



Depression, Suicidal Thoughts, and Burnout Among Physicians During the COVID-19 Pandemic: a Survey-Based Cross-Sectional Study

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Abstract

Objectives Frontline workers have been a bulwark in the fight against COVID-19, while being subject to major unexpected stressors. These include conflicting news, evolving guidelines, perceived inadequate personal protective equipment, overflow of patients with rising death counts, absence of disaster training, and limitations in the implementation of social distancing. This study investigates the incidence and associated factors of depression, suicidal thoughts, and burnout among physicians during the COVID-19 pandemic.

Methods In a cross-sectional survey-based study of resident, fellow, and attending physicians from a tertiary university hospital during the height of the COVID-19 pandemic in New York from April 24 to May 15, 2020, demographics and practice specialty, attending vs. resident/fellow status, call frequency, emotional exhaustion, depersonalization, and depression severity were examined.

Results Two hundred twenty-five subjects completed the survey (response rate of 16.3%), with rates of 6.2% depression, 6.6% suicidal ideation, and 19.6% burnout. Depression, suicidal ideation, and burnout were all associated with history of prior depression/anxiety and frequency of on call. Suicidal ideation and burnout were also associated with younger age. There was no difference in rates of depression, suicidal ideation, or burnout between attending and resident physicians. Female physicians reported less work-life balance and more burnout.

Conclusions These findings highlight the importance of considering physician mental health during times of peak stress, such as natural or man-made disasters. The prominence of premorbid depression/anxiety as a relevant factor underscores the need to further understand physician mental health and provide early screening and treatment.

Keywords Coronavirus disease 2019 · COVID-19 · Physician mental health · Depression · Burnout · Suicidal ideation

In December 2019, the novel SARS-CoV-2 coronavirus was identified to be the cause of pneumonia in patients in Wuhan, China. A CoV-2 pandemic was identified by the World Health Organization on March 11, 2020, at which time there were more than 118,000 cases in 114 countries and 4291 deaths [1]. As of October 10, 2020, there were more than 37 million cases and 1,070,000 deaths worldwide [2]. These data underscore that coronavirus 2019 (COVID-19) will remain a major public health issue for the foreseeable future and likely have lasting effects on healthcare systems worldwide. Healthcare

personnel have been working tirelessly to combat this pandemic. They were subject to long work-hours; overflow of patients; strict personal protective equipment (PPE) protocols; the looming threat of low supplies, including PPE; and the emotional distress from possibly contracting the disease or transmitting it to loved ones. Our institution, located in Suffolk County, New York, experienced a peak of COVID-19-positive patients and persons under investigation in April 2020; see Fig. 1. At that time, approximately 80% of the total ventilator supply was in use. Strict PPE protocols and systems for recycling equipment were put into place. Physicians across almost all specialties were redeployed to staff COVID-19 specific units.

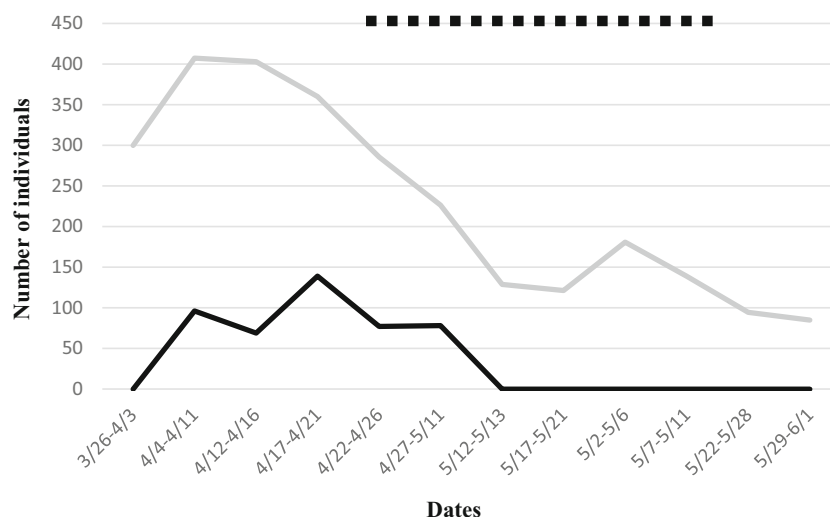
We believe it is reasonable to surmise that stressors for practicing physicians would be amplified during the COVID-19 pandemic and have a considerable impact on physicians' mental health. This study was originally designed,

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Fig. 1 Temporal representation of number of patients COVID-19 positive and persons under investigation (gray line) and residents redeployed (black line) at Stony Brook University Hospital during March–May 2020. The dotted line indicates the period during which the survey was completed



prior to the onset of the COVID-19 pandemic, to examine the rates of depression, suicidal ideation, and burnout among practicing physicians in a tertiary care academic center. We decided to proceed with the study during the pandemic, given the relative lack of literature regarding the effects of COVID-19 on physician mental health. The data was collected during the height of the pandemic in New York. Our central hypothesis was that psychopathology in the form of depression, suicidal ideation, and burnout symptoms will be associated with history of depression or anxiety, and on-call burden. The study objectives were to (a) establish a point prevalence of depression, suicidal thoughts, and burnout; (b) identify factors associated with the development of these mental health issues; (c) examine differences between attending and resident physicians; and (d) examine differences between female and male physicians.

Methods

The study sample was composed of residents, fellows, and attending physicians from 26 specialties working at Stony Brook University Hospital, a tertiary-level center which serves a suburban population in Suffolk County, New York. Subjects met inclusion criteria if they were a resident, fellow, or attending physician and agreed to participate.

We utilized Qualtrics software (February 2020 version, Provo, UT, USA), a secure electronic survey platform, to create and distribute a survey via email. The survey consisted of 22 items, divided into four parts: consent, demographic and general data, two single-item questions of emotional exhaustion and depersonalization, and the Patient Health Questionnaire for Depression (PHQ-9) [3]. An email invitation was generated via Qualtrics from the Departments of Orthopaedic Surgery and Psychiatry, with no individual

signature, to participate with a link to the survey sent on April 24, 2020, to listservs including all resident and attending physicians at Stony Brook University Hospital. Weekly reminders were sent until May 22, 2020. Additionally, senior faculty in multiple departments encouraged participation. No compensation or protected time was given to complete the survey. Coercion was avoided by the completely anonymized design of the survey, the results of which showed no identifying information of the responders.

Electronic informed consent was obtained from all subjects by answering the first question of the survey. Demographic and general data collected included specialty, age, gender, professional category (attending physician or resident/fellow), relationship status (single, married, or separated/divorced), number of times on call in the past month, prior diagnosis or treatment for depression or anxiety, and perception of adequate work-life balance. Single-item measures of emotional exhaustion and depersonalization were used. The Maslach Burnout Inventory (MBI) is a widely used and validated instrument for measuring burnout using 22 items [4]. However, its length can limit its use. West et al. found that two distinct single-item measures for emotional exhaustion and depersonalization showed 90% and 92% probability of burnout, respectively [5]. We used the two questions with the highest factor loading for emotional exhaustion and depersonalization: “I feel burned out from my work” (emotional exhaustion) and “I have become more callous toward people since I took this job” (depersonalization). The answers were analyzed as categorical variables. The final section consisted of the PHQ-9 to assess depression and suicidal thoughts [6]. Participants who scored ≥ 10 were considered provisionally diagnosed with major depression [7]. Responders were considered to have suicidal ideation if they scored ≥ 1 for question 9.

Data from resident redeployments from April 4 through May 1, 2020, to cover COVID-19 patient wards were

analyzed. Attendings from several specialties were also redeployed; however, reliable data could not be collected. All the procedures contributing to this work complied with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008. All procedures were approved by the Stony Brook University Institutional Review Board. Electronic informed consent was obtained from all patients.

Logistic regression analysis was performed for the question “Do you feel you have adequate work-life balance?” as a dependent variable while cumulative logistic regression analysis was used for the questions “I have become more callous toward people since I took this job” and “I feel burned out from my work” as dependent variables. Gender, professional category, relationship status, age, being on call in the last month, number of calls in the last month, and previous diagnosis or treatment for depression or anxiety were independent variables for both analyses. The complete survey is available on request from the corresponding author.

Depression was evaluated as a continuous variable (PHQ-9 score) and as a categorical variable (major depression defined by PHQ-9 score ≥ 10) [6]. A general linear model was used to examine the relationship between PHQ-9 score and covariates including gender, professional category, relationship status, age, being on call in the last month, number of calls in the last month, and previous diagnosis or treatment for depression or anxiety. Logistic regression analysis was used for presence of major depression with the same covariates.

Differences between female and male physicians and between attending and resident/fellow physicians were determined with chi-square test for categorical variables and t-student test for quantitative variables.

Results

Surveys were sent via email to the eligible 478 resident/fellow and 901 attending physicians for a total of 1379 possible participants. Of these, 225 individuals completed the survey, yielding a response rate of 16.3%. Table 1 shows the demographic and general characteristics of our sample. The majority of participants were female (57%) and married (61%). Sixty-five participants (29%) had previously been diagnosed or treated for depression or anxiety. Table 2 shows the response and redeployment rates for residents by specialty. Of the 334 surveys started, 225 completed between April 24 and May 15, 2020. The median time for completion was 149 s. Only completed surveys were included in the analysis. A total of 565 resident redeployment assignments occurred during the study.

Table 3 shows the rates of depression (6.2%), suicidal ideation (6.6%), and burnout (19.6%). There was no difference between attendings and residents/fellows regarding rates of depression severity ($t = 145$; $p = 0.146$), suicidal ideation (t

$= 0.641$; $p = 0.522$), or feelings of burnout, $X^2 (1, n = 225) = 3.2$, $p = 0.736$.

Table 4 shows the factors associated with depression, suicidal ideation, and burnout. Tentative clinical diagnosis of depression was positively associated with a history of being diagnosed or treated for depression or anxiety (OR, 15.01; 95% CI [3.59, 62.77]; $p < 0.001$) and with number of times on call in the last month (OR, 4.21; 95% CI [1.49, 11.89]; $p = 0.01$). A general linear model showed that PHQ-9 scores were predicted by age, number of calls, and whether the subject had been diagnosed or treated for depression or anxiety. Older age was found to be a protective factor. Previous diagnosis or treatment for depression or anxiety and number of times on call were positively associated with PHQ-9 scores.

Presence of suicidal ideation was positively associated with history of being diagnosed or treated for depression or anxiety (OR, 8.44; 95% CI [2.47, 28.87]; $p = 0.01$), higher number of times on call in the last month (OR, 1.17; 95% CI [1.04, 1.32]; $p = 0.02$), and lower age (OR, 0.07; 95% CI [0.04, 0.14]; $p = 0.05$).

Work-life balance was negatively associated with female gender (OR = 0.44; 95% CI [0.20, 0.95]; $p = 0.04$) and higher number of times on call in the past month (OR = 0.47; 95% CI [0.25, 0.90]; $p = 0.02$).

Feelings of burnout were associated with history of depression or anxiety (OR, 2.38; 95% CI [1.40, 4.07]; $p = 0.0014$), negatively with age (OR, 0.63; 95% CI [0.45, 0.86]; $p = 0.004$), and positively with higher number of times on call in the last month (OR, 1.86; 95% CI [1.17, 2.05]; $p = 0.008$).

Regarding gender differences, female physicians reported less work-life satisfaction $X^2 (1, n = 225) = 10.44$, $p = 0.001$) and more burnout ($X^2 (1, n = 225) = 4.19$, $p = 0.041$). There were no other significant gender differences.

Discussion

Prior to launching our initially planned study focused on depression, suicidal ideation, and burnout, the COVID-19 pandemic reached our health system. Any investigation thereafter would have been confounded by the additional stress and pressure placed on the hospital system. Thus, we adjusted our goals to investigate physician mental health during the COVID-19 pandemic. Our main findings were as follows: (a) rates of 6.2% depression, 6.6% suicidal ideation, and 19.6% burnout in practicing physicians; (b) depression was associated with history of depression/anxiety, and higher frequency of call; (c) suicidal ideation was associated with history of depression/anxiety, higher frequency of call, and younger age; (d) burnout was associated with history of depression/anxiety, younger age, and higher frequency of call; (e) there was no difference in rates of depression, suicidal ideation, or burnout between attending and resident physicians; and (f)

Table 1 General characteristics of physicians in an academic center during COVID-19 pandemic, those with depression, and those reporting suicidal ideation

	Total study sample	No tentative diagnosis of major depression	Tentative diagnosis of major depression	Suicidal ideation
N (%)				
All	225 (100%)	211 (93.8%)	14 (6.2%)	15 (6.7%)
Attendings	112 (49.8%)	105 (93.8%)	7 (6.3%)	8 (7.1%)
Residents/fellows	113 (50.2%)	106 (93.8%)	7 (6.2%)	7 (6.2%)
Age				
All	38.57 ± 11.48	38.63 ± 11.59	37.64 ± 9.95	40.60 ± 14.26
Attendings	47.06 ± 1.01	47.22 ± 10.76	44.71 ± 9.27	50.75 ± 12.17
Residents/fellows	30.15 ± 2.76	30.12 ± 2.72	30.57 ± 3.46	29.00 ± 2.71
Gender				
Female (all)	129 (57.3%)	120 (93.0%)	9 (7.0%)	8 (6.2%)
Female (attendings)	71 (63.4%)	68 (95.8%)	3 (4.2%)	4 (5.6%)
Female (residents/fellows)	58 (51.3%)	52 (89.7 %)	6 (10.3%)	4 (6.9%)
Marital status				
Single	81 (36%)	77 (95.1%)	4 (4.9%)	6 (7.4%)
Married	138 (61.3%)	129 (93.5%)	9 (6.5%)	8 (5.8%)
Separated/divorced	6 (2.7%)	5 (83.3%)	1 (16.7%)	1 (16.7%)
Specialty				
Anesthesiology	21 (9.3%)	18 (85.7%)	3 (14.3%)	2 (9.5%)
Emergency medicine	17 (7.6%)	16 (94.1%)	1 (5.9%)	1 (5.9%)
Surgical specialties (excluding Orthopedic surgery)	31 (13.8%)	30 (96.8%)	1 (3.2%)	1 (3.2%)
Internal medicine and other non-surgical specialties	59 (26.2%)	54 (91.5%)	5 (8.5%)	6 (10.2%)
Obstetrics and gynecology	12 (5.3%)	11 (91.7%)	1 (8.3%)	1 (8.3%)
Orthopedic surgery	26 (11.6%)	26 (100%)	0 (0%)	1 (3.8%)
Pediatrics	31 (13.8%)	29 (93.5%)	2 (6.5%)	2 (6.5%)
Psychiatry	28 (12.4%)	27 (96.4%)	1 (3.6%)	1 (3.6%)
Times on call in the last month				
All	5.31 ± 6.03	5.02 ± 5.65	9.57 ± 9.48	7.40 ± 9.33
Attendings	5.28 ± 6.02	4.97 ± 5.60	9.86 ± 10.19	9.4 ± 11.80
Residents/fellows	5.34 ± 6.06	5.08 ± 5.74	9.29 ± 9.52	5.14 ± 5.43
Previous diagnosis/treatment of depression or anxiety				
All	65 (28.9%)	54 (83.1%)	11 (16.9%)	11 (16.9%)
Attendings	29 (25.9%)	24 (82.8%)	5 (17.2%)	4 (13.8%)
Residents/fellows	36 (31.9%)	30 (83.3%)	6 (16.7%)	7 (19.4%)
Adequate work-life balance				
All	165 (73.3%)	159 (96.4%)	6 (3.6%)	6 (3.6%)
Attendings	82 (73.2%)	78 (95.1%)	4 (4.9%)	3 (3.7%)
Residents/fellows	83 (73.5%)	81 (97.6%)	2 (2.4%)	3 (3.6%)

Tentative diagnosis of major depression defined as PHQ-9 = > 10; suicidal ideation defined as answering > 0 in question 9 of the PHQ-9. Column one, "Total study sample," is read vertically so that rates (%) for All, Attendings, and Residents/fellows for each area occur as a percentage of the total study sample for that sub-population. Columns two, three, and four are read horizontally such that the rates (%) occur as a percentage of the respective denominator for that sub-population in column one

female physicians reported less work-life satisfaction and more burnout than male counterparts. These findings confirmed our central hypothesis that physician's

depression, suicidal ideation, and burnout were associated with history of depression/anxiety and higher on-call burden.

Table 2 Response rates to the study survey and resident/fellow redeployment in an academic center during the COVID-19 pandemic

Specialty group	Survey response rate	Redeployment rate per specialty group
Internal medicine and other non-surgical specialties	11.1% (57/514)	65% (129/146)
Anesthesiology	18.5% (21/113)	80% (32/40)
General surgery and other surgical specialties (excluding Orthopaedic surgery)	15.6% (33/211)	77% (57/74)
Orthopaedic surgery	52% (26/50)	67% (18/27)
Psychiatry	18.5% (28/151)	43% (17/40)
Pediatrics	20% (31/155)	36% (14/39)
Emergency medicine	18.1% (17/94)	0%
Obstetrics and gynecology	13.2% (12/91)	100% (20/20)
Total	16.31% (225/1379)	74.4% (287/386)

The rate of depression in our study (6%) was lower than most previous reports. The 2012 national study of burnout and depression reported that 38% of participants screened positive for depression symptoms [8]. In contrast, a study in Japan with 795 practicing physicians showed a depression rate of 2% [9]. Schwenk et al. found the prevalence of depressive symptoms to be 11.3% in 1154 physicians in Michigan [10]. However, a recent systematic review and meta-analysis of 31 cross-sectional studies and 9447 participants found a pooled prevalence of depression among resident physicians of 29% [11].

Two of the first studies performed in healthcare workers in Asia during the COVID-19 pandemic showed slightly higher rates of depression (9–12%) [6, 12]. Since then, Pappa et al. published in August 2020 a meta-analysis of 13 available studies, mostly from China, with a combined sample size of 33,063 subjects [13]. The combined prevalence for anxiety was 23%, for depression 28%, and for insomnia 39%. Similar results were reported in the Middle East and South America [14, 15]. These higher rates may be influenced by these studies being carried out during the very first few weeks of the pandemic when its impact was not fully understood. A study performed in New York City showed that 48% screened positive for depressive symptoms, 33% for anxiety, 75% at least moderate insomnia, and 57% for acute stress, with significant differences between physicians and nurses [16].

The rate of suicidal ideation in the prior 2 weeks (6%) was comparable to previous reports that 6–14% of physicians were experiencing suicidal ideation in the past 12 months [8, 17–20]. However, lifetime prevalence is much higher, between 43 and 51% [20, 21]. It was noteworthy that we found more and different individuals endorsing suicidal ideation ($n = 15$) than those with a diagnosis of depression ($n = 14$). Most suicides occur in the context of mental illness, while depression accounts for the majority of suicides [22]. Nonetheless, suicidal ideation can occur independently of depression [23]. Indeed, most psychiatric conditions are linked to suicidal thoughts and behavior, including anxiety disorders, substance

use, acute stress disorder, and post-traumatic stress disorder, all of which are found in healthcare workers during disasters.

Regarding burnout symptoms, we found that 20% of individuals acknowledged emotional exhaustion and 16% endorsed depersonalization. These are lower rates of burnout compared to previous reports. Shanafelt et al. used single-item measures for emotional exhaustion and depersonalization similar to those in our study, and found higher emotional exhaustion (38%) and depersonalization (29%) in a large national sample of physicians [8]. Other studies have found higher rates, 26–32%, of burnout among practicing physicians in the USA [24, 25]. Alarming, one multicenter cross-sectional study examining medical residents in the United Arab Emirates found that 70% were experiencing at least one symptom of burnout [26]. It is possible that the lower rates of depression, suicidal ideation, and burnout in our study are related to unique circumstances associated with the COVID-19 pandemic, such as a strong sense of purpose, partnership within medical staff, community support, an altruistic drive to help others, and a sense of meaningful work [27]. Additionally, the ongoing practice of a dedicated psychiatrist to assist residents struggling with mental illness, the establishment of a hotline, enhanced employee assistance program, and a dedicated hospital space for breaks and time-out for employees during the pandemic may have contributed to the observed lower rates of psychopathology in our study compared to prior reports. On the other hand, the impact of a self-selection bias, which could yield opposite effects, is hard to quantify. Either individuals who were less impacted by the COVID-19 pandemic and its consequences may have been more prone to answer the survey, or the survey may have been more salient for those with ongoing more severe depression or burnout at the time.

The associations between younger age and higher on-call frequency with burnout may be explained in part by the different roles of resident and attending physicians. Resident/fellow physicians are typically younger and have more

Table 3 Factors associated with depression, suicidal ideation, and burnout in physicians in an academic center during COVID-19 pandemic

	Total study sample	No tentative diagnosis of major depression	Tentative diagnosis of major depression	Suicidal ideation
N (%)				
All	225 (100%)	211 (93.8%)	14 (6.2%)	15 (6.7%)
Attendings	112 (49.8%)	105 (93.8%)	7 (6.3%)	8 (7.1%)
Residents/fellows	113 (50.2 %)	106 (93.8%)	7 (6.2%)	7 (6.2%)
Depression severity (X ± SD) (PHQ-9 score)				
All	4.53 ± 4.67	3.70 ± 3.38	17.07 ± 9.95	11.07 ± 4.62
Attendings	4.10 ± 4.68	3.23 ± 3.30	17.14 ± 2.80	10.88 ± 4.45
Residents/fellows	4.96 ± 4.63	4.17 ± 3.42	17.00 ± 3.92	11.29 ± 5.16
Clinical depression (PHQ-9 score ≥ 10)				
All	14 (6.2%)	0 (0%)	14 (100%)	3 (21.4%)
Attendings	7 (6.3%)	0 (0%)	7 (100%)	2 (28.6%)
Residents/fellows	7 (6.2%)	0 (0%)	7 (100%)	1 (14.3%)
Suicidal ideation (Q9 PHQ-9)				
All	15 (6.7%)	12 (80.0%)	3 (20.0%)	15 (100%)
Attendings	8 (7.1%)	6 (75.0%)	2 (25.0%)	8 (100%)
Residents/fellows	7 (6.2%)	6 (85.7%)	1 (14.3%)	7 (100%)
Feeling burnout from work at least a few times a week				
All	45 (20.0%)	30 (66.7%)	13 (28.9%)	7 (15.6%)
Attendings	25 (22.3%)	19 (76.0%)	6 (24.0%)	5 (20.0%)
Residents/fellows	18 (15.9%)	11 (61.1%)	9 (50.0%)	2 (11.1%)
“Become more callous” toward people since I took this job at least a few times a week				
All	36 (16.0%)	12 (33.3%)	8 (22.2%)	5 (13.9%)
Attendings	13 (11.6%)	10 (76.9%)	3 (23.1%)	3 (23.1%)
Residents/fellows	23 (20.4%)	18 (78.3%)	5 (21.7%)	2 (8.7%)

Tentative diagnosis of major depression defined as PHQ-9 = > 10; suicidal ideation defined as answering > 0 in question 9 of the PHQ-9. Column one, “Total study sample,” is read vertically so that rates (%) for All, Attendings, and Residents/fellows for each area occur as a percentage of the total study sample for that sub-population. Columns two, three, and four are read horizontally such that the rates (%) occur as a percentage of the respective denominator for that sub-population in column one

demanding call schedules. Being on call can impact work satisfaction and performance, family life and sleep, and has been associated with burnout and depression in resident and attending physicians [18, 26, 28]. Residents may be a particularly high-risk group for mental health issues. Mata et al. in a meta-analysis reported that 21 to 43% of resident physicians screened positive for depression or symptoms of depression [11]. Given the high risk for burnout among residents and fellows, education on early identification of burnout symptoms and access to mental health services are pressing needs.

Our findings showed that female physicians were less likely to achieve work-life balance. Female physicians have twofold higher suicide rate compared to the general population [29]. Compared to other professions, female physicians are more likely to have depressive symptoms, suicide attempts, and sleep disorders [30]. Factors associated with poor mental health in female physicians include degrading experiences, harassment, stressful meetings, burden to personal relationships, child-rearing, and work-life balance [17, 31]. It is possible that the

COVID-19 pandemic selectively worsened female physicians’ mental health by placing a greater burden on them for family-related demands for unexpected childcare associated with sudden school closures during the pandemic, contributing to added stress and difficulty maintaining work-life balance.

A major finding of our study is that previous diagnosis or treatment by a healthcare provider for depression or anxiety strongly predicted the presence of major depression, suicidal ideation, and burnout. We found a considerable number (29%) of practicing physicians with history of depression or anxiety, though lower than the 45% rate reported in a 2017 multicenter study in physicians prior to starting their internship [32]. The literature is relatively limited regarding prior psychiatric history as a predictor of these conditions among physicians. One prospective study regarding the prevalence and risk factors for depression among medical interns identified a significant association between a history of depression and the development of depressive symptoms during internship [33]. A 15-year longitudinal study of graduating medical

Table 4 Factors associated with the main outcomes: depression, suicidal ideation, work-life balance, and burnout in physicians in an academic center during COVID-19 pandemic

Variable	Odds ratio	95% confidence interval	p value
Clinical diagnosis of depression			
History of depression/anxiety	15.01	3.59–62.77	0.0002
Number of calls last month	4.21	1.49–11.89	0.01
Suicidal ideation			
History of depression/anxiety	8.44	2.47–28.87	0.0001
Number of calls last month	1.17	1.04–1.32	0.01
Age	0.07	0.04–0.14	0.05
Work-life balance			
Female gender	0.44	0.25–0.95	0.04
Number of calls last month	0.47	0.25–0.90	0.02
Feeling burnout			
History of depression/anxiety	2.38	1.40–4.07	0.0014
Age	0.63	0.45–0.86	0.0039
Number of calls last month	1.86	1.17–2.05	0.0082

No variables significantly predicted a “becoming more callous” answer

students in Norway also revealed that having severe depressive symptoms upon graduation from medical school was an independent risk factor for future depressive symptoms [34]. Another report identified that low subjective well-being significantly predicted depression during medical internship [35]. Regarding burnout, the direction of association between reduced psychological well-being, depression, and burnout is unclear [36–38]. To our knowledge, this is the first report demonstrating the association of previous psychiatric history with burnout.

The clinical implications of our findings include raising awareness of the number of physicians with previous history of depression and anxiety, which is a strong predictor for future episodes, particularly under very challenging conditions. Our data also support the case not only for adequate PPE during disasters such as the COVID-19 pandemic, but also of proactive psychological support for frontline personnel. Thirdly, we confirm previous findings of higher rates of depression and burnout in female and in resident physicians. A corollary is the need for appropriate support for physicians’ mental health. As already occurs with high-risk populations, such as the military and pilots, and partially with first responders, police, and firefighters, physicians may benefit from universal mental health screening [39]. This practice may help reduce the stigma associated with mental illness, facilitate needed care by clinicians, and may have a greater positive impact on physician well-being leading to better patient care [40].

The main limitation of this study is that it was not designed with the COVID-19 pandemic in mind; hence, no measures on trauma, PTSD, or anxiety in general were included. We took advantage of the unexpected opportunity to examine the mental health of practicing physicians at the zenith of the pandemic. Our response

rate was 16.3%, lower than most surveys performed in healthcare workers (range 43–95%) [13], which may be explained not only by the hectic time and overworked personnel, but also by the lack of compensation or protected time to complete it. We currently cannot ascertain whether the responders were a self-selected subset of the physicians who were most or least impacted with depression and/or burnout during the COVID-19 pandemic. Another potential limitation is the utilization of single-item measures for burnout instead of the full MBI, chosen for reasons of brevity and to facilitate full completion of the survey. Additionally, the question “I have become more callous toward people since I took this job” may have caused some confusion in the respondents between the time on their current positions and the period since the COVID-19 pandemic hit our community. We did not collect information regarding training and experience in disaster medicine or about the attitudes of physicians toward working with COVID-19 patients or toward redeployment or other changes in their usual scope of practice.

In conclusion, our findings highlight the importance of considering physician mental health during times of peak stress, such as natural or man-made disasters. The association of premorbid depression/anxiety with present symptoms of depression, suicidal ideation, and burnout underscores the need to support physician mental health, providing early screening and treatment. Physicians that are female, are younger in age, or have more call may also be particularly vulnerable to burnout. Future investigations regarding the immediate and long-term effects of the COVID-19 pandemic on mental health are needed to better prepare the healthcare workforce for future health crises.

Declarations

Disclosure RC has received research funding from Neuronetics, Janssen Pharmaceuticals, *National Center for Advancing Translational Sciences*, National Institute of General Medical Sciences, National Institute on Aging, and the Veteran Health Administration. All other authors declare no conflicts of interest to report or financial interests related to this manuscript.

Ethical Considerations All procedures were approved by the Stony Brook University Institutional Review Board. Written informed consent was obtained from all patients.

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