The Impact of the COVID-19 Pandemic on Mental Health, Occupational Functioning, and Professional Retention Among Health Care Workers and First Responders

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BACKGROUND: The COVID-19 pandemic has greatly affected front-line health care workers (HCW) and first responders (FR). The specific components of COVID-19 related occupational stressors (CROS) associated with psychiatric symptoms and reduced occupational functioning or retention remain poorly understood.

OBJECTIVES: Examine the relationships between total and factored CROS, psychiatric symptoms, and occupational outcomes.

DESIGN: Observational, self-report, single time-point online assessment.

PARTICIPANTS: A total of 510 US HCW (N = 301) and FR (N = 209) with occupational duties affected by the COVID-19 pandemic.

MAIN OUTCOMES AND MEASURES: CROS were assessed using a custom 17-item questionnaire. Post-traumatic stress disorder (PTSD), depression, insomnia, and generalized anxiety symptoms were assessed using the PTSD Checklist-5 (PCL5), Patient Health Questionnaire-9 (PHQ9), Insomnia Severity Index (ISI), and General Anxiety Disorder-7 (GAD7). Respondents’ likelihood of leaving current field and occupational functioning were assessed with 2-item PROMIS subscales. Relationships were modeled using multivariable regression. Open-ended responses were coded using rapid template analysis.

RESULTS: CROS total scores correlated significantly with all four psychiatric symptom domains (Rs = .42–.53), likelihood of leaving one’s current occupation (R = .18), and trouble doing usual work (R = .28), all p’s < .001. Half of HCW indicated a decreased likelihood of staying in their current occupation as a result of the pandemic. CROS were fit to a 3-factor model consisting of risk, demoralization, and volume factors. All CROS factors were associated with psychiatric symptom burden, but demoralization was most prominently associated with psychiatric symptoms and negative occupational outcomes. Among psychiatric symptoms, PTSD symptoms were most strongly associated with negative occupational outcomes. Open-ended responses emphasized lack of protection and support, increased occupational demands, and emotional impact of work duties.

CONCLUSIONS AND RELEVANCE: These results demonstrate potentially treatable psychiatric symptoms in HCW and FR experiencing CROS, impacting both wellbeing and the health care system. Mitigating CROS, particularly by addressing factors driving demoralization, may improve HCW and FR mental health, occupational functioning, and retention.

KEY WORDS: COVID-19; PTSD; Occupational trauma; Insomnia; Professional retention.

INTRODUCTION

Health care workers (HCW) and first responders (FR) working during a pandemic experience a variety of acute and sustained stressors, including fear for their own safety and that of their colleagues and family, exposure to death and suffering, separations from family, and prolonged periods of exhaustion and vigilance. They may also experience demoralization1 related to inadequate support or seeing their contributions as ineffective. The impact of these types of experiences has been well documented in contexts such as military service, where both isolated and cumulative trauma exposure is strongly associated with high psychiatric symptom burden, as well as decreased occupational functioning and workplace participation3–4. Understanding how such occupational stressors affect HCW/FR is important to identify risks to HCW/FR and to our health care system, and develop strategies to reduce those risks5.

High rates of psychiatric symptoms have been documented in HCW working during the COVID-196–11 and prior
Pandemic-related stressors identified as potential risk factors include quarantine procedures, isolation from social supports, stigmatization, and infection risk\textsuperscript{12,13}. Less is known about the experiences of FR, despite exposure to similar pandemic-related stressors, often in less controlled environments. Consistent with the potential for high risks for this group, a survey of HCW and emergency medical services (EMS) workers in Italy during the COVID-19 pandemic found high levels of distress in both groups, but increased anger and regret, increased intrusiveness related to trauma, and decreased perception of self-efficacy in EMS relative to HCW\textsuperscript{16}.

Physical and emotional stressors among HCW/FR have also been associated with decreased professional longevity and poorer patient care\textsuperscript{17,18}. The potential for significant professional attrition of HCW related to the COVID-19 pandemic has been emphasized in abundant media reports\textsuperscript{19,20} as well as organizational surveys\textsuperscript{21}, and a review of medical leave in firefighters and emergency medical services (EMS) workers in New York early in the COVID-19 pandemic found increased use of medical leave, leading to decreased workforce availability\textsuperscript{22}. However, little published data are available regarding the factors driving or modulating the risk of increased attrition or decreased occupational functioning among HCW/FR during the COVID-19 pandemic.

To address these gaps, we conducted an observational, cross-sectional study among HCW (clinical and support staff) and FR (EMS, fire, and law enforcement officers [LEO]) working in the USA during the COVID-19 pandemic. The goal of this study was to characterize and assess associations among COVID-19-related occupational stressors (CROS), psychiatric symptoms (depression, anxiety, insomnia, and post-traumatic stress disorder [PTSD]), and self-reported functional impairment and likelihood of leaving one’s current field. CROS were quantified as a total score and by factor analysis, to identify specific types of CROS and their potential for differential impact. It is hoped that a better understanding of these relationships will facilitate the development of targeted interventions to protect HCW and FR even during periods of increased risk and workload.

**METHODS**

The study was approved by the VA Puget Sound Health Care System Human Subjects Committee. Prior to enrollment, all participants were provided an information statement that detailed the purpose, risks, benefits, and alternatives to participation.

**Participants**

A convenience sample of 510 participants was recruited through targeted outreach and paid advertising on Facebook between September 15, 2020, and February 7, 2021. Targeted outreach included large and COVID-focused HCW Facebook groups and emails to professional organizations (e.g., unions) and list-serves. Participants were asked to self-attest that they were a HCW or FR who provided professional services affected by the COVID-19 pandemic. The sample for the present study includes 301 HCW (60 physicians, 188 RN/LPN) and 200 FR (162 EMS, 54 firefighters, and 19 law enforcement officers [LEO]). LEO and firefighters were merged for subgroup analyses below, and individuals reporting dual EMS and LEO/firefighting roles were categorized under LEO/fire.

Responses spanned 47 states and 445 zip codes, with broad distribution across the rural–urban continuum\textsuperscript{23} (Supplementary Fig. 1).

**Procedures**

Self-report assessments were collected using Qualtrics. To encourage broad and representative participation, participants were not required to provide their legal name and were able to skip questions. Email addresses were collected to allow longitudinal follow-up for up to 9 months. Compensation was not provided. Data presented represent an analysis of the baseline survey only, except for the free-text response analysis. In order to include more respondents’ perspectives to this optional item, and a broader range of themes, free-text responses from any time point during the same calendar period were included in this analysis.

**Measures**

**COVID-19 Related Occupational Stressors.** Exposure to CROS was assessed using a measure designed for this study by a collaborative team of physicians working in New York City hospitals and emergency rooms in March and April 2020 and our research team (Appendix A). This instrument asks four yes/no questions about personal experiences of loss due to COVID-19, and 13 questions assessing the frequency over the past 2 weeks of caring for individuals with COVID-19, perceiving increased risk to self or family due to occupational exposure to COVID-19, experiences of patient suffering related to the impacts of COVID-19, inadequate support or protection related to COVID-19, and feeling unable to provide effective or adequate care due to COVID-19, with responses scored 0–3. The 13-Likert scale items were summed to provide a CROS total score, while the initial 4 yes/no questions were used to characterize the sample and as covariates in multivariable regression models. Following this structured assessment, participants were asked an optional open-ended item, “Is there anything else you would like to share with us that is increasing your stress from your occupational duties?”.

**Psychiatric Symptoms and Prior Trauma Exposure.** Psychiatric symptoms were assessed using the Patient Health Questionnaire 9-item (PHQ9)\textsuperscript{24}, the Generalized Anxiety Disorder 7-item (GAD7)\textsuperscript{25}, the Insomnia Severity Index (ISI)\textsuperscript{26}, and the PTSD Checklist for DSM-5 (PCL5)\textsuperscript{27}. Prior trauma history was assessed using the Life Events Checklist\textsuperscript{28}; a numerical index of prior trauma exposure was calculated using
items selected a priori as those most likely to meet criterion A of PTSD (items 7–8, 11, and 14–16), and constituted the sum of items a participant reported they had witnessed or experienced.

**Occupational Outcomes.** Functional impairment was assessed using the two work-related items from the PROMIS Short Form v2.0 Ability to Participate in Social Roles and Activities measure, modified to focus on occupational work (Supplemental Table 1). The likelihood of leaving one’s current profession was assessed with two items: “How likely do you think it is that you will still be working in your current field in 5–10 years?” and “How have your experiences providing care during the COVID-19 pandemic affected your interest, willingness, or ability to continue working in your current field?”

**Data Analysis**

Data were analyzed using R and RStudio. Correlation coefficients were implemented using the stat_cor function from ggpubr. Pearson’s R was used for variables representing scale totals, while Spearman’s correlation coefficients were used when one or more of the variables represented a single ordinal item or the sum of two ordinal items. Figures were created using ggplot2 and jtools, tables using flextable. For all analyses, we selected a p value of < 0.05 to determine statistical significance. Participants with missing data were excluded from analyses using items or measures with missing data. Missingness ranged from 2.8 to 30% (Supplementary Table 2). Most missing data represented partial survey completers rather than missing items, so no data were imputed. Completers of the instruments that came later in the survey (e.g., GAD7, PHQ9) were more likely to be married, physicians, to have had COVID, and to report a higher number of prior trauma exposures.

Characterization and factor analysis of the CROS was implemented using psych and psychTools. Cronbach’s alpha was 0.88 (CI 0.86–0.9), indicating strong internal consistency. Following the scree plot (Supplemental Fig. 2), a 3-factor solution was chosen. Using varimax rotation produced a solution with mean item complexity of 1.5 and RMSR of 0.04. These data-driven factors emphasized 3 conceptually coherent, face-valid domains (Fig. 1). Items characterizing a total

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**Fig. 1 Factor analysis of COVID-19-related occupational stressors (CROS).** Results of a 3-factor analysis of COVID-19 exposure items into 3 factors, termed volume, demoralization, and risk, based on an interpretation of their most highly weighted items. Color shading is proportional to the numeric weight on each cell, and indicates the weight that item contributes to the factor below. See Appendix A for complete wording of CROS items.
volume of COVID-19-related care delivered were most heavily weighted by factor 1, which was termed the “volume” factor. Factor 2 most heavily weighted items addressing the ability to provide high quality and effective care to all patients, being asked to take unnecessary risks, or being unsupported by one’s workplace; this factor was termed the “demoralization” factor. The third factor most heavily weighted one’s personal risk or one’s family’s risk of contracting COVID-19, termed the “risk” factor.

Multivariable linear regression models were implemented using rjma,35 with either continuous CROS factor scores or continuous psychiatric symptom domain scores as the predictor variables. All multivariable models included age and gender as covariates. For models characterizing the relationship of CROS factors to psychiatric symptoms and occupational outcomes, an index of prior trauma exposure, personal history of COVID-19 infection, history of COVID-19 infection in a family member, and death of a family member or close colleague due to COVID-19 were additionally included as covariates.

Analysis of free-text responses was carried out using a rapid template qualitative analysis, an established rapid analysis method ideally suited for pragmatically describing textual data (e.g., the restricted range and fragmented text for this single open-ended questionnaire item).36,37 A coding template summarizing broad “codes” was initially developed by the senior qualitative analyst from reading a random sample of responses. Initial codes were then applied independently by two coders. Codes were updated as needed when discrepancies or lack of clarity occurred. Discrepancies were resolved until an intercoder agreement was reached. Responses were excluded if they were not related to COVID (n = 1) or were redundant responses by the same respondent across assessments (n = 2).

Initial coding was done with the combined HCW and FR sample to identify relevant themes. We then performed stratified counts and identified issues most salient to HCW or FR; i.e., if an overrepresented proportion of that occupational category endorsed a theme, defined as > 5% higher than would be expected given the overall proportion of open-ended respondents from that occupational group.

RESULTS

Table 1 presents sample characteristics, including demographic, CROS scores, psychiatric symptoms, and outcome assessments, for the entire sample and stratified by subgroups. In addition to comparing HCW and FR, sufficient respondents from the subgroup physicians, nurses, LEO plus fire, and EMS were present to analyze these groups independently. In general, responses were similar for HCW and FR, including similar scores on CROS measures. However, nurses scored significantly higher than physicians on both total exposure (CROS total, p < 0.01) and most psychiatric symptoms domains (PTSD, depression and insomnia p < 0.01, thoughts of suicide or self-harm p = 0.04). Similarly, CROS total was significantly higher for EMS versus LEO/fire (p < 0.01), as were symptoms of depression (p < 0.01). Fewer FR (40.6%) than HCW (55%) reported experiences working during the pandemic had decreased their likelihood of remaining in their current field (p = 0.004).

Bivariate Relationship of CROS Total Score to Psychiatric Symptoms and Occupational Outcomes

Figure 2 presents bivariate associations between demographic variables, exposure scores, and psychiatric symptom scores. Of the psychiatric symptom domains, the CROS total was most strongly correlated with the PCL5 (R = 0.52) but was also significantly associated with the PHQ9 (R = 0.44), ISI (R = 0.41), and GAD7 (R = 0.43, all p < 1e-15). CROS total also was significantly correlated with thoughts of suicide or self-harm (R = 0.25, p < 1e-5), problems completing work tasks (R = 0.28, p < 1e-8), and likelihood of leaving field (R = 0.18, p < 0.001). For the subgroup that reported at least moderate insomnia symptoms and was asked about the impact of sleep problems on functioning at work (N = 367), CROS total was significantly related to reported impact of sleep problems on work performance (R = 0.37, p < 1e-11).

Multivariable Relationships of the 3 CROS Factors to Psychiatric Symptoms and Occupational Outcomes

We conducted a series of multivariable linear regression models. The relationships of CROS factors to psychiatric symptoms across all respondents are presented in Fig. 3A, and by subgroup in Supplemental Fig. 3. These models found that all 3 CROS factors were significantly and positively related to all 4 psychiatric symptom domains. Across all participants and for both HCW and FR, the demoralization factor was the strongest correlate of PTSD (HCW β = 0.37, FR β = 0.59), depression (HCW β = 0.30, FR β = 0.5) and anxiety symptoms (HCW β = 0.29, β = 0.42, all p < 0.0001). The relationships were similar across the four small subgroups (physicians, nurses, LEO + fire, and EMS) with the exception that for LEO + fire, the volume factor was as or more strongly associated with these outcomes than demoralization (β = 0.58 GAD7, β = 0.47 PTSD, β = 0.44, all p < 0.01). For insomnia symptoms, the demoralization factor was strongly associated with symptom intensity for physicians (β = 0.41, p < 0.05) and EMS (β = 0.35, p < 0.01), while the risk factor was associated with symptom intensity for nurses (β = 0.36, p < 0.01).

Across all respondents, thoughts of suicide or self-harm were significantly and positively related to both the volume
Table 1 Sample Demographics, COVID-19-Related Occupational Stressors (CROS), Psychiatric Symptoms, and Functional Outcome Measures

| Demographics                          | All HCW | Physician | Nurse | All FR | LEO or fire | EMS |
|---------------------------------------|---------|-----------|-------|--------|-------------|-----|
| Age, years (mean ± SD)                | 41.3 ± 10 | 42.3 ± 10 | 42.9 ± 11 | 39.6 ± 11 | 44.0 ± 11 | 36.8 ± 10 |
| Education, years (mean ± SD)          | 15.8 ± 3.1 | 16.3 ± 3.2 | 20.4 ± 2.0 | 14.4 ± 2.4 | 14.1 ± 3.1 | 14.6 ± 1.9 |
| Married, %                            | 57.8% (301/510) | 63.2% (139/218) | 56.7% (76/134) | 50.0% (68/136) | 62.5% (119/190) | 39.7% (31/78) |
| Veteran, %                            | 9.1% (46/510) | 5% (11/220) | 7.4% (10/134) | 16.1% (22/136) | 14.1% (31/219) | 9.0% (7/78) |
| COVID-19 exposure assessment          |        |           |       |        |             |     |
| Had Covid                             | 35.6% (180/508) | 30.2% (62/207) | 38.8% (23/60) | 34.8% (57/164) | 44.4% (77/175) | 44.1% (45/102) |
| Family member Covid                   | 24.5% (123/506) | 25.4% (53/210) | 27.3% (17/60) | 35.4% (57/164) | 38.9% (68/175) | 44.1% (45/102) |
| Close death from Covid                | 22.4% (99/449) | 21.9% (59/269) | 26.1% (43/165) | 21.5% (43/197) | 20.8% (21/101) | 20.8% (21/101) |
| Medical condition increasing risk     | 41.1% (180/438) | 39.8% (104/261) | 45.6% (73/160) | 42.1% (72/171) | 37.1% (23/65) | 42.6% (43/102) |

| Psychiatric Symptoms and Functional Outcome** |
|-----------------------------------------------|---------|-----------|-------|--------|-------------|-----|
| PTSD (PCL5 total)                             | 27.7 ± 18.4 | 28.2 ± 18 | 19.5 ± 15.2 | 26.6 ± 19 | 24.3 ± 20 | 28.1 ± 18.9 |
| % clinical range (≥ 31)                      | 37.8% (152/402) | 38.8% (94/242) | 42.3% (63/149) | 36.4% (56/154) | 36.1% (22/61) | 36% (31/86) |
| Depression (PHQ9)                             | 9.9 ± 6.6 | 9.6 ± 6.2 | 6.1 ± 4.7 | 10.2 ± 7.1 | 7.9 ± 7.1 | 11.7 ± 6.7 |
| % clinical range (≥ 5)                        | 73.9% (264/357) | 74.1% (160/216) | 51% (26/51) | 73% (100/137) | 56.6% (30/53) | 83.3% (65/78) |
| Insomnia (ISI total)                           | 12.3 ± 5.6 | 12.2 ± 5.5 | 9.0 ± 5.3 | 12.3 ± 5.7 | 11.5 ± 6.1 | 12.7 ± 5.5 |
| % clinical range (≥ 15)                       | 35.1% (174/496) | 35% (103/294) | 39.6% (72/182) | 34.4% (67/195) | 33.3% (24/72) | 34.8% (40/115) |
| GAD7 total                                     | 9.3 ± 6.1 | 9.6 ± 6.0 | 7.9 ± 5.6 | 8.8 ± 6.3 | 7.6 ± 6.5 | 9.7 ± 6.2 |
| % clinical range (≥ 5)                        | 74.7% (274/367) | 75.8% (169/223) | 75.9% (104/137) | 72.7% (101/137) | 61.8% (33/54) | 79.7% (63/79) |
| Thoughts of suicide or self-harm (PHQ #9)      | 15.3% (55/363) | 12.4% (27/218) | 3.9% (2/51) | 19% (26/137) | 13.2% (7/53) | 24.4% (19/78) |
| Decreased likelihood remaining in field        | 49.3% (215/436) | 55% (143/260) | 46.4% (26/56) | 40.6% (69/170) | 39.5% (23/64) | 43.9% (43/98) |
| Trouble completing work tasks                 | 18.5% (80/436) | 21.2% (55/259) | 17.9% (10/56) | 14.3% (24/168) | 15.9% (10/63) | 12.2% (12/98) |

* Responses are indicated as the percent responding positively (the 4 binary response items) or the mean ± SD (the 13 individual Likert scale items, range 0–3); total exposure score represents the sum of the 13 Likert scale items (range 0–39).

** Psychiatric symptom and functional outcome characterization: mean ± SD of measure totals for PCL5 PTSD Checklist for DSM5, PHQ9 Patient Health Questionnaire 9-item (depression symptoms), ISI Insomnia Severity Index, GAD7 Generalized Anxiety Disorder 7-item.
factor and the demoralization factor, as well as to prior trauma history (Fig. 3B and Supplemental 3B). On subgroup analysis, this pattern was maintained for nurses and EMS, but not for physicians (no significant predictors) or LEO + fire (volume factor $\beta = 0.95$, $p < 0.001$).

In examining the relationship of CROS factors to occupational outcome measures across all respondents, only the demoralization factor was significantly related to the likelihood of leaving one’s current field or problems completing work-related tasks. This pattern was preserved across subgroups, with the exception that for LEO + fire demoralization was significantly related to the likelihood of leaving one’s field ($\beta = 0.52$, $p < 0.01$) but not to occupational functioning, while for EMS demoralization was significantly related to occupational functioning ($\beta = 0.55$, $p < 0.001$) but not the likelihood of leaving one’s field.

**Relationship of Psychiatric Symptom Domains to Functional Outcome Measures and Suicidality**

The relationship of psychiatric symptom domains (PTSD, anxiety, depression, and insomnia) to functional outcome measures and thoughts of suicide or self-harm were similarly characterized (Fig. 3C and Supplemental 3C). Across all participants, PTSD symptom severity was significantly related to the likelihood of leaving one’s current field, trouble completing work tasks, and thoughts of self-harm or suicide. In addition, older age had a significant positive relationship to the likelihood of leaving one’s current field, and depression symptoms were significantly and positively related to thoughts of self-harm or suicide. However, based on subgroup analyses, the relationship of PTSD symptoms to the increased likelihood of leaving one’s current field was driven most strongly by nurses ($\beta = 0.41$, $p < 0.01$) and LEO + fire ($\beta = 0.74$, $p < 0.05$), while the relationship of PTSD to occupational functioning was driven most strongly by physicians ($\beta = 0.67$, $p < 0.05$) and EMS ($\beta = 0.43$, $p < 0.01$). Interestingly, for LEO + fire, anxiety symptoms were strongly and positively associated with thoughts of suicide or self-harm ($\beta = 1.2$, $p < 0.001$) but strongly and negatively associated with thoughts of leaving one’s field ($\beta = 0.91$, $p < 0.01$).

**Qualitative Analysis of Free-Text Responses**

Over one-third of participants (36% of total, 37.5% of HCW and 32.4% of FR) responded to the optional, open-ended question about sources of occupational stress during the COVID-19 pandemic, with an average response length of 31 words (range: 1–169). Responses vividly conveyed the
Fig. 3 Relationships between different factors of COVID-19-related occupational stressors (CROS factors), psychiatric symptom expression, and functional outcomes. Results of multivariable regression models relating CROS factors and covariates to psychiatric symptom clusters (A) and functional outcome measures along with thoughts of suicide or self-harm (B). C Results of independent multivariable regression models relating symptom clusters as measured by total scores on the PCL5, PHQ9, GAD7, and ISI, along with covariates of age and gender, to functional outcome measures.
Table 2 Thematic Analysis of Free-Text Responses

| Category | Total Responses | HCW | FR | Other |
|----------|----------------|-----|----|-------|
| Poor Communication, Planning, and Leadership | 20 | 65% | 35% |
| Lack of Protection and Support | 41 | 61% | 34% | 5% |
| Increased Demands | 38 | 84% | 16% |
| Staffing Shortages | 29 | 83% | 17% |
| Fear of or enacted reprisal from leaders | 7 | 57% | 43% |
| Betrayal by Colleagues | 10 | 60% | 40% |
| Betrayal by Society | 28 | 71% | 29% |
| Emotional Toll of Self | 29 | 67% | 33% |
| Concern for the Well-being of Others | 24 | 58% | 38% |
| Financial Impacts | 16 | 69% | 31% |

We determined responses as being overrepresented when the proportions of respondents who endorsed the item deviated by > 5% from the occupational category’s representation in the open-ended text responses (i.e., 67% HCW, 31% FR, and 2% other). For example, if 73% of a theme was endorsed by HCW, it was considered overrepresented, and thereby uniquely relevant to that occupational group.

challenges faced by HCW and FR and the magnitude of associated distress. A rapid template analytic approach identified 12 overarching codes within respondent data, which are described, along with illustrative quotes in Table 2.

Overall, responses were highly consistent with the quantitative analyses above. Among the 12 identified codes, “Lack of Protection and Support,” “Increased Demands,” and “Emotional Toll” were the most common. Respondents described their work during COVID-19 as involving “some of the saddest death stories” they had experienced and feeling “spread thin and exhausted.” Notable for a relative lack of representation were comments addressing respondents’ personal risk of COVID-19 infection, with most references to this type of risk taking the form of concern for the impact of this risk on others.

HCWs were overrepresented (> 5% deviation) in categories “staffing shortages,” “increased demands,” and “patient care.” FRs were overrepresented in “fear of or enacted reprisal from leaders,” “concern for the well-being of others,” and “betrayal by colleagues.” HCW and FR were represented in all categories.
DISCUSSION

Our findings are consistent with previous demonstrations of high levels of psychiatric symptoms and distress in HCW working during the COVID-19 pandemic. In the present study, a quantitative measure of CROS was associated with psychiatric distress. The relationships remained significant when HCW and FR were analyzed independently and when a quantitative measure of exposure to prior traumatic stressors was included as a covariate, suggesting the high rates of psychiatric symptoms are unlikely to represent baseline rates in this population independent of COVID-19-related occupational stressors.

The overall magnitude of most relationships identified was similar, or sometimes greater, in FR vs. HCW. This was particularly striking and concerning regarding thoughts of suicide or self-harm, reported by 19% of FR and 12% of HCW and strongly related to CROS. Given prior work demonstrating high trauma exposure and psychiatric symptoms in FR, including high rates of both suicidal thoughts and behaviors, particularly in EMS, results highlight the importance of addressing the impact of working during a pandemic on FR. Similarly, findings underscored the higher CROS exposure and psychiatric distress in nurses as compared with physicians, building on prior work finding increased distress, suicidal ideation, and suicidal behavior specifically in nurses.

A substantial proportion of both HCW and FR reported their likelihood of staying in their current field had been somewhat or significantly decreased by their experiences working during the COVID-19 pandemic and that they at least sometimes had difficulty completing work-related tasks. These results are consistent with and build upon findings from previous pandemics and are particularly worrisome given existing concerns about current and future shortages in the health care workforce. The present study suggests healthcare staffing shortages are in and of themselves a critical intervention component and are particularly effective and cost-efficient approach.

Among psychiatric symptom domains, PTSD symptoms stood out for both the strength of their relationship with overall COVID-19-related occupational stressors, and as the symptom domain most related to adverse occupational outcomes. Along with depression symptoms, PTSD symptoms were also significantly related to thoughts of suicide or self-harm. This suggests that the identification and implementation of interventions to reduce the risk of PTSD in HCW and FR should be a top priority. Moreover, PTSD symptoms may be particularly important to detect and treat in HCW and FR. Broadly implemented strategies to reduce risk and strengthen resilience while proactively identifying and providing accessible, confidential care for those who require more intensive services, maybe a particularly effective and cost-efficient approach.

The current work has limitations. Our results highlight the significant variety of experiences of HCW and FR working during the COVID-19 pandemic and the importance of these differences for outcomes. However, our data do not include a detailed assessment of factors related to financial resources, family obligations, or position and influence within one’s specific field or the health care system more broadly, each of which are likely to interact with many of the factors explored here. Follow-up studies of the persistent impacts of working during previous pandemics underscore the need for longitudinal follow-up of the affected workforce, and further work following the impact of CROS on psychiatric symptom burdens and occupational functioning over time will be important. The work relies upon participants’ self-report of exposure history, workplace experiences, and psychiatric symptoms, which may result in same source bias. The survey instrument was long, and some participants did not complete all instruments. In addition, the study used targeted outreach and paid advertising targeting regions with high rates of COVID-19 cases. The results obtained from the current sample may not reflect rates in all health care workers, nationally or...
internationally. At the same time, the broad geographic and rural/urban diversity of study respondents is a strength, particularly given the geographic variability in pandemic intensity and community response.

Finally, the relationships characterized are observational and cross-sectional, and cannot be assumed to represent unidirectional, causal relationships. For example, PTSD symptoms were found to be strongly associated with suicidality and negative occupational outcomes. This suggests that prevention and/or treatment of PTSD symptoms may decrease the risk of suicidal behavior and improve functioning and workforce retention. However, this hypothesis will need to be tested in a prospective trial.

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**Author Contribution** RCH designed the study, with input from RAS, BPC, CAM, and MAR. RCH supervised the implementation of the study, with RAS playing a significant role in all implementation steps. RCH carried out the analysis of all results with consultation by RGT, with the exception of the thematic analysis of free-text responses which was carried out by KDH and GRM. RCH wrote the initial draft of the manuscript, with contributions from RAS, KDH and MAR. All authors provided input into the interpretation of the analysis and the drafting of the manuscript.

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Data Sharing: Deidentified data sets may be requested by contacting the corresponding author.

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