

The Impact of Physicians' COVID-19 Pandemic Occupational Experiences on Mental Health

Rebecca M. Schwartz, PhD, Molly McCann-Pineo, MS, PhD, Mayer Bellehsen, PhD, Vansha Singh, MD, Prashant Malhotra, MBBS, MD, Rehana Rasul, MA, MPH, Samantha S. Corley, Sophia Jan, MD, MSHP, Nidhi Parashar, PhD, MSW, Sonia George, DO, FHM, Andrew C. Yacht, MD, MSc, and John Q. Young, MD, MPP, PhD

Objective: To examine the association between a number of negative COVID-19 occupational experiences and probable anxiety, depression, and PTSD among physicians. **Methods:** Cross-sectional examination of longitudinal registry data consisting of physician personal and occupational well-being. Multivariable logistic regressions were performed to determine the association between negative COVID-19 experiences and outcomes. **Results:** Of the 620 eligible physicians, approximately half were female (49%), and 71% white with a mean age of 46.51 (SD = 13.28). A one-point increase in negative experience score was associated with a 23% increase in probable anxiety (OR = 1.23, 95% CI: 1.14–1.34), a 23% increase in probable depression (OR = 1.23, 95% CI: 1.13–1.33), and a 41% increase in probable PTSD (OR = 1.41, 95% CI: 1.30–1.52). **Conclusions:** Negative

pandemic experiences were strongly associated with adverse mental health outcomes while greater resilience was protective.

Keywords: anxiety, COVID-19, depression, physicians, posttraumatic stress disorder

It has been over 1 year since the beginning of the COVID-19 pandemic during which healthcare workers (HCW) have faced prolonged alarming demands in patient care. As of June 2021, the United States alone has surpassed 33 million confirmed cases and over 600,000 deaths.¹ New York (NY), the epicenter of the first wave, has accumulated nearly 100,000 cases, with New York City alone being responsible for over 44% of said cases.² Recent literature has indicated that COVID-19 related exposures (ie, negative occupational COVID-19-related experiences), specifically experienced among frontline HCWs, have negative psychological implications, including increases in stress, anxiety, depression, and burnout.^{3–8} This is concerning, particularly among physicians, who are already at heightened risk for adverse psychological outcomes due to the nature of their occupation, irrespective of COVID-19.^{9–13} In COVID-19 studies among U.S. physicians, the prevalence of anxiety and depression were as high as 30% and 38%, respectively.^{14,15} Further, in the one study assessing symptoms of posttraumatic stress disorder (PTSD), 40% of physician respondents demonstrated elevated symptoms.¹⁵ These mental health outcomes have also been reported to be higher among those who work in high exposure risk settings, such as in those with direct contact with COVID-19 positive patients.^{14–17} Female physicians and those earlier in their careers (ie, residents and fellows) have also been reported to be disproportionately impacted by COVID-19 related experiences.^{14,15,17}

The studies examining COVID-19 exposure and mental health outcomes are limited in their assessment of healthcare worker-specific occupational exposures during the pandemic. To date, occupational exposures to COVID-19 have predominantly been measured as a binary assessment, primarily focusing on whether HCWs have treated patients with COVID-19.^{16,17} To the best of our knowledge, no studies have investigated COVID-19 occupational exposures represented as an impact score and then evaluated how these cumulative exposures or impacts relate to measures of providing mental health. One study did collect other COVID-19 exposure variables, including high versus low-risk clinical working environments and personal and familial stressors, but did not assess specific occupational stressors and experiences, such as adequate/inadequate personal protective equipment, negative interactions with colleagues and staff, and witnessing patient deaths, which have all been identified as significant occupational stressors currently faced by HCWs.^{17,18} There is a need to assess COVID-19 occupational exposures in a more systematic and consistent manner to effectively understand their impact on physician mental health.

In addition to understanding the impact of COVID-19 occupational stressors and experiences on physician mental health

From the The Feinstein Institutes for Medical Research, Northwell Health, Great Neck, New York (Dr Schwartz, Dr McCann-Pineo, Rasul, Corley, Dr Jan); Department of Occupational Medicine Epidemiology and Prevention, Donald and Barbara Zucker School of Medicine at Hofstra/Northwell, Hempstead, New York (Dr Schwartz, Dr McCann-Pineo, Rasul, Corley); Center Traumatic Stress, Resilience and Recovery at Northwell Health, Great Neck, New York (Dr Schwartz, Dr McCann-Pineo, Rasul, Corley); Unified Behavioral Health Center for Military Veterans and their Families, Northwell Health, Great Neck, New York (Dr Bellehsen); Division of Infectious Disease, Donald and Barbara Zucker School of Medicine at Hofstra/Northwell, Hempstead, New York (Dr Singh, Dr Malhotra); Division of Pediatrics and Medicine, Donald and Barbara Zucker School of Medicine at Hofstra/Northwell, Hempstead, New York (Dr Jan); Division of Pediatrics, Steven and Alexandra Cohen Children's Medical Center, New Hyde Park, New York (Dr Jan); Department of Psychiatry and Resident Mental Health Program, Lenox Hill Hospital, New York, New York (Dr Parashar); Department of Psychiatry, Donald and Barbara Zucker School of Medicine at Hofstra/Northwell, Hempstead, New York (Dr Parashar, Dr Young); Division of Hospital Medicine, Donald and Barbara Zucker School of Medicine at Hofstra/Northwell, Hempstead, New York (Dr George); Donald and Barbara Zucker School of Medicine at Hofstra/Northwell, Hempstead, New York (Dr Yacht); Department of Psychiatry, Zucker Hillside Hospital at Northwell Health, Glen Oaks, New York (Dr Young).

Clinical Significance: The pandemic poses a significant threat to the mental health of the physician workforce potentially impacting the care that patients receive. Continued monitoring of pandemic impacts and implementation of appropriately tailored interventions are critical.

Ethical Considerations and Disclosures: The current study was reviewed by an Institutional Review Board and was determined to be of exempt status.

Funding sources: None to disclose.

Conflict of interest: None declared.

The authors report no conflicts of interest.

Supplemental digital contents are available for this article. Direct URL citation appears in the printed text and is provided in the HTML and PDF versions of this article on the journal's Web site (www.joem.org).

Address correspondence to: Molly McCann-Pineo, MS, PhD, Department of Occupational Medicine, Epidemiology and Prevention, The Feinstein Institutes for Medical Research, Northwell Health, 175 Community Drive, Great Neck, NY 11030 (mmcann1@northwell.edu).

Copyright © 2021 The Author(s). Published by Wolters Kluwer Health, Inc. on behalf of the American College of Occupational and Environmental Medicine. This is an open access article distributed under the terms of the Creative Commons Attribution-Non Commercial-No Derivatives License 4.0 (CCBY-NC-ND), where it is permissible to download and share the work provided it is properly cited. The work cannot be changed in any way or used commercially without permission from the journal.

DOI: 10.1097/JOM.0000000000002380

outcomes, it is also important to consider what may reduce, or moderate these impacts. It has been widely reported that resilience and social support are protective against adverse mental health outcomes in the presence of stress.^{19–21} Among physicians specifically, resilience has been associated with reduced stress and higher professional quality of life.^{22–24} Organizational social support has been also known to be effective in reducing stress and burnout.^{25–28} COVID-19 impact studies have yet to incorporate provider resilience and organizational support as potential moderators of mental health outcomes.^{29–31} A better understanding of factors that protect against the negative impacts of a pandemic can help inform the development of future strategies to support healthcare workers during a pandemic.

The objective of this study is to examine the association between the number of COVID-19 reported occupational experiences and anxiety, depression, and PTSD symptoms among physicians across a large, diverse health system disproportionately impacted during the first peak of the pandemic in the spring of 2020. It is hypothesized that physicians with more reported pandemic-related negative occupational experiences will have higher levels of mental health symptoms. We aim to address previous limitations by utilizing a cumulative exposure measure specifically designed to capture the many elements of COVID-19 occupational stressors and experiences. This is also the first study to investigate if associations between COVID-19 occupational experiences and mental health outcomes are modified by resilience, occupational support, and utilization of organizational well-being resources. Understanding the impact of negative occupational experiences during the pandemic on physicians' mental health is critical to address ongoing provider well-being concerns and information gained can help inform interventions aimed at mitigating stress and attenuating adverse mental health outcomes.

METHODS

Study Design and Participants

We conducted a cross-sectional examination of pre-existing, longitudinal registry data of physicians across a diverse NY health system. The purpose of the registry was to assess healthcare providers personal and occupational well-being as it relates to the COVID-19 pandemic. Physicians were one of the various cohorts of healthcare providers included, and participation was voluntary. The registry consists of a baseline assessment, in addition to ongoing prospective data collections to evaluate changes over time. However, for the purpose of this study, we only analyzed data from the baseline assessments among physicians. Baseline assessments were conducted specifically among physicians between June 21 and August 21, 2020, and evaluated COVID-19 exposures from the three preceding months (March–May 2020) via an electronic health questionnaire that was directly emailed to eligible participants. We utilized a secure, HIPAA-compliant database, REDCap, for all consent and baseline assessment data collection purposes. All study measurements, including COVID-19-related exposures, potential modifiers, and mental health outcomes were contained within the baseline questionnaire. Participants eligible for study inclusion included physicians (attending, resident, or fellow) who were employed by or were affiliated with the health system during March and August of 2020 and were able to electronically consent for participation. Individuals who were either unable to electronically consent or not employed or affiliated during the aforementioned time frame were excluded. Of the 12,542 eligible physicians who were sent the baseline questionnaire, 620 completed it, resulting in a 4.9% participation rate. All registry data are stored and maintained by an institutional department. The current study was reviewed by an Institutional Review Board and was determined to be of exempt status.

Primary Predictor

To measure the extent of COVID-related negative impacts and experiences among our sample, we utilized the Supplemental Healthcare Module of the Epidemic-Pandemic Impact Inventory (EPII-SHMB). The larger 92-item version of the EPII was recently developed by Grasso et al in response to the COVID-19 pandemic to understand both the positive and negative impacts of the pandemic on various areas of personal and family life among non-healthcare workers.³² Although it is not currently validated, it is the most comprehensive tool to date that has been widely used since the beginning of the pandemic with initial psychometric properties reported on the larger inventory.^{33–40} For the purposes of the registry, we used the brief version of the Healthcare Module that was developed for use among healthcare worker populations.⁴¹ This adaptation contains 25-items that examine the many ways in which frontline healthcare workers may have been impacted by the pandemic due to their occupational setting. For the purposes of the current study, we used the first sixteen items which query potential negative occupational impacts that healthcare workers may have experienced since the start of the COVID-19 pandemic. An example item is: "Deaths of patients despite heroic efforts by the treatment team." Each item is measured dichotomously, with a positive endorsement resulting in one point, and a negative or non-applicable resulting in zero points for a potential score (EPII score) ranging from 0 to 16 (Cronbach alpha = 0.77).

Outcomes

Our outcomes included validated measures assessing anxiety, depression, and PTSD symptoms. Anxiety and depression symptoms were measured using the Patient Health Questionnaire-4 (PHQ-4), which has been widely validated.⁴² Of the four total questions, two items correspond to an anxiety subscale, and two to a depression subscale. Survey items assess symptoms experienced over the last 2 weeks on a 4-point Likert scale, responses ranging from "0-Not at all" to "3-Nearly every day." PHQ-4 anxiety and depression subscales have separate ranges of 0 to 6 with a score of 3 or greater defined as probable anxiety or depression.⁴³ PTSD was measured utilizing the 5-item Primary Care PTSD Screen for the DSM-5 (PC-PTSD-5) which assesses recent exposure to traumatic events.⁴⁴ The PC-PTSD-5 contains five yes/no questions, with any positive endorsement resulting in 1-point, and any negative endorsement resulting in 0 points for each question. All positive responses are summed to a total score, with a range of 1 to 5. Scores of 3 or higher were indicative of probable PTSD.⁴⁴

Moderators

Potential moderators of the association between COVID HCW negative impacts and the three mental health outcomes were resilience, perceived occupational support, and utilization of workplace well-being resources. Resilience was assessed by the Brief Resilience Scale (BRS).⁴⁵ The BRS is a 6-item scale that assess one's perceived ability to "bounce back" after stressful or difficult experiences. Each item on the BRS has responses between 1 and 5 (1 = Strongly Disagree to 5 = Strongly agree). Items were averaged to create the resilience score (range: 1–5), with higher scores indicating higher levels of resilience. We assessed organizational support via two separate questions, one inquiring about perceived workplace support and the other assessed the number of organizational provided well-being resources utilized by participants. Perceived occupational support was measured using the question, "On a scale of 1–5, how often did you feel supported at work?" with 5 choices ranging from 1: Not Supported to 5: Completely Supported. This measure was further dichotomized into the binary variable indicating 1: Somewhat/completely supported and 0: Neutral to Not Supported. Use of organizational well-being resources was defined

as whether a participant reported that they utilized any workplace-sponsored well-being program (yes/no). See Supplemental Material, <http://links.lww.com/JOM/A987> for distributions of use.

Other Measures

Demographic variables were collected and included age, gender, race, Hispanic ethnicity (yes/no), and partner status. We also collected physician occupational descriptors including the level of training, provision of direct COVID-19 care, redeployment status—defined as deployment to a COVID-19 clinical area that is not typically where they see patients and in-patient familiarity which was based on medical specialty. Physicians were considered to be familiar with adult inpatient medicine if they reported a specialty in medicine (ie, critical care, cardiology, gastroenterology, geriatric medicine, hematology/oncology, infectious disease, and pulmonary medicine), family medicine, or emergency medicine.

Statistical Analysis

Proportions of probable anxiety, probable depression, and probable PTSD were compared by study variables. Two sample *t* test was used to compare mean age and mean EPII score among those with and without probable anxiety, depression, and PTSD. Chi-square test was used to assess associations between outcomes and categorical study variables.

Separate multivariable logistic regressions were performed to determine the association between EPII score and mental health outcomes. Candidate variables to include in the model were EPII score, BRS score, use of organizational well-being resources, occupational support, redeployment status, level of training, age, gender, race, Hispanic ethnicity, partner status, inpatient medicine familiarity based on specialty, and provision of direct COVID patient care. Variables were chosen by the study team based on known previous risk factors of mental health outcomes. Observations with responses for gender = “prefer not to answer” (*n* = 2) and partner status = “other” (*n* = 7) were excluded from modeling analyses due to low frequencies. VIF was calculated and indicated no collinearity (all VIF < 5). To create a model which does not overfit the data, the variable selection was first performed using LASSO regression. For each outcome, variables selected in the LASSO regression which yielded the lowest mean squared error were retained for the final model. Then final logistic regression models including only the selected variables were performed to obtain effect estimates. Interactions between EPII score and each potential moderator (BRS score, occupational support, and use of organizational well-being resources) were also tested to determine whether there were differential effects of EPII score on outcomes due to these subgroups and if significant, they were also included in the final models. Adjusted odds ratios (OR) and 95% confidence intervals (CI) were presented. Analyses were conducted utilizing SAS version 9.4 (SAS Institute).

RESULTS

Of the 620 physicians in the study, the mean age was 46.51 (SD = 13.28) (Table 1). The majority were White (71.0%) and non-Hispanic (89.3%). About half were female (48.8%). These demographics generally reflect those of physicians in the larger health system although we had slightly higher proportions of female and White participants. Overall utilization of organizational resources was 14.2%. We further examined utilization by volunteer status and frequencies of use were similar (10.4% vs 11.8%; data not in tabular format). Mean EPII score was 7.11 (SD = 3.53) and was higher among those who had probable anxiety, probable depression, and probable PTSD. Several individual EPII items were commonly associated with all three mental health outcomes; namely, risk of contracting COVID-19, contact with patients’ distressed family members, and family/friends not understanding exhaustion caused by work (Figure 1).

Unadjusted analyses indicated that participants with a higher EPII score, low to neutral occupational support (vs high support), and higher utilization of organizational well-being resources (vs no utilization) had higher proportions of all mental health outcomes. Resilience, as measured by the BRS score, was also lower among those who had probable anxiety, probable depression, and probable PTSD.

Multivariable logistic regression models were fitted using >90% of the sample.

An increase in the EPII score, meaning an increase in one of the listed COVID-19 negative impacts from the EPII instrument, was associated with a 23% increase (95% CI: 1.14–1.34) in probable anxiety, a 23% increase (95% CI: 1.13–1.33) in probable depression, and a 41% increase (95% CI: 1.30–1.52) in probable PTSD while controlling for other factors from their respective models (Table 2). The interactions between EPII score and potential moderators (resilience, occupational support, and use of organizational well-being resources) were not significant and therefore the interactions were not included in the final models. This suggests that resilience and support do not modify the relationship between EPII and outcomes. There were, however, strong individual associations between resilience and outcomes. A one-unit increase in BRS score was associated with 46% and 54% protection in mental health outcomes. In addition, perceived lack of occupational support was associated with a two-fold increased odds of probable anxiety.

DISCUSSION

This is the first study to date to assess the relationship between the degree of COVID-19-specific healthcare worker impacts, as measured by EPII score, on three key mental health outcomes typically associated with traumatic stress exposure—probable anxiety, probable depression, and probable PTSD. The EPII score can be considered a measure of the burden of COVID-19 exposure since items are summed to create the score. In our study, the EPII score was a strong predictor of each mental health outcome studied, even after controlling for other important variables.

Though some physicians in our sample have been in the position of returning to pre-pandemic routines, others have continued to serve on the frontlines and may have been impacted more severely by ongoing exposure (as measured by EPII). Our findings suggest a need to target those with the greatest exposure for more support, including exposure from the initial surge and from the potential stressors of ongoing care delivery. Furthermore, the association between exposure and mental health outcomes was strongest for probable PTSD. PTSD is often comorbid with depression and anxiety,^{46,47} and these results suggest strong consideration of targeting PTSD when considering interventions.

As measured by the EPII, factors such as fear of contagion, death of patients despite all efforts, circumstances involving contact with a distressed family member and the inability of friends and family to understand physician’s physical and emotional exhaustion ranked as top concerns for adverse mental health outcomes. This supports recent research findings which indicate that factors primarily relating to emotional trauma from treating COVID-19 patients are the prominent concern of HCW.⁴⁸ Future research should focus efforts on understanding whether there are specific factor structures within the EPII that may be more strongly associated with mental health as compared to others.

We were surprised that measures of resilience did not moderate the impact of exposure on mental health outcomes. However, consistent with other studies^{29,49} we were able to demonstrate that resilience was protective against all of the negative mental health outcomes in that it was independently associated with symptoms of depression, anxiety, and PTSD. This would suggest that interventions that bolster the resilience of the workforce will be critical in protecting against the mental health sequelae of healthcare workers

TABLE 1. Characteristics of Study Sample Compared by Mental Health Outcomes

Variable	Total, No. (%) [*]	Probable Anxiety		Probable Depression		Probable PTSD	
		No, No. (%)	Yes, No. (%)	No, No. (%)	Yes, No. (%)	No, No. (%)	Yes, No. (%)
Age, mean (SD)	46.51 (13.28)	47.20 (13.43)	43.02 (11.90)	46.29 (13.3)	47.18 (11.71)	47.25 (13.53)	43.04 (11.51)
Gender							
Female	300 (48.8)	228 (76.8)	69 (23.2)	264 (88.9)	33 (11.1)	206 (70.3)	87 (29.7)
Male	313 (50.9)	268 (86.7)	41 (13.3)	274 (89.3)	33 (10.7)	255 (84.2)	48 (15.8)
Prefer not to answer	2 (0.3)	2 (100.0)	0 (0.0)	2 (100.0)	0 (0.0)	2 (100.0)	0 (0)
Race							
White only	434 (71.0)	351 (81.8)	78 (18.2)	382 (89.3)	46 (10.7)	320 (76.2)	100 (23.8)
Asian only	116 (19.0)	92 (80.0)	23 (20.0)	102 (87.9)	14 (12.1)	89 (78.8)	24 (21.2)
Black/African American	18 (2.9)	13 (76.5)	4 (23.5)	16 (94.1)	1 (5.9)	14 (77.8)	4 (22.2)
Other/multiple races	43 (7.0)	37 (86.0)	6 (14.0)	36 (87.8)	5 (12.2)	36 (83.7)	7 (16.3)
Hispanic ethnicity							
Yes	65 (10.7)	51 (81.0)	12 (19.0)	62 (95.4)	3 (4.6)	53 (84.1)	10 (15.9)
No	542 (89.3)	436 (81.2)	101 (18.8)	469 (88.0)	64 (12)	402 (76.1)	126 (23.9)
Partner status							
Single/separated/divorced/widowed	144 (23.4)	108 (76.1)	34 (23.9)	126 (88.1)	17 (11.9)	104 (74.3)	36 (25.7)
Other	7 (1.1)	6 (85.7)	1 (14.3)	6 (85.7)	1 (14.3)	4 (57.1)	3 (42.9)
Married/engaged	464 (75.4)	382 (83.2)	77 (16.8)	408 (89.5)	48 (10.5)	354 (78.5)	97 (21.5)
Redeployed							
No	449 (72.4)	374 (83.9)	72 (16.1)	398 (90.2)	43 (9.8)	346 (79.7)	88 (20.3)
Yes	171 (27.6)	125 (75.3)	41 (24.7)	145 (85.8)	24 (14.2)	119 (70.8)	49 (29.2)
Did you directly care for patients with COVID-19 or suspected of having COVID-19?							
No	126 (20.3)	107 (85.6)	18 (14.4)	111 (90.2)	12 (9.8)	107 (89.9)	12 (10.1)
Yes	494 (79.7)	392 (80.5)	95 (19.5)	432 (88.7)	55 (11.3)	358 (74.1)	125 (25.9)
Trainee status							
Attending	491 (79.2)	407 (83.9)	78 (16.1)	428 (88.4)	56 (11.6)	376 (79.0)	100 (21.0)
Fellow	33 (5.3)	25 (75.8)	8 (24.2)	30 (90.9)	3 (9.1)	24 (72.7)	9 (27.3)
Resident	96 (15.5)	67 (71.3)	27 (28.7)	85 (91.4)	8 (8.6)	65 (69.9)	28 (30.1)
Inpatient medicine familiarity							
Yes	204 (33.1)	164 (81.2)	38 (18.8)	177 (88.1)	24 (11.9)	144 (71.6)	57 (28.4)
No	412 (66.9)	332 (81.6)	75 (18.4)	363 (89.4)	43 (10.6)	319 (80.2)	79 (19.8)
EPII Score, mean (SD)	7.11 (3.53)	6.6 (3.35)	9.14 (3.50)	6.83 (3.36)	9.43 (3.82)	6.35 (3.3)	9.85 (2.97)
Brief Resilience Score, mean (SD)	3.87 (0.77)	3.97 (0.70)	3.43 (0.88)	3.92 (0.73)	3.47 (0.93)	3.95 (0.70)	3.56 (0.76)
Occupational support							
Not supported/neutral	135 (22.1)	90 (67.7)	43 (32.3)	102 (77.3)	30 (22.7)	87 (65.9)	45 (34.1)
Somewhat/completely supported	477 (77.9)	403 (85.2)	70 (14.8)	435 (92.2)	37 (7.8)	372 (80.2)	92 (19.8)
Use of organizational well-being resources							
Yes	88 (14.2)	63 (71.6)	25 (28.4)	74 (84.1)	14 (15.9)	63 (72.4)	24 (27.6)
No	532 (85.8)	436 (83.2)	88 (16.8)	469 (89.8)	53 (10.2)	402 (78.1)	113 (21.9)

SD, standard deviation; EPII, Epidemic-Pandemic Impacts Inventory; PTSD, posttraumatic stress disorder.

^{*}Total and percents based on non-missing data.

during the pandemic. Further, the finding that a perceived lack of organizational support was associated with a greater mental health burden, specifically with anxiety in the multivariable analysis, is important as perceived organizational support has been considered protective against burnout and poorer mental health outcomes.⁵⁰ Providing and communicating psychological supports in a manner that is well-received by physicians (and all HCWs) is an important area for intervention and maybe a key target for resilience-building. Peer supports, in particular, have been identified as an important mechanism to support HCW and may offer the dual benefit of increasing perceptions of support to enhance resilience while addressing distress as well.^{51,52}

The use of organizational well-being resources was not associated with mental health outcomes in the multivariable models. Only 14% of the sample used any service and the potential options ranged widely from daily wellness posts to the utilization of the Employee Assistance Program (EAP) for individual mental health-care with a professional. It is possible that there is a more nuanced impact of the use of services in which those who had greater mental

health symptoms were more likely to use services such as EAP, but small sample sizes prevent us from examining those associations. As more well-being resources are being offered and made easily accessible to physicians, it will be important to continue to track utilization over time to determine whether the use of such resources impacts mental health symptoms longitudinally.

Limitations

Several limitations should be noted. This is a cross-sectional study and temporal relationships cannot be ascertained. Responses were also collected after the first surge of the COVID-19 pandemic for NY and responses should be interpreted with respect to this timeframe. Also, study results may not generalize to all physicians and our sample was only a fraction of the larger sampling frame. Our lower than anticipated response rate may not accurately represent the underlying population of physicians, which may have led to over or underestimations of true estimates. Although age was distributed similarly in our sample compared to those within the greater health system, females and whites were more represented in our sample.

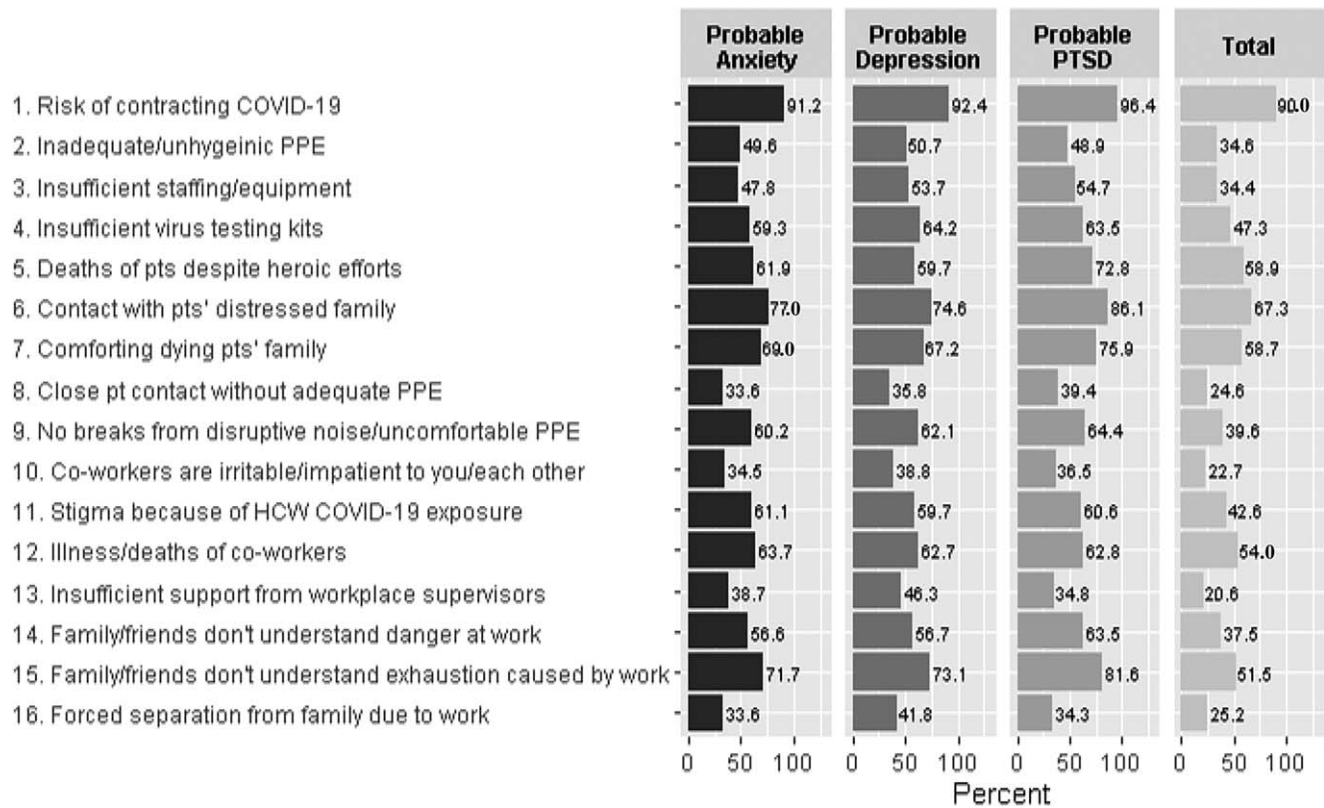


FIGURE 1. Distribution of EPII item responses by mental health outcomes. EPII, Epidemic-Pandemic Impacts Inventory.

TABLE 2. Multivariable Logistic Regression Models of the Associations Between EPII Score with Mental Health Outcomes

Probable Anxiety				
	OR*	95% CI		P value
EPII score	1.23	1.14	1.34	<0.001
Brief Resilience Score	0.46	0.34	0.62	<0.001
Use of workplace well-being resources, yes vs no	1.61	0.88	2.95	0.12
Perceived occupational support, not supported/neutral vs somewhat/completely supported	2.02	1.20	3.39	0.008
Deployed, yes vs no	1.57	0.92	2.68	0.10
Female vs male	1.65	1.02	2.66	0.04
Inpatient medicine familiarity, yes vs no	1.35	0.81	2.27	0.25
Direct COVID patient care, yes vs no	0.53	0.26	1.07	0.08
Probable Depression				
	OR*	95% CI		P value
EPII score	1.23	1.13	1.33	<0.001
Brief Resilience Score	0.54	0.38	0.75	<0.001
Probable PTSD				
	OR*	95% CI		P value
EPII score	1.41	1.30	1.52	<0.001
Brief Resilience Score	0.50	0.36	0.68	<0.001
Female vs male	1.90	1.18	3.05	0.008
Asian only vs White only	0.43	0.23	0.80	0.008
Other/multiple races vs White only	0.74	0.32	1.73	0.49
Single vs partner	0.77	0.45	1.32	0.34

OR, odds ratio; CI, confidence interval; EPII, Epidemic-Pandemic Impacts Inventory; LASSO, Least Absolute Shrinkage and Selection Operator; PTSD, posttraumatic stress disorder. *Odds ratios were adjusted for all variables listed for each outcome. Variables chosen from LASSO regression.

Additionally, the EPII is a new instrument and has not been validated. The burden of EPII score was studied to examine the impact of exposure; however, it is important to separate which items or types of items are driving the associations found. For example, one could envision fear of contagion being more associated with anxiety, while witnessing significant deaths may be more associated with PTSD. Lastly, probable mental health outcomes were determined with the use of brief self-report instruments and not the clinical interview.

CONCLUSIONS

This is the first study, to the best of our knowledge, to demonstrate a strong association between the degree of COVID-19 negative impacts and poorer mental health outcomes in a large population of physicians. The protective role of resilience and organizational support underscores the importance of considering preventive interventions that strengthen resilience processes while also providing mental health interventions to address probable anxiety, depression, and PTSD. Future studies will be needed to establish the prevalence of these conditions with standardized clinical interviews and will need to explore the trajectory of these conditions over time.

ACKNOWLEDGMENTS

The authors would like to thank the Northwell Health COVID-19 Research Consortium for their assistance in facilitating this study.

REFERENCES

1. Coronavirus Resource Center. John Hopkins University and Medicine. Tracked Reported Cases of COVID-19. Available at: <https://coronavirus.jhu.edu/map.html>. Accessed June 24, 2021.
2. New York State Department of Health. COVID-19 Tracker. Available at: <https://covid19tracker.health.ny.gov/views/NYS-COVID19-Tracker/NYS-DOHCOVID-19Tracker-Map?%3Aembed=yes&%3Atoolbar=no&%3Atabs=n>. Accessed June 24, 2021.
3. Lai J, Ma S, Wang Y, et al. Factors associated with mental health outcomes among health care workers exposed to coronavirus disease 2019. *JAMA Netw Open*. 2020;3:e203976.
4. Vizheh M, Qorbani M, Arzaghi SM, Muhidin S, Javanmard Z, Esmaeili M. The mental health of healthcare workers in the COVID-19 pandemic: a systematic review. *J Diabetes Metab Disord*. 2020;19:1–12.
5. Sahebi A, Nejati-Zarnaqi B, Moayedi S, Yousefi K, Torres M, Golitaleb M. The prevalence of anxiety and depression among healthcare workers during the COVID-19 pandemic: an umbrella review of meta-analyses. *Prog Neuro-psychopharmacol Biol Psychiatry*. 2021;107:110247.
6. Orrù G, Marzetti F, Conversano C, et al. Secondary traumatic stress and burnout in healthcare workers during COVID-19 outbreak. *Int J Environ Res Public Health*. 2021;18:337.
7. Lasalvia A, Amadeo F, Porru S, et al. Levels of burn-out among healthcare workers during the COVID-19 pandemic and their associated factors: a cross-sectional study in a tertiary hospital of a highly burdened area of north-east Italy. *BMJ Open*. 2021;11:e045127.
8. Buselli R, Corsi M, Baldanzi S, et al. Professional quality of life and mental health outcomes among health care workers exposed to Sars-Cov-2 (Covid-19). *Int J Environ Res Public Health*. 2020;17:6180.
9. Rotenstein LS, Torre M, Ramos MA, et al. Prevalence of burnout among physicians: a systematic review. *JAMA*. 2018;320:1131–1150.
10. Hsu K, Marshall V. Prevalence of depression and distress in a large sample of Canadian residents, interns, and fellows. *Am J Psychiatry*. 1987;144:1561–1566.
11. Tomioka K, Morita N, Saeki K, Okamoto N, Kurumatani N. Working hours, occupational stress and depression among physicians. *Occup Med (Lond)*. 2011;61:163–170.
12. Tyssen R, Vaglum P, Grønvoold NT, Ekeberg O. Suicidal ideation among medical students and young physicians: a nationwide and prospective study of prevalence and predictors. *J Affect Disord*. 2001;64:69–79.
13. Jacob Sendler D, Rutkowska A, Makara-Studzinska M. How the exposure to trauma has hindered physicians' capacity to heal: prevalence of PTSD among healthcare workers. *Eur J Psychiatry*. 2016;30:321–334.
14. Linzer M, Stillman M, Brown R, et al. Preliminary report: US physician stress during the early days of the COVID-19 pandemic. *Mayo Clin Proc Innov Qual Outcomes*. 2021;5:127–136.
15. Shechter A, Diaz F, Moise N, et al. Psychological distress, coping behaviors, and preferences for support among New York healthcare workers during the COVID-19 pandemic. *Gen Hosp Psychiatry*. 2020;66:1–8.
16. Evanoff BA, Strickland JR, Dale AM, et al. Work-related and personal factors associated with mental well-being during the COVID-19 response: survey of health care and other workers. *J Med Internet Res*. 2020;22:e21366.
17. Kannampallil TG, Goss CW, Evanoff BA, Strickland JR, McAlister RP, Duncan J. Exposure to COVID-19 patients increases physician trainee stress and burnout. *PLoS One*. 2020;15:e0237301.
18. Ayanian JZ. Mental health needs of health care workers providing frontline COVID-19 care. *JAMA Health Forum*. 2020;1:e200397–e1200397. American Medical Association.
19. Ozbay F, Johnson DC, Dimoulas E, Morgan CA, Charney D, Southwick S. Social support and resilience to stress: from neurobiology to clinical practice. *Psychiatry (Edgmont)*. 2007;4:35–40.
20. Rutter M. Psychosocial resilience and protective mechanisms. *Am J Orthopsychiatry*. 1987;57:316–331.
21. Cohen S, Sherrod DR, Clark MS. Social skills and the stress-protective role of social support. *J Pers Soc Psychol*. 1986;50:963–973.
22. McCain RS, McKinley N, Dempster M, Campbell WJ, Kirk SJ. A study of the relationship between resilience, burnout and coping strategies in doctors. *Postgrad Med J*. 2018;94:43–47.
23. Sood A, Prasad K, Schroeder D, Varkey P. Stress management and resilience training among Department of Medicine faculty: a pilot randomized clinical trial. *J Gen Intern Med*. 2011;26:858–861.
24. Ding J, Jia Y, Zhao J, Yang F, Ma R, Yang X. Optimizing quality of life among Chinese physicians: the positive effects of resilience and recovery experience. *Qual Life Res*. 2020;29:1655–1663.
25. McAbee JH, Ragel BT, McCartney S, et al. Factors associated with career satisfaction and burnout among US neurosurgeons: results of a nationwide survey. *J Neurosurg*. 2015;123:161–173.
26. Lorenz VR, Guirardello Ede B. The environment of professional practice and Burnout in nurses in primary healthcare. *Rev Lat Am Enfermagem*. 2014;22:926–933.
27. Osatuke K, Moore SC, Ward C, Dyrenforth S, Belton L. Civility Respect, Engagement in the Workforce (CREW): nationwide organization development intervention at Veterans Health Administration. *J Appl Behav Sci*. 2009;45:384–410.
28. Leiter MP, Laschinger HKS, Day A, Oore DG. The impact of civility interventions on employee social behavior, distress, and attitudes. *J Appl Psychol*. 2011;96:1258–1274.
29. Mosheva M, Hertz-Palmor N, Dorman Ilan S, et al. Anxiety, pandemic-related stress and resilience among physicians during the COVID-19 pandemic. *Depress Anxiety*. 2020;37:965–971.
30. Douillet D, Caillaud A, Riou J, et al. Assessment of physicians' resilience level during the COVID-19 pandemic. *Transl Psychiatry*. 2021;11:283.
31. Santarone K, McKenney M, Elkbuli A. Preserving mental health and resilience in frontline healthcare workers during COVID-19. *Am J Emerg Med*. 2020;38:1530–1531.
32. Grasso DJ, Briggs-Gowan MJ, Ford JD, Carter AS. *The Epidemic – Pandemic Impacts Inventory (EPII)*. 2020. University of Connecticut School of Medicine.
33. Appelhans BM, Thomas AS, Roisman GI, Booth-LaForce C, Bleil ME. Preexisting executive function deficits and change in health behaviors during the COVID-19 pandemic. *Int J Behav Med*. 2021;1–7.
34. Jacka BP, Janssen T, Garner BR, et al. Impacts of the COVID-19 pandemic on healthcare access among patients receiving medication for opioid use disorder. *Drug Alcohol Depend*. 2021;221:108617.
35. Yuksel D, McKee GB, Perrin PB, et al. Sleeping when the world locks down: correlates of sleep health during the COVID-19 pandemic across 59 countries. *Sleep Health*. 2021;7:134–142.
36. Barone Gibbs B, Kline CE, Huber KA, Paley JL, Perera S. Covid-19 shelter-at-home and work, lifestyle and well-being in desk workers. *Occup Med (Lond)*. 2021;71:86–94.
37. MacCarthy S, Izenberg M, Barreras JL, Brooks RA, Gonzalez A, Linnemayr S. Rapid mixed-methods assessment of COVID-19 impact on Latinx sexual minority men and Latinx transgender women. *PLoS One*. 2020;15:e0244421.
38. Trammell PhD, Joseph JP, Harriger NTJA. Racial and ethnic minority disparities in COVID-19 related health, health beliefs and behaviors, and well-being among students. *J Am Coll Health*. 2021;1–7.
39. Williams L, Rollins L, Young D, et al. What have we learned about positive changes experienced during COVID-19 lockdown? Evidence of the social patterning of change. *PLoS One*. 2021;16:e0244873.

40. DeLuca JS, Andorko ND, Chibani D, et al. Telepsychotherapy with youth at clinical high risk for psychosis: clinical issues and best practices during the COVID-19 pandemic. *J Psychother Integr*. 2020;30:304.
41. Ford JD, Carter AS, Grasso DJ, Briggs-Gowan MJ. *The Epidemic – Pandemic Impacts Inventory (EPII) Supplemental Healthcare Module – Brief Version (EPII-SHMB)*. 2020. University of Connecticut School of Medicine.
42. Löwe B, Wahl I, Rose M, et al. A 4-item measure of depression and anxiety: validation and standardization of the Patient Health Questionnaire-4 (PHQ-4) in the general population. *J Affect Disord*. 2010;122:86–95.
43. Kroenke K, Spitzer RL, Williams JB, Löwe B. An ultra-brief screening scale for anxiety and depression: the PHQ-4. *Psychosomatics*. 2009;50:613–621.
44. Prins A, Bovin MJ, Smolenski DJ, et al. The primary care PTSD screen for DSM-5 (PC-PTSD-5): development and evaluation within a veteran primary care sample. *J Gen Intern Med*. 2016;31:1206–1211.
45. Smith BW, Dalen J, Wiggins K, Tooley E, Christopher P, Bernard J. The brief resilience scale: assessing the ability to bounce back. *Int J Behav Med*. 2008;15:194–200.
46. Rytwinski NK, Scur MD, Feeny NC, Youngstrom EA. The co-occurrence of major depressive disorder among individuals with posttraumatic stress disorder: a meta-analysis. *J Trauma Stress*. 2013;26:299–309.
47. Brady KT, Killeen TK, Brewerton T, Lucerini S. Comorbidity of psychiatric disorders and posttraumatic stress disorder. *J Clin Psychiatry*. 2000;61(Suppl 7):22–32.
48. Shanafelt T, Ripp J, Trockel M. Understanding and addressing sources of anxiety among health care professionals during the COVID-19 pandemic. *JAMA*. 2020;323:2133–2134.
49. Barzilay R, Moore TM, Greenberg DM, et al. Resilience, COVID-19-related stress, anxiety and depression during the pandemic in a large population enriched for healthcare providers. *Transl Psychiatry*. 2020;10:291.
50. National Academies of Sciences, Engineering, and Medicine; National Academy of Medicine; Committee on Systems Approaches to Improve Patient Care by Supporting Clinician Well-Being. *Taking Action Against Clinician Burnout: A Systems Approach to Professional Well-Being*. Washington (DC): National Academies Press (US); October 23, 2019.
51. Albott CS, Wozniak JR, McGlinch BP, Wall MH, Gold BS, Vinogradov S. Battle buddies: rapid deployment of a psychological resilience intervention for health care workers during the COVID-19 pandemic. *Anesth Analg*. 2020;131:43–54.
52. Wu AW, Connors C, Everly Jr GS. COVID-19: peer support and crisis communication strategies to promote institutional resilience. *Ann Intern Med*. 2020;172:822–823.