Transdiagnostic Psychiatric Symptoms, Burnout, and Functioning in Frontline Health Care Workers Responding to the COVID-19 Pandemic: A Symptomics Analysis

Lorig K. Kachadourian, PhD[a,b,*]; Adriana Feder, MD[c]; James W. Murrough, MD, PhD[d,e]; Jordyn H. Feingold, MAPP[f]; Halley Kaye-Kauderer, BA[f]; Dennis Charney, MD[c,d,g]; Steven M. Southwick, MD[a,c]; Lauren Peccoralo, MD[f,h,i]; Jonathan Ripp, MD, MPH[h,i]; and Robert H. Pietrzak, PhD, MPH[a,b,c,j]

ABSTRACT

Objective: The coronavirus disease 2019 (COVID-19) pandemic has led to an increased risk of psychiatric symptoms among frontline health care workers (FHCWs). In the current study, a novel "symptomics" approach was employed to examine the association between acute transdiagnostic symptoms of posttraumatic stress disorder (PTSD), major depressive disorder (MDD), and generalized anxiety disorder (GAD) and burnout and work and relationship difficulties in FHCWs at an urban tertiary care hospital in New York City.

Methods: Symptoms of COVID-19–related PTSD (4-item PTSD Checklist-5), MDD (Patient Health Questionnaire-8), GAD (Generalized Anxiety Disorder-7), burnout (Single-Item Mini-Z Burnout Assessment), and functional difficulties (Brief Inventory of Psychosocial Functioning) were assessed. Relative importance analyses were conducted to identify PTSD, MDD, and GAD symptoms associated with burnout and functional difficulties.

Results: The total number of eligible participants included 6,026 presumed FHCWs, of which 3,360 (55.8%) completed the survey and 2,579 (76.8%) of whom endorsed directly treating patients with COVID-19 and provided sufficient responses to our outcome variables for analysis. Feeling tired/having little energy, being easily annoyed or irritable, and feeling nervous, anxious, or on edge were most strongly associated with burnout; feeling tired/having little energy accounted for the greatest amount of explained variance (> 15%). Negative expectations of oneself or the world, trouble concentrating, and feeling easily annoyed or irritable were most strongly associated with work difficulties; negative expectations of oneself or the world accounted for the greatest amount of explained variance (> 9%). Feeling easily annoyed or irritable, negative expectations about oneself or the world, and feeling bad about oneself were most strongly associated with relationship difficulties; feeling easily annoyed or irritable accounted for the greatest amount of explained variance (> 10%).

Conclusions: Results of this study underscore the importance of a transdiagnostic, symptom-based approach when examining associations between acute psychopathology and burnout and functional difficulties in FHCWs. Further work is needed to determine if early interventions aimed at ameliorating specific psychiatric symptoms may help mitigate risk for peri- and posttraumatic burnout and functional difficulties in this population.

J Clin Psychiatry 2021;82(3):20m13766

To cite: Kachadourian LK, Feder A, Murrough JW, et al. Transdiagnostic psychiatric symptoms, burnout, and functioning in frontline health care workers responding to the COVID-19 pandemic: a symptomics analysis. *J Clin Psychiatry.* 2021;82(3):20m13766.

To share: https://doi.org/10.4088/JCP.20m13766

[a]Department of Psychiatry, Yale School of Medicine, New Haven, Connecticut

[b]US Department of Veterans Affairs National Center for Posttraumatic Stress Disorder, VA Connecticut Healthcare System, West Haven, Connecticut

[c]Department of Psychiatry, Icahn School of Medicine at Mount Sinai, New York, New York

[d]Department of Neuroscience, Icahn School of Medicine at Mount Sinai, New York, New York

[e]Depression and Anxiety Center for Discovery and Treatment, Department of Psychiatry, Icahn School of Medicine at Mount Sinai, New York, New York

[f]Department of Medical Education, Icahn School of Medicine at Mount Sinai, New York, New York

[g]Department of Pharmacological Sciences, Icahn School of Medicine at Mount Sinai, New York, New York

[h]Department of Medicine, Icahn School of Medicine at Mount Sinai, New York, New York

[i]Office of Well-Being and Resilience, Icahn School of Medicine at Mount Sinai, New York, New York

[j]Department of Environmental Medicine and Public Health, Icahn School of Medicine at Mount Sinai, New York, New York

**Corresponding author:* Lorig K. Kachadourian, PhD, VA Connecticut Healthcare System, 950 Campbell Ave, West Haven, CT 06516 (lorig.kachadourian@yale.edu).

Severe acute respiratory syndrome coronavirus 2, the virus that causes coronavirus disease 2019 (COVID-19), was first reported in Wuhan, China, in December 2019. The virus then spread throughout the country and subsequently the world and quickly became a pandemic. As a result, there was an emergent call for frontline health care workers (FHCWs), including physicians, nurses, and other health care professionals, to step up to the challenge of immediately assessing, managing, and treating massive numbers of patients infected with and potentially dying from the virus. As COVID-19 spread to the US, New York City (NYC) quickly emerged as the initial epicenter of COVID-19, resulting in the declaration of the state of New York as a major disaster area by the Federal Emergency Management Agency.[1]

Given the unprecedented strain that the pandemic had on the health care work force in NYC at that time, including the strain of having hospital systems run over capacity, with the specter of possible shortages of critical care medical resources and personal protective equipment, there was an increased concern for the mental health impact on FHCWs. As such, the importance of meeting the mental health needs of FHCWs in NYC was identified as a high priority.[2] Despite this, the impact of the COVID-19 pandemic on the mental health and overall functioning of FHCWs in NYC, particularly in the immediate aftermath (ie, the days and

Clinical Points

- Burnout and functional difficulties are prevalent in health care workers on the frontlines of the COVID-19 pandemic, yet little is known about transdiagnostic psychiatric symptoms associated with these outcomes.
- Assessment, monitoring, and treatment of individual PTSD, MDD, and GAD symptoms may provide a more personalized and targeted approach to mitigating burnout and functional difficulties in this population.

weeks following the outbreak in this area), is still not clearly understood.

To date, research on the mental health impact of the COVID-19 pandemic on health care workers has primarily been conducted in China,[3–11] although a few studies have also been conducted in other countries as well, including the US.[12–14] Collectively, results of these studies revealed increases in depression, anxiety, posttraumatic stress symptoms, and overall psychological distress, in addition to poor sleep quality. Studies have also found increases in burnout in FHCWs.[15,16] Similar findings also were observed among FHCWs in Italy, another country highly affected by the COVID-19 pandemic.[17] These studies highlight the burden of mental health difficulties associated with the COVID-19 pandemic in FHCWs.

In addition to documenting the prevalence of mental health difficulties in FHCWs, it is also important to examine the impact that individual psychiatric symptoms may have on functional outcomes of key relevance to FHCWs, such as burnout and occupational and interpersonal functioning. To date, however, no study of which we are aware has examined this possibility. Furthermore, given that there is considerable variability in psychiatric symptom presentation among FHCWs,[11] certain symptoms may be more strongly associated with different aspects of functioning. Indeed, previous research has shown that certain symptoms of posttraumatic stress disorder (PTSD) and major depressive disorder (MDD) are differentially associated with functional outcomes.[18,19] For example, nonspecific anhedonic and hyperarousal symptoms of PTSD have shown stronger associations with mental health functioning compared to other PTSD symptoms.[19] Characterization of specific psychiatric symptoms that are most strongly associated with burnout and aspects of functioning, particularly in the early emergence of the COVID-19 pandemic, can help inform the development of more targeted, transdiagnostic, and symptom-focused approaches to minimize the potential of developing long-term burnout and functional difficulties following trauma exposure in FHCWs.[20]

In the current study, we examined the cross-sectional association between individual symptoms of COVID-19–related PTSD, MDD, and generalized anxiety disorder (GAD) and burnout and 2 aspects of functioning (ie, work difficulties and relationship difficulties) in a large sample of 2,579 FHCWs working in NYC during the COVID-19 pandemic surge. We also sought to examine which specific symptoms were most strongly associated with these outcomes and quantified the relative importance of individual symptoms in relation to burnout and functional difficulties.

METHODS

Sample

Data were collected between April 14 and May 11, 2020, through an electronically administered anonymous survey delivered to a purposively selected sample of FHCWs working at The Mount Sinai Hospital, an urban tertiary care hospital in NYC. This period corresponded with the peak and downward slope of the epidemic curve at this hospital, as defined by COVID-19 inpatient census data. Survey participants were eligible to receive a $25 gift card after survey completion. The study was approved by the Institutional Review Board at the Icahn School of Medicine at Mount Sinai.

The eligible study population included health care workers most likely to be directly involved in the care of patients infected with COVID-19, as a result of either their standard practice or their anticipated redeployment within the study period. The research team worked with hospital and administrative leaders to identify those most likely to be involved in frontline care prior to procuring contact information for the study invitation. The sample was composed of attending-level physician faculty and house staff from several departments, including Internal Medicine and surgical subspecialties, Anesthesiology, Emergency Medicine, Pediatrics, and Psychiatry, as well as all nurses, physician assistants, hospital chaplains, social workers, and clinical dietitians. Participants were excluded if email invitations went undelivered to addresses on file. Missing data were imputed using an iterative Markov chain Monte Carlo method.

Assessments

Psychiatric symptoms.

COVID-19–related PTSD symptoms. Symptoms of PTSD were assessed using a 4-item PTSD-Checklist (PCL4-5),[21] an abbreviated version of the PTSD-Checklist for *DSM-5*,[22] with questions modified to assess PTSD symptoms related to COVID-19 exposure (eg, "Over the past two weeks, how often were you bothered by repeated, disturbing, and unwanted memories of your experiences related to the COVID-19 pandemic?"). A positive screen for significant COVID-19–related PTSD symptoms was defined by a score ≥ 8, which showed the highest efficiency (90.4%; sensitivity = 0.81, specificity = 0.94) in diagnosing PTSD[21] (Cronbach α = .85).

Major depressive disorder symptoms. Symptoms of MDD were assessed using the Patient Health Questionnaire-8 (PHQ-8),[23] an 8-item measure that assesses symptoms of MDD experienced over the previous 2 weeks. A positive screen for significant MDD symptoms was defined by a score ≥ 10, which yields comparable estimates of the prevalence

of current major depressive or other depressive disorders relative to diagnostic interviews (Cronbach α = .89).

Generalized anxiety disorder symptoms. Symptoms of GAD were assessed using the Generalized Anxiety Disorder-7 (GAD-7),[24] a 7-item measure that assesses symptoms of GAD experienced over the past 2 weeks. A positive screen for significant GAD symptoms was defined by a score ≥ 10, which has a sensitivity of 0.89 and specificity of 0.82 in diagnosing GAD[24] (Cronbach α = .91).

Burnout. Burnout was assessed using the Single-Item Mini-Z Burnout Assessment, which is rated on a 5-point scale. The presence of burnout was indicated by a rating of 3 ("I am definitely burning out and have one or more symptoms of burnout, e.g., emotional exhaustion"), 4 ("The symptoms of burnout that I am experiencing won't go away. I think about work frustrations a lot"), or 5 ("I feel completely burned out. I am at the point where I may need to seek help"). The Mini-Z has been validated against the emotional exhaustion subscale of the Maslach Burnout Inventory,[25] with a correlation of 0.64 ($P < .001$).

Functional difficulties. The Brief Inventory of Psychosocial Functioning (B-IPF)[26] was used to assess functional impairment in 7 functional domains, including romantic relationships, family relationships, work, friendships and socializing, self-care, education, and parenting. Exploratory factor analysis of B-IPF items in the current sample revealed a 2-factor solution, with one factor containing items reflecting work difficulties (eg, "I had trouble at work"; factor loadings = 0.55–0.78; Cronbach α = .78) and relationship difficulties (eg, "I had trouble with my family relationships"; factor loadings = 0.51–0.80; Cronbach α = .79).

Data Analysis

Data analyses proceeded in 3 steps. First, we computed descriptive statistics to summarize sociodemographic, exposure, and clinical characteristics of the sample. Second, to identify individual COVID-19–related PTSD, MDD, and GAD symptoms associated with burnout and current work and relationship difficulties, we conducted 3 sets of multiple regression analyses (logistic regression for burnout, and linear regressions for work and interpersonal difficulties); age, gender, and profession (registered nurse [RN] vs other) were adjusted for in these analyses. Third, we conducted relative importance (RI) analyses using the R package Relaimpo[27] to assess the unique proportion of variance in burnout and work and relationship difficulties associated with each PTSD, MDD, and GAD symptom. These analyses partition the explained variance in a dependent variable that is explained by each independent variable while simultaneously accounting for intercorrelations among these independent variables. The LMG metric was used to estimate the relative importance of each PTSD, MDD, and GAD symptom by dividing the total R^2 into individual values of explained variance for each symptom, which sums to the total explained R^2. Bootstrapped 95% confidence intervals (10,000 samples) and P values of the RI coefficients were also computed to determine which PTSD, MDD, and/or GAD symptoms were significantly associated with burnout and work and relationship difficulties.

RESULTS

The total number of eligible participants included 6,026 presumed FHCWs, of which 3,360 (55.8%) completed the survey and 2,579 (76.8%) of whom endorsed directly treating patients with COVID-19 and provided sufficient responses to our outcome variables for analysis.

Sample Characteristics

A total of 1,322 (52.0%) workers were 25 to 34 years old; 2.5%, 35 to 44; 12.7%, 45 to 54; and 10.1%, 55 and older; 1,897 were female (73.6%), and 1,821 were married/partnered (70.6%). With regard to profession, 1,082 (42.0%) were RNs; 541 (21.0%), medical residents or fellows; 398 (15.4%), attending physicians; 394 (15.3%), physician assistants or advanced practice registered nurses; and 164 (6.4%), other (eg, social workers, psychologists, chaplains). The median number of years in practice was 6.0 (interquartile range [IQR] = 8.0), median number of hours working onsite was 37.5 (IQR = 10.3), and median number of COVID-19 patients treated was 30.0 (IQR = 48.0).

Prevalence of Positive Screens for COVID-19–Related PTSD, MDD, and GAD in Addition to Burnout

A total of 1,005 FHCWs (39.0%) screened positive for significant symptoms of COVID-19–related PTSD, MDD, or GAD; 599 (23.3%, 95% CI = 21.7%–25.0%) screened positive for COVID-19–related PTSD symptoms, 683 (26.6%, 95% CI = 24.9%–28.3%) for MDD symptoms, and 642 (25.0%, 95% CI = 23.3%–26.7%) for GAD symptoms. A total of 1,015 (39.4%, 95% CI = 37.6%–41.5%) FHCWs screened positive for burnout on the Mini-Z.

Multiple Regression Analyses

Table 1 shows results of regression analyses examining COVID-19–related PTSD, MDD, and GAD symptoms and their associations with burnout and work and relationship difficulties. Results revealed that PTSD symptoms of intrusive thoughts of the COVID-19 pandemic; MDD symptoms of feeling tired/having little energy, psychomotor disturbance, and feeling depressed, down, and hopeless; and GAD symptoms of being easily annoyed or irritable, feeling afraid that something awful might happen, and feeling nervous, anxious, and on edge were independently associated with burnout.

PTSD symptoms of intrusive thoughts of the COVID-19 pandemic, negative expectations of self/world, and exaggerated startle response; MDD symptoms of feeling tired/having little energy, feeling bad about oneself, trouble concentrating, and psychomotor disturbance; and GAD symptoms of trouble relaxing and being easily annoyed or irritable were independently associated with work difficulties.

Table 1. Results of Multivariable Regression Analyses of Associations Between COVID-19–Related PTSD, MDD, and GAD Symptoms and Burnout and Work and Relationship Difficulties in Frontline Health Care Workers[a,b]

	Mean (SD)	Range	Burnout (Nagelkerke $R^2 = 0.38$), OR (95% CI)	Work Difficulties (Adjusted $R^2 = 0.40$), β	Relationship Difficulties (Adjusted $R^2 = 0.34$), β
COVID-19–related PTSD symptoms	4.5 (4.0)	0–16			
Intrusive thoughts of COVID-19 pandemic	1.4 (1.2)	0–4	1.18 (1.05–1.33)**	0.05*	0.01
Avoidance of reminders of COVID-19 pandemic	1.3 (1.3)	0–4	0.99 (0.88–1.11)	−0.01	0.01
Negative expectations of self/world	0.9 (1.1)	0–4	1.09 (0.97–1.22)	0.14***	0.09***
Exaggerated startle response	0.9 (1.1)	0–4	0.94 (0.83–1.06)	0.05*	0.06**
MDD symptoms	6.7 (5.5)	0–24			
Feel down, depressed, hopeless	0.8 (0.9)	0–3	1.37 (1.16–1.63)***	0.04	0.06*
Loss of interest or pleasure in doing things	0.8 (0.9)	0–3	1.15 (0.98–1.36)	0.04	−0.02
Sleep difficulties	1.2 (1.0)	0–3	1.07 (0.94–1.21)	−0.04	0.04
Feeling tired/having little energy	1.4 (1.0)	0–3	1.69 (1.46–1.95)***	0.12***	0.06**
Appetite disturbance	1.1 (1.0)	0–3	0.96 (0.85–1.08)	0.04	0.06**
Feeling bad about oneself	0.5 (0.8)	0–3	1.07 (0.91–1.26)	0.08***	0.07**
Trouble concentrating	0.7 (0.9)	0–3	1.08 (0.92–1.26)	0.12***	0.06*
Psychomotor disturbance	0.3 (0.7)	0–3	0.76 (0.63–0.93)**	0.05*	0.07**
GAD symptoms	6.3 (5.4)	0–21			
Feeling nervous, anxious, on edge	1.3 (1.0)	0–3	1.40 (1.19–1.65)***	−0.03	−0.05
Not able to stop or control worrying	1.0 (1.0)	0–3	1.02 (0.85–1.21)	0.02	0.03
Worrying too much about different things	0.9 (1.0)	0–3	0.88 (0.74–1.04)	−0.02	−0.02
Trouble relaxing	1.0 (1.0)	0–3	1.12 (0.95–1.32)	0.08**	0.10**
Restlessness	0.5 (0.8)	0–3	0.99 (0.84–1.17)	−0.03	−0.04
Easily annoyed or irritable	0.9 (0.9)	0–3	1.68 (1.46–1.94)***	0.11***	0.16***
Feel afraid something awful might happen	0.9 (1.0)	0–3	0.82 (0.70–0.95)**	0.02	0.01

[a]N = 1,015 (39.4%) screened positive for burnout; mean work difficulties score = 21.3 (SD = 23.9; range, 0–100), mean relationship difficulties score = 22.0 (SD = 24.5; range, 0–100).

[b]Results are adjusted for age, gender, and profession (ie, registered nurse [RN] vs other): younger age (OR = 1.30, 95% CI = 1.07–1.58) was associated with greater likelihood of screening positive for burnout; younger age (β = .09, $P < .001$) and male gender (β = .06, $P < .001$) were associated with greater work difficulties; younger age (β = .05, $P = .005$), male gender (β = .07, $P < .001$), and non-RN profession (β = .04, $P = .039$) were associated with greater relationship difficulties.

*$P < .05$; **$P < .01$; ***$P < .001$ (significant associations).

Abbreviations: CI = confidence interval, GAD = generalized anxiety disorder, MDD = major depressive disorder, OR = odds ratio, PTSD = posttraumatic stress disorder.

PTSD symptoms of negative expectations of self/world and exaggerated startle response; MDD symptoms of feeling tired/having little energy, appetite disturbance, feeling bad about oneself, trouble concentrating, psychomotor disturbance, and feeling down, depressed, and hopeless; and GAD symptoms of trouble relaxing and being easily annoyed or irritable were independently associated with relationship difficulties.

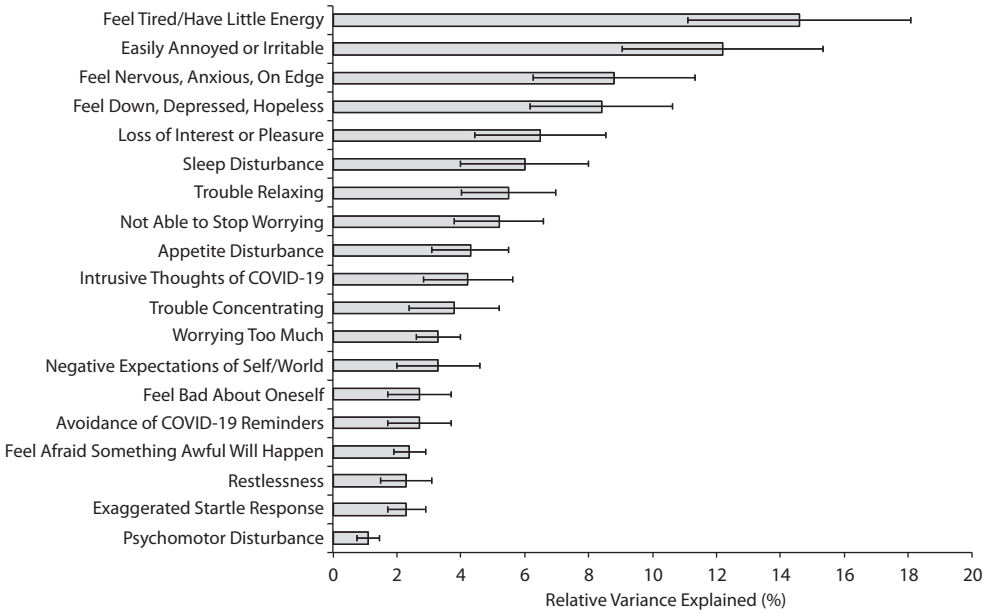
Relative Importance Analyses

Figure 1 shows results of relative importance analyses of PTSD, MDD, and GAD symptoms associated with burnout. Results revealed that the MDD symptoms of feeling tired/having little energy; feeling down, depressed, and hopeless; and loss of interest or pleasure and the GAD symptoms of being easily annoyed or irritable and feeling nervous, anxious, or on edge were the strongest predictors of burnout. Of all symptoms, feeling tired/having little energy showed the strongest association, accounting for > 15% of the total variance in burnout. Collectively, these 5 symptoms explained > 40% of the total variance in burnout. Secondary analyses that additionally incorporated total PCL4-5, PHQ-8, and GAD-7 scores into this analysis revealed that these scores explained only 2.8%, 5.1%, and 4.6% of the relative variance in burnout, respectively.

Figure 2 shows results of relative importance analyses of PTSD, MDD, and GAD symptoms associated with work difficulties. Results revealed that the PTSD symptom of having negative expectations of oneself or the world; the MDD symptoms of feeling bad about oneself, feeling tired and having little energy, and trouble concentrating; and GAD symptoms of being easily annoyed or irritable were the strongest predictors of work difficulties. Negative expectations of oneself or the world accounted for the greatest amount of explained variance (> 9%). Collectively, these 5 symptoms explained > 40% of the total explained variance in work difficulties. Secondary analyses that additionally incorporated total PCL4-5, PHQ-8, and GAD-7 scores into this analysis revealed that these scores explained only 4.0%, 5.0%, and 4.0% of the relative variance in work difficulties, respectively.

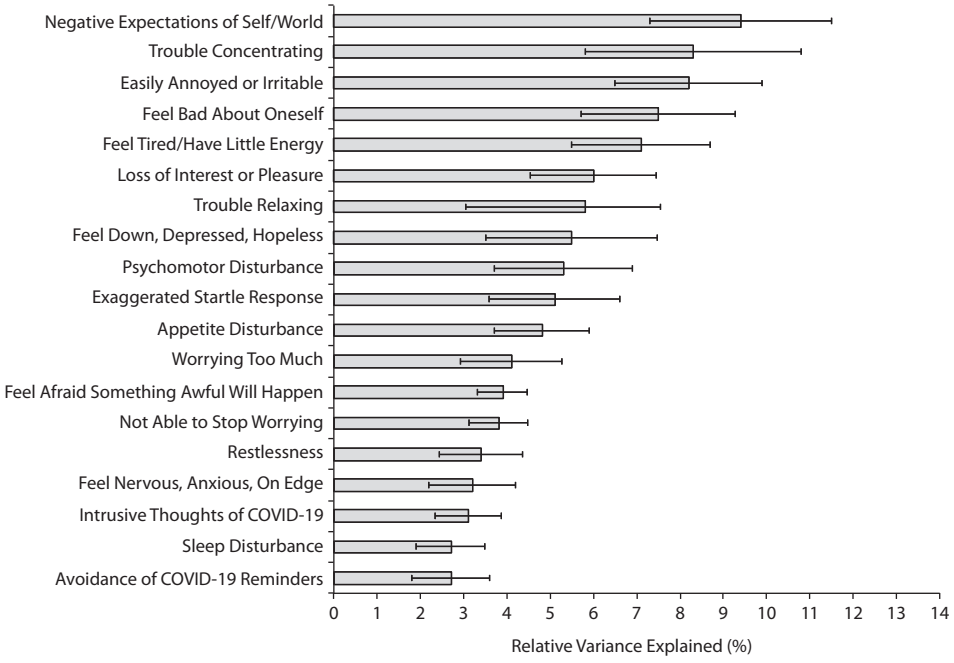
Figure 3 shows results of relative importance analyses of PTSD, MDD, and GAD symptoms associated with relationship difficulties. Results revealed that the GAD symptom of feeling easily annoyed or irritable, PTSD symptom of negative expectations of oneself or the world, and MDD symptoms of feeling bad about oneself, loss of interest or pleasure, and trouble concentrating were the strongest predictors of relationship difficulties. Feeling annoyed or irritable accounted for the most explained variance in relationship difficulties (> 10%). Collectively, these symptoms explained > 40% of the total explained variance in relationship difficulties. Secondary analyses that additionally incorporated total PCL4-5, PHQ-8, and

Figure 1. Results of Relative Importance Analysis of COVID-19–Related PTSD, MDD, and GAD Symptoms Associated With Burnout[a]



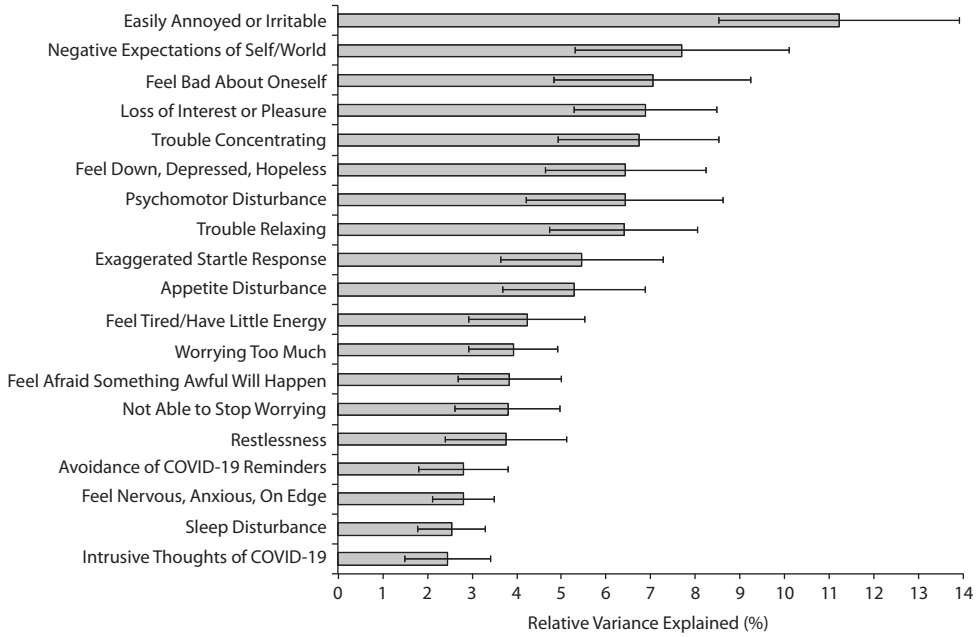
[a]Error bars represent 95% confidence intervals. Relative variance explained by age, gender, and profession was 1.8%, 0.9%, and 0.5%, respectively.
Abbreviations: COVID-19 = coronavirus disease 2019, GAD = generalized anxiety disorder, MDD = major depressive disorder, PTSD = posttraumatic stress disorder.

Figure 2. Results of Relative Importance Analysis of COVID-19–Related PTSD, MDD, and GAD Symptoms Associated With Work Difficulties[a]



[a]Error bars represent 95% confidence intervals. Relative variance explained by age, gender, and profession was 3.1%, 0.7%, and 0.2%, respectively.
Abbreviations: COVID-19 = coronavirus disease 2019, GAD = generalized anxiety disorder, MDD = major depressive disorder, PTSD = posttraumatic stress disorder.

Figure 3. Results of Relative Importance Analysis of COVID-19–Related PTSD, MDD, and GAD Symptoms Associated With Relationship Difficulties[a]



[a]Error bars represent 95% confidence intervals. Relative variance explained by age, gender, and profession was 1.2%, 1.4%, and 0.3%, respectively.
Abbreviations: COVID-19 = coronavirus disease 2019, GAD = generalized anxiety disorder, MDD = major depressive disorder, PTSD = posttraumatic stress disorder.

GAD-7 scores into this analysis revealed that these scores explained only 3.8%, 4.9%, and 4.3% of the relative variance in relationship difficulties, respectively.

DISCUSSION

To our knowledge, this study is the first to employ a transdiagnostic and symptomic approach to examining the association between symptoms of COVID-19–related PTSD, MDD, and GAD and clinically relevant outcomes in FHCWs responding to the COVID-19 pandemic. Using data from 2,579 NYC-based FHCWs working during the height of the spring 2020 pandemic surge in NYC, we observed unique associations between individual PTSD, MDD, and GAD symptoms and measures of burnout and work and relationship difficulties. Notably, these symptom-level associations explained more variance in these outcomes than total PTSD, MDD, and GAD symptoms, thus underscoring the importance of individual psychiatric symptoms as potential correlates/drivers of these outcomes.

In the current study, 2 of 5 FHCWs screened positive for significant COVID-19–related PTSD, MDD, and GAD symptoms, as well as burnout. These findings align with those of other studies examining the mental health impact of the COVID-19 pandemic on FHCWs in the United States, China, and other countries hard hit by the pandemic.[4–17] In addition, several of these symptoms, spanning diverse symptoms of COVID-19–related PTSD, MDD, and GAD, showed significant associations with burnout and work and relationship difficulties, with some of the same symptoms emerging as key correlates in all 3 of these outcomes. The fact that similar symptoms are associated with burnout, in addition to both work and relationship difficulties, illustrates the pervasive impact of these symptoms on the day-to-day lives of FHCWs during the acute aftermath of the pandemic surge in NYC.

Feeling tired/having little energy showed the strongest association with burnout, followed by being easily annoyed or irritable and feeling nervous, anxious, or on edge. This could be explained in part by higher work demands during the pandemic surge, sleep deprivation, and possible compassion fatigue, which is defined as physical or psychological distress that occurs as a consequence of an ongoing and demanding relationship with in-need individuals.[28] Compassion fatigue has been shown to be common in health care workers, particularly those that work in intensive care units,[29] and has also been linked to occupational burnout.[30] ICUs were initially over capacity early in the COVID-19 outbreak in NYC. Thus, compassion fatigue may have contributed to both feeling tired/having low energy and burnout.

Psychiatric symptoms that were most strongly associated with work and relationship functioning were somewhat similar, albeit to differing degrees. For example, the PTSD symptom of negative expectations of oneself and of the world was most strongly associated with work difficulties, followed by GAD symptoms of trouble concentrating and feeling easily annoyed or irritable. This finding may stem from the myriad of ethically difficult scenarios faced by these individuals as a result of the pandemic,[31] or perhaps that individuals did not feel prepared or trained for the clinical

duties expected of them during the pandemic. Moreover, having negative beliefs, which may include beliefs such as "I am bad" and "The world is completely dangerous," may influence the ability of FHCWs to work effectively, possibly leading to other occupational difficulties.

The GAD symptom of feeling easily annoyed or irritable was most strongly associated with relationship difficulties, followed by the PTSD symptom of negative expectations about oneself and the world and the MDD symptom of feeling bad about oneself. The association between being easily annoyed and irritable and relationship difficulties is consistent with research documenting the negative impact of anger and hostility on relationship satisfaction.[32] Thus, to the extent that working in a high-stress environment may influence one's relationships, this would be consistent with the notion of "work-family spillover," which is defined as cross-domain transmission of demands and consequent strain from one area of life to another.[33,34] Negative expectations and feeling bad about oneself may also stem from work-life integration challenges, such as being apart from loved ones for an extended period of time, fear of infecting loved ones, and feeling torn between work and family responsibilities during the pandemic surge, which may account for the strong association between these specific symptoms and relationship difficulties. Longitudinal studies are needed to disentangle directional associations among these variables.

Characterization of individual PTSD, MDD, and GAD symptoms that are associated with burnout and work and relationship difficulties is a novel approach that allows for a more nuanced understanding of specific symptoms linked to these outcomes. This information may help inform more personalized assessment, monitoring, and early intervention approaches in FHCWs working in areas highly affected by the pandemic. It may also help inform prevention strategies for FHCWs in other parts of the US experiencing surges in COVID-19 for the first time.[2]

At a broader level, results showing that symptoms spanning 3 disorders (ie, COVID-19–related PTSD, MDD, GAD) are associated with burnout and work and relationship difficulties support a transdiagnostic approach to the assessment, monitoring, and treatment of these symptoms and relevant clinical outcomes such as burnout and functional difficulties in FHCWs. For example, treatment approaches could be tailored to individuals depending on their symptom presentation and clinical needs. Although evidence-based treatments for PTSD, including prolonged exposure[35] and cognitive processing therapy,[36] are considered to be first-line treatment approaches, interventions that target specific symptoms could also be implemented as either stand-alone or adjunctive treatments. For example, anger management treatments[37] may be useful in targeting symptoms of irritability and anger as a way to possibly help mitigate relationship difficulties. Further, specific components of cognitive-behavioral interventions that focus on challenging maladaptive beliefs,[38] perhaps related to guilt or shame for difficulties in managing COVID-19 patients,[39] could be implemented to target negative beliefs about oneself and the world as a way to possibly mitigate the deleterious effect of such beliefs on work functioning. Moreover, organizational strategies aimed at managing workload, schedule rotations, and teamwork/transitions,[40] as well as psychological strategies to help promote sleep hygiene,[41] may help mitigate risk for burnout. Further research is needed to examine the extent to which personalized treatment approaches, in addition to organizational strategies, may help mitigate the negative impact of the COVID-19 pandemic on mental health and functional outcomes in FHCWs.

Limitations of the current study must be noted. First, the overall response rate was < 60%, and < 43% of the eligible sample endorsed directly treating patients with COVID-19 and provided sufficient responses for outcome measures. Thus, the extent to which the sample is representative of FHCWs is unclear, and results may under- or overrepresent the burden of psychiatric symptoms, burnout, and functional difficulties in this population. Second, the cross-sectional study design precludes conclusions regarding causality between how transdiagnostic psychiatric symptoms relate to burnout and functional difficulties. Third, all variables were assessed via self-report, and assessment of PTSD was limited to 4 symptoms specific to COVID-19. Future research that includes a more comprehensive assessment of all 20 PTSD symptoms in addition to other mental health variables (eg, substance use) would be important in more comprehensively elucidating symptom-level associations with clinically relevant outcomes in FHCWs. Other, more nuanced assessments of work (eg, work satisfaction, relationships with coworkers and supervisors) and more specific aspects of relationship functioning, in addition to broader psychosocial indices (eg, life satisfaction, quality of life), would also be important to examine in future work. In a related vein, burnout was assessed using a single-item measure. Further research using more comprehensive assessments of burnout-related symptomatology is needed to identify potentially more nuanced associations between psychiatric symptoms and different aspects of burnout (eg, emotional exhaustion, sense of professional accomplishment). Fourth, due to limitations related to privacy and the potential for participants to be identified, we did not assess race and ethnicity in this study. Further research is needed to examine the role of race/ethnic factors as potential moderators of associations between psychiatric symptoms and clinical outcomes of relevance in FHCWs, particularly in light of documented race/ethnic disparities of the pandemic's impact.[42,43]

These limitations notwithstanding, the current study adds to the emerging "psychiatric symptomics" literature[18,19] by examining how individual symptoms of PTSD, MDD, and GAD may be linked to clinical outcomes of high relevance to health care workers on the frontlines of the COVID-19 pandemic. This approach provides insight into how the more nuanced clinical manifestation of these disorders may shape risk for burnout as well as work and relationship difficulties during the acute phase of a large-scale traumatic

event. Further research using network analysis may be useful in further elucidating key psychiatric symptoms that drive the manifestation and maintenance of stress-related psychopathology in FHCWs and other populations affected by the COVID-19 pandemic.[44] Given the low response rates and burden associated with conducting lengthy surveys of FHCWs, particularly during an ongoing pandemic, further work is also needed to evaluate the utility and efficacy of more feasible approaches such as digital monitoring and interventions for mental health difficulties.[45–47] Finally, more research is needed to evaluate the generalizability of these results to other FHCWs in other areas of the US and across the world, identify longitudinal associations between individual psychiatric symptoms and measures of burnout and functioning, and evaluate the clinical utility of symptom-based approaches in assessment, monitoring, and treatment of mental health and functional difficulties in FHCWs and other trauma-affected populations.

Submitted: November 11, 2020; accepted February 22, 2021.

Published online: April 27, 2021.

Potential conflicts of interest: None.

Funding/support: This study was supported by internal funding devoted to COVID-19–related projects from the Icahn School of Medicine at Mount Sinai. Preparation of this report was supported in part by a Department of Veterans Affairs Clinical Science Research and Development Career Development Award (IK2 CX-001259-01; principal investigator: Dr Kachadourian) and the US Department of Veterans Affairs National Center for Posttraumatic Stress Disorder (Dr Pietrzak).

Role of the sponsor: None of the funding agencies had a role in the conduct or publication of the study.

REFERENCES

1. Federal Emergency Management Agency. (2020). President Donald J. Trump approves major disaster declaration for New York. HQ-20-019. https://www.fema.gov/news-release/20200723/president-donald-j-trump-approves-major-disaster-declaration-new-york. Published March 20, 2020. Accessed April 3, 2020.
2. Ripp J, Peccoralo L, Charney D. Attending to the emotional well-being of the health care workforce in a New York City health system during the COVID 19 pandemic. *Acad Med*. 2020;95(8):1136–1139.
3. Cai W, Lian B, Song X, et al. A cross-sectional study on mental health among health care workers during the outbreak of corona virus disease 2019. *Asian J Psychiatr*. 2020;51:102111.
4. Huang Y, Zhao N. Generalized anxiety disorder, depressive symptoms and sleep quality during COVID-19 outbreak in China: a web-based cross-sectional survey. *Psychiatry Res*. 2020;288:112954.
5. Li Z, Ge J, Yang M, et al. Vicarious traumatization in the general public, members, and non-members of medical teams aiding in COVID-19 control. *Brain Behav Immun*. 2020;88:916–919.
6. Li X, Yu H, Bian G, et al. Prevalence, risk factors, and clinical correlates of insomnia in volunteer and at home medical staff during the COVID-19. *Brain Behav Immun*. 2020;87:140–141.
7. Lu W, Wang H, Lin Y, et al. Psychological status of medical workforce during the COVID-19 pandemic: a cross-sectional study. *Psychiatry Res*. 2020;288:112936.
8. Xu J, Xu QH, Wang CM, et al. Psychological status of surgical staff during the COVID-19 outbreak. *Psychiatry Res*. 2020;288:112955.
9. Zhang W-R, Wang K, Yin L, et al. Mental health and psychosocial problems of medical health workers during the COVID-19 epidemic in China. *Psychother Psychosom*. 2020;89(4):242–250.
10. Yin Q, Sun Z, Liu T, et al. Posttraumatic stress symptoms of health care workers during the corona virus disease 2019. *Clin Psychol Psychother*. 2020;27(3):384–395.
11. Vindegaard N, Benros ME. COVID-19 pandemic and mental health consequences: systematic review of the current evidence. *Brain Behav Immun*. 2020;89:531–542.
12. Petzold MB, Bendau A, Plag J, et al. Risk, resilience, psychological distress, and anxiety at the beginning of the COVID-19 pandemic in Germany. *Brain Behav*. 2020;10(9):e01745.
13. Salopek-Žiha D, Hlavati M, Gvozdanović Z, et al. Differences in distress and coping with the COVID-19 stressor in nurses and physicians. *Psychiatr Danub*. 2020;32(2):287–293.
14. 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.
15. Matsuo T, Kobayashi D, Taki F, et al. Prevalence of health care worker burnout during the coronavirus disease 2019 (COVID-19) pandemic in Japan. *JAMA Netw Open*. 2020;3(8):e2017271.
16. Hu D, Kong Y, Li W, et al. Frontline nurses' burnout, anxiety, depression, and fear statuses and their associated factors during the COVID-19 outbreak in Wuhan, China: a large-scale cross-sectional study. *EClinicalMedicine*. 2020;24:100424.
17. Rossi R, Socci V, Pacitti F, et al. Mental health outcomes among frontline and second-line health care workers during the coronavirus disease 2019 (COVID-19) pandemic in Italy. *JAMA Netw Open*. 2020;3(5):e2010185.
18. Fried EI, Nesse RM. The impact of individual depressive symptoms on impairment of psychosocial functioning. *PLoS One*. 2014;9(2):e90311.
19. Kachadourian LK, Harpaz-Rotem I, Tsai J, et al. Posttraumatic stress disorder symptoms, functioning, and suicidal ideation in US military veterans: a symptomics approach. *Prim Care Companion CNS Disord*. 2019;21(2):18m02402.
20. Gray MJ, Litz BT. Behavioral interventions for recent trauma: empirically informed practice guidelines. *Behav Modif*. 2005;29(1):189–215.
21. Geier TJ, Hunt JC, Hanson JL, et al. Validation of abbreviated four- and eight-item versions of the PTSD Checklist for *DSM*-5 in a traumatically injured sample. *J Trauma Stress*. 2020;33(3):218–226.
22. Weathers FW, Litz BT, Keane TM, et al. The PTSD Checklist for *DSM-5* (PCL-5) Scale. National Center for PTSD US Dept of Veterans Affairs website. 2013. www.ptsd.va.gov
23. Kroenke K, Strine TW, Spitzer RL, et al. The PHQ-8 as a measure of current depression in the general population. *J Affect Disord*. 2009;114(1-3):163–173.
24. Spitzer RL, Kroenke K, Williams JBW, et al. A brief measure for assessing generalized anxiety disorder: the GAD-7. *Arch Intern Med*. 2006;166(10):1092–1097.
25. Rohland BM, Kruse GR, Rohrer JE. Validation of a single-item measure of burnout against the Maslach Burnout Inventory among physicians. *Stress Health*. 2004;20(2):75–79.
26. Marx BP, Schnurr PP, Lunney C, et al. The Brief Inventory of Psychosocial Functioning (B-IPF) [measurement instrument]. US Dept of Veterans Affairs website. https://www.ptsd.va.gov. 2019.
27. Grömping U. Relative importance for linear regression in R: the package Relaimpo. *J Stat Softw*. 2006;17(1):1–27.
28. Nimmo A, Huggard P. A systematic review of the measurement of compassion fatigue, vicarious trauma, and secondary traumatic stress in physicians. *Australas J Disaster Trauma Stud*. 2013;1:37–44.
29. van Mol M, Kompanje E, Bakker J, et al. Compassion fatigue and burnout among healthcare professionals in the ICU. *Crit Care*. 2014;18(suppl 1):19.
30. Meadors P, Lamson A, Swanson M, et al. Secondary traumatization in pediatric healthcare providers: compassion fatigue, burnout, and secondary traumatic stress. *Omega (Westport)*. 2009-2010;60(2):103–128.
31. Williamson V, Murphy D, Greenberg N. COVID-19 and experiences of moral injury in front-line key workers. *Occup Med (Lond)*. 2020;70(5):317–319.
32. Renshaw KD, Blais RK, Smith TW. Components of negative affectivity and marital satisfaction: the importance of actor and partner anger. *J Res Pers*. 2010;44(3):328–334.
33. Bolger N, DeLongis A, Kessler RC, et al. The contagion of stress across multiple roles. *J Marriage Fam*. 1989;51(1):175–183.
34. Westman M. Crossover of stress and strain in the work-family context. In: Jones F, Burke RJ, Westman M, eds. *Work-Life Balance: A Psychological Perspective*. East Sussex, England: Psychology Press; 2006.
35. Foa EB, Hembree EA, Cahill SP, et al. Randomized trial of prolonged exposure for posttraumatic stress disorder with and without cognitive restructuring: outcome at academic and community clinics. *J Consult Clin Psychol*. 2005;73(5):953–964.
36. Resick PA, Nishith P, Weaver TL, et al. A comparison of cognitive-processing therapy with prolonged exposure and a waiting condition for the treatment of chronic posttraumatic stress disorder in female rape victims. *J Consult Clin Psychol*. 2002;70(4):867–879.
37. Reilly PM, Shopshire MS. *Anger Management for Substance Abuse and Mental Health Clients: A Cognitive Behavioral Therapy Manual. Updated*. US Department of Health and Human Services, Substance Abuse and Mental Health Services Administration, Center for Substance Abuse Treatment; 2019.
38. Beck J. *Cognitive Therapy: Basics and Beyond*. Guilford; 1995.

39. Haller M, Norman SB, Davis BC, et al. A model for treating COVID-19-related guilt, shame, and moral injury. *Psychol Trauma*. 2020;12(S1):S174–S176.
40. Zhang X-J, Song Y, Jiang T, et al. Interventions to reduce burnout of physicians and nurses: an overview of systematic reviews and meta-analyses. *Medicine (Baltimore)*. 2020;99(26):e20992.
41. Zhou F-C, Yang Y, Wang Y-Y, et al. Cognitive behavioural therapy for insomnia monotherapy in patients with medical or psychiatric comorbidities: a meta-analysis of randomized controlled trials. *Psychiatr Q*. 2020;91(4):1209–1224.
42. Polyakova M, Udalova V, Kocks G, et al. Racial disparities in excess all-cause mortality during the early COVID-19 pandemic varied substantially across states. *Health Aff (Millwood)*. 2021;40(2):307–316.
43. McKnight-Eily LR, Okoro CA, Strine TW, et al. Racial and ethnic disparities in the prevalence of stress and worry, mental health conditions, and increased substance use among adults during the COVID-19 pandemic—United States, April and May 2020. *MMWR Morb Mortal Wkly Rep*. 2021;70(5):162–166.
44. Wang Y, Hu Z, Feng Y, et al. Changes in network centrality of psychopathology symptoms between the COVID-19 outbreak and after peak. *Mol Psychiatry*. 2020;25(12):3140–3149.
45. Pospos S, Young IT, Downs N, et al. Web-based tools and mobile applications to mitigate burnout, depression, and suicidality among healthcare students and professionals: a systematic review. *Acad Psychiatry*. 2018;42(1):109–120.
46. Drissi N, Ouhbi S, Marques G, et al. A systematic literature review on e-mental health solutions to assist health care workers during COVID-19 [published online September 22, 2020]. *Telemed J E Health*.
47. Cheng P, Casement MD, Kalmach DA, et al. Digital cognitive behavioral therapy for insomnia promote later health resilience during the coronavirus disease 19 (COVID-19) pandemic [published online November 29, 2020]. *Sleep*. .