aid Well-Being Support Rounds for Frontline Healthcare Workers During COVID-19. *Front Psychiatry* 2021; 12:669009.
46. Preventing Physician Suicide. Available at: <https://www.ama-assn.org/practice-management/physician-health/preventing-physician-suicide>. Accessed March 2, 2023.
47. Melnick ER, Sinsky CA, Shanafelt T. Funding Research on Health Workforce Well-being to Optimize the Work Environment. *JAMA* 2023.
48. Jackson T, Morgan J, Jackson D, et al. Trends in surgeon wellness (take a sad song and make it better): a comparison of surgical residents, fellows, and attendings. *The American Surgeon* 2019; 85(6):579-586.
49. The U.S. Surgeon General's Framework for Workplace Mental Health & Well-Being. U.S. Department of Health and Human Services, 2022.
50. Medicine NAO. National Plan for Health Workforce Well-Being 2022.

Figure 1. Distribution of depression (a), anxiety (b), and alcohol use disorder (c) severity based on responses to the PHQ-9, GAD-7, and AUDIT scales.

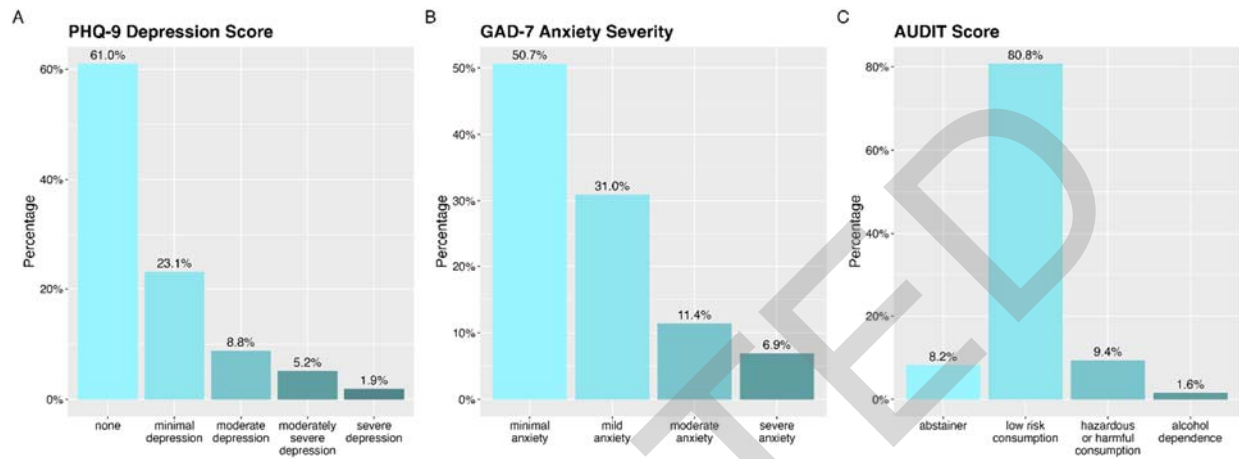
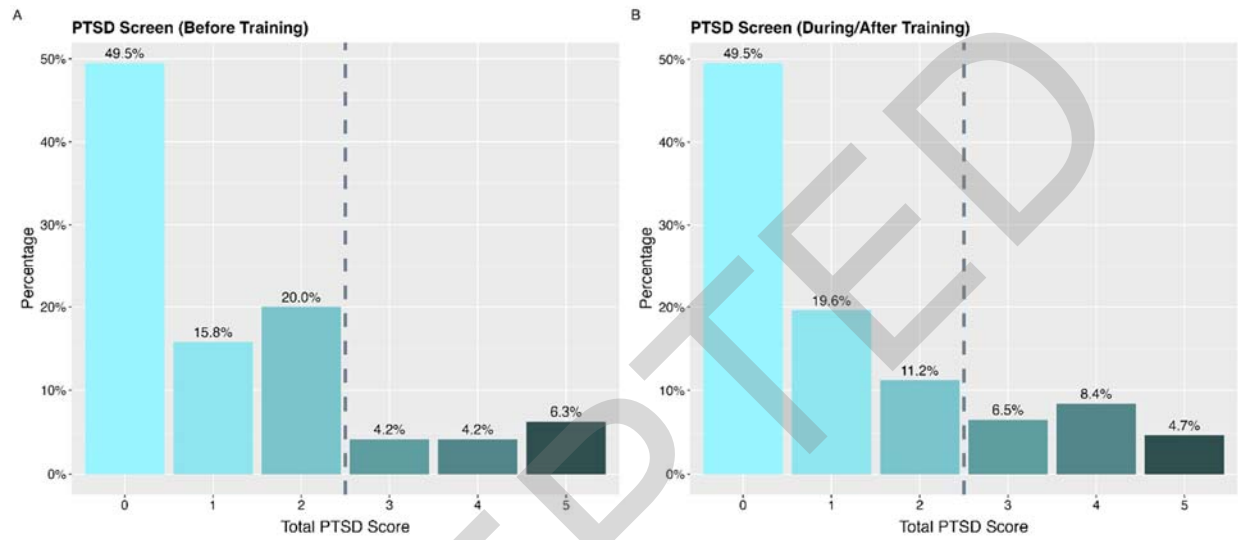


Figure 2. Post-traumatic stress disorder screening scores for traumatic events that occurred before (a) or during/after training (b). Scores to the right of the dotted lines are considered positive for PTSD.



**Table 1. Participant Demographics**

<b>Characteristic</b>	<b>N = 622<sup>1</sup></b>
<b>Age (N=519)<sup>2</sup></b>	
<25	12 (2.3%)
25-34	140 (27.0%)
35-44	175 (33.7%)
45-54	91 (17.5%)
55-64	63 (12.1%)
>64	34 (6.6%)
Prefer not to disclose	4 (0.8%)
<b>Sex (N=519)<sup>2</sup></b>	
Female	263 (50.7%)
Male	253 (48.7%)
Prefer not to disclose	3 (0.6%)
<b>Ethnicity (N=510)<sup>2</sup></b>	
Hispanic or Latino	34 (6.6%)
Non-Hispanic or Latino	468 (90.2%)
Prefer not to disclose	8 (1.5%)
<b>Race (N=519)<sup>2</sup></b>	
Asian	100 (19.3%)
Black or African American	27 (5.1%)
White	354 (68.2%)
Other <sup>3</sup>	26 (5.0%)
Prefer not to disclose	15 (2.9%)
<b>Training Level (N=519)<sup>2</sup></b>	
Medical Student	42 (8.1%)
Resident/Fellow	117 (22.5%)
Assistant Professor	122 (23.5%)
Associate Professor	95 (18.3%)
Full Professor	75 (14.5%)
Division chief, Chair of Surgery, Dean	55 (10.6%)
None of the above	5 (1.0%)
Prefer not to disclose	8 (1.5%)
<b>Marital Status (N=519)<sup>2</sup></b>	
Unmarried	159 (30.6%)
Married/engaged/living with partner	352 (67.8%)
Prefer not to disclose	8 (1.5%)
<b>Parent or legal guardian? (N=519)<sup>2</sup></b>	
Yes	276 (53.2%)
No	234 (45.1%)
Prefer not to disclose	9 (1.7%)

<sup>1</sup>N respondents initiated the entire survey; <sup>2</sup>Respondents with unknown data due to partial responses or missing data were excluded; <sup>3</sup>Other includes American Indian/Alaskan Native, Native Hawaiian or Other Pacific Islander, and More Than One Race

**Table 2.** Mental health disorders associated with a perceived medical error in the past 3 months

<b>Mental health disorder</b>	<b>No Medical Error, N = 478<sup>1</sup></b>	<b>Medical Error, N = 81<sup>1</sup></b>	<b>p-value</b>
<b>GAD7 (N=531)<sup>2,3</sup></b> anxiety screen negative anxiety screen positive	379 (83.8%) 73 (16.2%)	54 (68.4%) 25 (31.6%)	<b>0.001</b>
<b>PHQ9 (N=520)<sup>2,3</sup></b> depression screen negative moderate to severe depression	386 (86.7%) 59 (13.3%)	52 (69.3%) 23 (30.7%)	<b>&lt;0.001</b>
<b>PC-PTSD-5 (525)<sup>2,4</sup></b> PTSD screen negative PTSD screen positive	422 (94.4%) 25 (5.6%)	68 (87.2%) 10 (12.8%)	<b>0.018</b>
<b>AUDIT (507)<sup>2,5</sup></b> no or low risk consumption hazardous consumption	391 (90.3%) 42 (9.7%)	61 (81.3%) 14 (18.7%)	<b>0.022</b>

<sup>1</sup>N respondents who answered the question “Are you concerned that you made a major medical error in the past three months?”; <sup>2</sup>Respondents with unknown data were excluded; <sup>3</sup>Cut-point of 10 or greater to screen positive; <sup>4</sup>Cut-point of 3 or greater to screen positive; <sup>5</sup>Cut-point of 8 or greater to screen positive



Characteristic	Suicidal Ideation <sup>1</sup>		Univariate OR (95%CI)	Multivariable AOR (95%CI) <sup>4,5</sup>
	Yes, N=73 <sup>2</sup>	No, N=478 <sup>2</sup>		
<b>Sex (N=508)<sup>3</sup></b>				
Male	23 (9.2)	226 (90.8)	-	-
Female	43 (16.6)	216 (83.4)	1.96 (1.15-3.40, <b>p=0.015</b> )	1.69 (0.91-3.20, p=0.099)
<b>Training Level (N=497)<sup>3</sup></b>				
Medical Student	2 (5.1)	37 (94.9)	0.31 (0.05-1.17, p=0.134)	-
Resident/Fellow	17 (15.4)	99 (84.6)	-	-
Assistant Professor	18 (14.9)	103 (85.1)	1.02 (0.49-2.10, p=0.962)	-
Associate Professor	19 (20.2)	75 (79.8)	1.48 (0.72-3.06, p=0.289)	-
Full Professor	8 (6.3)	120 (93.7)	0.39 (0.15-0.91, <b>p=0.035</b> )	-
<b>Marital Status (N=503)<sup>3</sup></b>				
Married	40 (11.5)	307 (88.5)	-	-
Not married	23 (14.7)	133 (85.3)	1.33 (0.75-2.29, p=0.315)	-
<b>Parent/Guardian (N=502)<sup>3</sup></b>				
Yes	33 (12.1)	239 (87.9)	-	-
No	31 (13.5)	199 (86.5)	1.13 (0.67-1.91, p=0.652)	-
<b>Household (N=500)<sup>3</sup></b>				
Living with someone	51 (12.2)	364 (87.8)	-	-
Living alone	12 (14.1)	73 (85.9)	1.17 (0.57-2.24, p=0.644)	-
<b>Mental Health Disorder (N=529)<sup>3</sup></b>				
No	35 (9.0)	355 (90.0)	-	-
Yes	35 (25.2)	104 (74.9)	3.41 (2.03-5.74, <b>p&lt;0.001</b> )	1.97 (1.04-3.65, <b>p=0.033</b> )
<b>GAD7 (N=522)<sup>3</sup></b>				
anxiety screen negative	42 (9.8)	388 (91.2)	-	-
anxiety screen positive	27 (29.3)	65 (70.7)	3.84 (2.20-6.63, <b>p&lt;0.001</b> )	-

<b>PHQ9 (N=514)<sup>3</sup></b> depression screen negative moderate to severe depression	36 (8.3) 32 (40.5)	399 (91.7) 47 (59.5)	- 7.55 (4.29-13.30, <b>p&lt;0.001</b> )	- 4.30 (2.21-8.29, <b>p&lt;0.001</b> )
<b>PC-PTSD-5 (N=518)<sup>3</sup></b> PTSD screen negative PTSD screen positive	53 (11.0) 15 (42.9)	430 (89.0) 20 (57.1)	- 6.08 (2.90-12.57, <b>p&lt;0.001</b> )	- 3.93 (1.61-9.44, <b>p=0.002</b> )
<b>AUDIT (N=500)<sup>3</sup></b> no or low risk consumption hazardous consumption	51 (11.4) 16 (29.1)	395 (88.6) 39 (70.9)	- 3.18 (1.62-6.01, <b>p&lt;0.001</b> )	- 1.53 (0.67-3.30, p=0.295)
<b>Medical error (N=541)<sup>3</sup></b> No Yes	59 (12.7) 13 (16.9)	406 (87.3) 64 (83.1)	- 1.42 (0.71-2.67, p=0.293)	- -

**Table 3.** Demographics and mental health scores of surgeons with suicidal ideation in the last 12 months

<sup>1</sup>N (%); <sup>2</sup>N respondents who answered the question “During the past 12 months have you had thoughts of taking your own life or wish that you were dead?”; <sup>3</sup>Respondents who reported “prefer not to disclose” or with unknown data were excluded; <sup>4</sup>Adjusted for sex, mental health disorder diagnosis, PHQ9, PC-PTSD-5, and AUDIT; <sup>5</sup>Excludes patients with unknown data for any of the covariates