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Research paper

Prevalence and correlates of stress and burnout among U.S. healthcare workers during the COVID-19 pandemic: A national cross-sectional survey study

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ABSTRACT

Background: COVID-19 has put extraordinary stress on healthcare workers. Few studies have evaluated stress by worker role, or focused on experiences of women and people of color.
Methods: The "Coping with COVID" survey assessed US healthcare worker stress. A stress summary score (SSS) incorporated stress, fear of exposure, anxiety/depression and workload (Omega 0.78). Differences from mean were expressed as Cohen's d Effect Sizes (ESs). Regression analyses tested associations with stress and burnout.
Findings: Between May 28 and October 1, 2020, 20,947 healthcare workers responded from 42 organizations (median response rate 20%, Interquartile range 7% to 35%). Sixty one percent reported fear of exposure or transmission, 38% reported anxiety/depression, 43% suffered work overload, and 49% had burnout. Stress scores were highest among nursing assistants, medical assistants, and social workers (small to moderate ESs, $p < 0.001$), inpatient vs outpatient workers (small ES, $p < 0.001$), women vs men (small ES, $p < 0.001$), and in Black and Latinx workers vs Whites (small ESs, $p < 0.001$). Fear of exposure was prevalent among nursing assistants and Black and Latinx workers, while housekeepers and Black and Latinx workers most often experienced enhanced meaning and purpose. In multilevel models, odds of burnout were 40% lower in those feeling valued by their organizations (odds ratio 0.60, 95% CIs [0.58, 0.63], $p< 0.001$).
Interpretation: Stress is higher among nursing assistants, medical assistants, social workers, inpatient workers, women and persons of color, is related to workload and mental health, and is lower when feeling valued.

1. Introduction

As the United States (US) surpasses 28 million COVID-19 cases and 515,000 deaths as of March 4th, 2021, many healthcare workers continue to be overloaded by work associated with caring for COVID-19 patients. Burnout among healthcare workers is not a newly recognized crisis [1], and is associated with higher rates of anxiety, depression, and substance abuse [2]. Globally, COVID-19 has presented unique challenges, leading to increased mental health issues among healthcare workers. Studies from China and Italy have illustrated these consequences and cautioned of long-term sequelae [3,4].

While the stress and mental health impacts of COVID-19 have predominantly been evaluated within specialties and single institutions in the US [5–7], few studies have used large, diverse, and multi-institution samples [8]. Attention on doctors and nurses as "healthcare heroes" has remained high, yet little focus has been allocated to other healthcare team members comprising 80% of the workforce [9]. For example, nursing assistants and respiratory therapists provide expertise on the frontlines and are at high risk of exposure [10]. Previous work has shown increased risk among non-White patients [11–13] and healthcare workers [8,14,15] for contracting COVID-19. While reports from the US Centers for Disease Control have

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Research in context

Evidence before this study

We searched PubMed for articles published between January 1, 2020 and February 1, 2021 using the Boolean search terms: (("healthcare workers" OR "clinicians") AND ("stress" OR "burnout" OR "distress") AND ("COVID-19″ OR "sars cov 2″)). While studies in many countries have evaluated COVID-related stress and burnout, few studies have been published across multiple institutions, multiple worker roles, and using large diverse samples including women and racially minoritized workers.

Added value of this study

In 20,947 healthcare workers in 42 organizations across the United States between May 28, 2020 and October 1, 2020, we found higher levels of stress and burnout in both clinical and non-clinical staff, including nursing assistants, medical assistants, housekeeping, and social workers. Higher stress scores were observed in female and racially minoritized workers. Fear of exposure to and transmission of COVID-19, mental health concerns, and work overload were associated with stress and burnout, while a sense of feeling valued was associated with improved outcomes.

Implications of all the available evidence

Understanding mediators of stress and burnout (i.e., fear, mental health, and work overload), and the potential mitigator of feeling valued may allow organizations to address these worklife factors and cultivate wellness among their healthcare workers.

illustrated increased prevalence of COVID-related mental health conditions among essential workers and Black and Hispanic people [16], no large-scale national study has characterized how stress from COVID-19 has impacted US healthcare workers, particularly those from racially and ethnically minoritized backgrounds.

Our study aims to provide a comprehensive view of how stress and burnout during the pandemic have impacted healthcare team members. We hypothesized stress would be higher among inpatient workers, such as nurses, respiratory therapists, nursing assistants, and housekeeping. Additionally, we suspected prevalence of self-reported psychological symptoms (i.e. anxiety and depression) would be high among all providers and highest among racially and ethnically minoritized workers. Finally, we anticipated that fear of exposure and transmission would be highest among minoritized staff.

2. Methods

2.1. Study design and participants

The Coping with COVID study has been described in detail elsewhere [17]. In brief, a US national survey was administered by multiple healthcare organizations at no cost beginning April 2020. Registration was available at a public website and open to organizations with > 100 physicians. At first, organizations were sampled via invitation from the American Medical Association (AMA). This invitation initially went out in March 2020 to 104 organizations; "word of mouth" communications added many other organizations. Because enrollment was on a rolling basis, 12 organizations (28.6%) had not completed enrollment by October 1. The current study includes data from 20,947 respondents collected between May 28 and October 1, 2020 at 7:28 AM Pacific Standard Time, representing a "second wave" after the first 10,000 respondents who received a briefer survey in the earlier days of the pandemic. Each institution determined the frequency of reminder emails; anonymous responses precluded knowing if people responded more than once. COVID testing and COVID exposure were not available. Responses were returned to a data management organization in Madison, WI, USA, and were analyzed at the AMA and the Hennepin Healthcare Institute for Professional Worklife (IPW). The Hennepin Healthcare Institutional Review Board (IRB) deemed this study a quality improvement/program evaluation project exempt from research requirements as it was felt to be low risk (non-interventional, no randomization, and survey-based). Dataset and analyses were available to Dr. Roger Brown, statistician, and Dr. Linzer and Ms. Prasad, from November 2020 until March 2021.

The Coping with COVID survey (sample questions in Appendix Fig. 1A), adapted in part from existing measures [18], is an approximately 10 item worklife survey with several demographic items (race/ethnicity, gender, years in practice, outpatient vs. inpatient practice environment, and work role). It begins with a single-item stress measure, scored 1−4, followed by three items assessing fear of exposure or transmission, self-reported anxiety/depression attributed to COVID-19 (one item), and work overload, also measured with 4-point Likert scales. In final scoring, these first four items were merged into a stress summary score (SSS). There was a single item to assess burnout, previously validated against emotional exhaustion in the Maslach Burnout Inventory [19], scored from no burnout (1) through highly burned out (5). Scores of 3, 4 or 5 comprised "burnout." For items ranging from 1 (not at all) to 4 (very high); 3 or 4 were considered "high" (e.g. highest identified categories of stress = 3 or 4). Summed SSSs varied between 4 and 16. Construct validity for the SSS was assessed with internal consistency measures, an intercorrelation matrix and correlations with the validated burnout score [17].

Statistical Analysis: Descriptive statistics portrayed stress and burnout levels as well as potentiators and mitigators. SSSs were calculated for the entire sample, and then by gender, race/ethnicity, inpatient vs outpatient, and worker role. The four items of the SSS had a Cronbach's alpha of 0.739, a McDonald's Omega of 0.782 (both acceptable to good), and a correlation matrix with high correlations between items (most correlations > 0.3, p's < 0.001, see Appendix Table 1A).

Differences between results by race/ethnicity, gender, specialty, location (outpatient vs inpatient) and worker role were tested for significance by Chi Square. Differences in SSSs were tested via t tests, normality assumptions were met. To overcome problems of multiple testing, the False Discovery Rate [20] was used which is not as conservative as Bonferroni's correction. It provides adjusted p-values, reducing the number of false positives, but allowing preservation of the number of true discoveries.

Since the sample size is large, Effect Sizes (ESs) were reported on most contrasts (Cohen's (d) for continuous measures (dES), and Cohen's (h) arcsin transformation for proportional differences (hES)). As is the convention, 0.2 was considered small, 0.5 moderate and 0.8 large [21]. In multivariate models, a Cohen's d ES of 0.2 was felt to be comparable to a Percent of Maximal Possible Change (POMP) of 9%. Missing data for demographics were less than 0.5%; subject characteristics such as years in practice and setting were as high as 23%, while missing data for perceptual measures (purpose and value) were less than 0.2% and considered missing at random. Given the low frequency of missingness on perceptual measures (a primary study focus), and the likelihood of these being missing at random (although not completely at random, shown by missing completely at random (MCAR) testing), impact of missing data was considered to be modest among responders.

Multilevel linear regressions and ordered logistic regression models were performed to assess correlates of stress and burnout, using the SSS, the single item stress score, and the single item burnout measure as outcomes. Because respondents were nested within

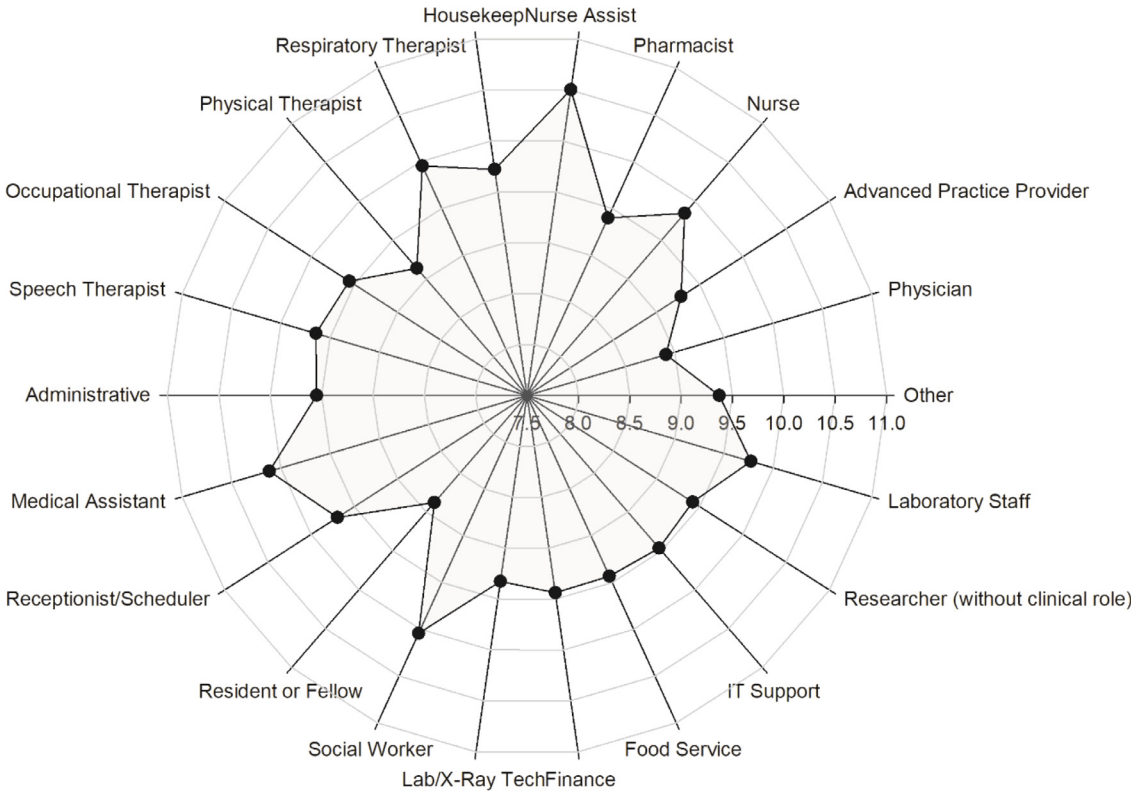

Fig. 1. Occupational variability in stress scores.
Range of stress summary scores (4–16).

organizations, we used multilevel models which recognize the existence of such data hierarchies. These multivariate findings were used to develop a comprehensive model of stress during the pandemic and subsequently tested via Structural Equation Modeling. Data were analyzed using Stata/SE 16.1.

Role of the funding source: The AMA had no role in determining study design, data interpretation, or writing or submission of the report. ML, CS, RB and KP had full access to all data in the study and final responsibility for manuscript submission.

3. Results

In 20,947 respondents, median response rate in 42 organizations was 20.0% (range 2% to 100%, interquartile range 7% to 35%). Of the organizations, 71.4% (n = 30) had completed data collection by October 1 (median response rate in "completed" organizations 24%). Of organizations in the sample, 62% were located in the US Northeast, 19% Midwest, 10% Western region, and 7% from the South. Forty percent were integrated health systems while 12% were academic medical centers. Large organizations (500+ beds) represented 43% of the sample, 40% were medium-sized (100–499 beds), and 10% were small (<100 beds). There were 15,041 female (71.8%) and 14,221 (67.9%) White respondents (with 1,199 Black (5.7%) and 1,271 Latinx (6.1%) respondents, see Table 1). Inpatient care was the focus for 10,729 workers (51.2%), with 5,359 in outpatient care (25.6%). Daily stress was scored as high or very high in 30% of respondents, while 61% had high fear of exposure or transmission (Table 2). Anxiety or depression was described by 38%, with work overload in 43%. Fifty percent noted an enhanced sense of meaning and purpose, while 46% felt highly valued by their organization. Average SSS was 9.52 (SD 2.82, possible range 4–16), with burnout (present, high or very high) in 49%.

Women described more challenging work environments than men (Table 2). For example, 61.2% of women feared exposure and transmission, vs 54.0% of men ($p < 0.001$). Self-reported prevalence of anxiety and depression was more common among women (39.3% vs 26.4%, $p < 0.001$), as was work overload (42.2% vs 37.7%, $p < 0.001$). Fewer women felt valued by their organizations (45.9% vs 55.5% of men, $p < 0.001$), and SSSs (9.5 vs 8.9) and burnout (49.4% vs 41.5%) were higher/more frequent in women (p's < 0.001). In 58 non-binary and 1,672 respondents not indicating gender, stress was substantially higher (mean SSS in "did not identify gender" (10.9) and non-binary gender (12.1) vs 9.5 in females, ES(d)s 0.50 and 0.92, respectively, $p < 0.001$). Similarly, burnout was more often seen in those preferring not to indicate gender (67.2% vs 49.4% in women ($p < 0.001$, ES(h)=0.36) and in the non-binary group (72.4% vs 49.4% in females, ES(h) = 0.48, $p < 0.001$, see Supplementary Appendix Table 2A).

Fear of exposure was higher among Black and Latinx workers versus Whites (70.1% and 74.4%, respectively, vs 56.0% in Whites, p's < 0.001). SSSs were higher (9.6 in Black, 10.1 in Latinx, 9.3 in White workers, p's < 0.001) although burnout rates were slightly to moderately lower among minority workers ($p < 0.05$ for Latinx workers and $p < 0.001$ for Black workers compared to Whites). The 2,667 respondents who preferred not to indicate (PNTI) race (Appendix Table 2A) had a high average SSS of 10.6 vs 9.6 in the 1,199 Black respondents ($p<0.001$, ES(d)= 0.31); burnout rates were 61.8% in PNTI respondents vs 41.7% in Black ($p<0.001$, ES(h) =0.40) and versus 45.3% in 1,271 Latinx respondents ($p<0.001$, ES (h)=0.33). An enhanced sense of meaning and purpose was frequently noted among racially minoritized workers (68.3% in Black, 67.2% in Latinx vs 45.6% in Whites, p's< 0.001). A far lower prevalence of feeling valued was seen in PNTI respondents. In gender comparisons, 22.7% of PNTI persons felt valued vs 45.9% of females ($p<0.001$, ES(h)=−0.50). In race/ethnicity comparisons, 29.2% of PNTI respondents felt valued vs 51.4% of Black ($p<0.001$, ES(h)=−0.46) and 52.8% of Latinx workers ($p<0.001$, ES(h) =−0.49).

Table 1
Description of sample in 20,947 healthcare workers in US Coping with COVID study.

Race/Ethnicity	Count	Percent
White/Caucasian	14,221	67.89
Prefer not to answer	2,667	12.73
Latinx/Hispanic	1,271	6.07
Asian/Pacific Islander	1,223	5.84
Black/African American	1,199	5.72
Other	279	1.33
Missing data	49	0.23
Native American/American Indian	38	0.18
Gender	**Count**	**Percent**
Female	15,041	71.81
Male	4,174	19.93
Prefer not to answer	1,672	7.98
Non-binary/third gender	58	0.28
Missing data	2	0.01
Years in practice	**Count**	**Percent**
More than 20 years	6,521	31.13
1–5 years	3,980	19.00
6–10 years	3,014	14.39
Missing data	2,848	13.60
11–15 years	2,519	12.03
16–20 years	2,065	9.86
Staff grouping	**Count**	**Percent**
Clinicians	9,513	45.41
Administrative staff	4,749	22.67
Missing data	3,112	14.86
Allied Health Professionals	2,579	12.31
Medical Technologists	767	3.66
Food service/Housekeeping	193	0.92
Setting	**Count**	**Percent**
Inpatient	10,729	51.22
Outpatient	5,359	25.56
Missing data (neither, both, other)	4,859	23.20
Position in organization	**Count**	**Percent**
Nurse	5,027	24.00
Physician	3,128	14.93
Other (please specify)	3,112	14.86
Administrative	2,967	14.16
Advanced Practice Provider	1,055	5.04
Receptionist/Scheduler	679	3.24
Nursing Assistant	535	2.55
Medical Assistant	508	2.43
Social Worker	500	2.39
Finance	474	2.27
Lab or X-Ray Technician	420	2.01
Physical Therapist	405	1.93
IT Support	349	1.67
Laboratory Staff	347	1.66
Resident or Fellow	303	1.45
Pharmacist	291	1.39
Researcher (non-clinical role)	280	1.34
Respiratory Therapist	152	0.73
Food Service	132	0.63
Occupational Therapist	104	0.50
Speech Therapist	84	0.40
Housekeeping	61	0.29

Table 3 shows differing responses by role. Female workers were predominant in roles with high SSS, including nurses, nursing assistants, medical assistants, and social workers. Likewise, racially minoritized workers comprised large proportions of certain high SSS groups, including nursing assistants, housekeepers, laboratory staff and medical assistants (see Appendix Figs. 2A and 3A).

SSSs were highest in nursing assistants (M = 10.51, SD=2.91 vs others M = 9.49, SD=2.80, Effect Size d (dES) = 0.36), medical assistants (M = 10.11, SD=2.99 vs others M = 9.5, SD=2.81, dES = 0.22), and social workers (M = 10.04, SD=2.69 vs others M = 9.50, SD=2.82, dES = 0.20), see Fig. 1.

Burnout was highest in speech therapists (prevalence = 60.7% vs others prevalence=49.3%, Effect Size h (hES) = 0.22), occupational therapists (prevalence=60.6% vs others prevalence=49.3%, hES = 0.22), and social workers (prevalence=59.8% vs others prevalence=49.1%, hES = 0.22).

Self-reported mental health symptoms (increased anxiety/depression) were prevalent among allied health workers, including speech therapists (prevalence = 50.0% vs others prevalence = 37.7%, hES = 0.24), nursing assistants (prevalence = 49.7% vs others prevalence = 37.4%, hES = 0.25), and medical assistants (prevalence = 48.6% vs others prevalence = 37.5%, hES = 0.22). Work overload was often noted by housekeeping, nursing assistants, social workers and medical assistants (prevalence 50% or greater).

An enhanced sense of meaning and purpose was high among housekeepers (75.4% vs others prevalence = 50.1%, hES = 0.53), nursing assistants (prevalence = 69.7% vs others prevalence = 50.1%, hES = 0.41) and respiratory therapists (prevalence = 63.2% vs others prevalence = 50.1%, hES= 0.26). Of all respondents, 45.9% felt highly valued. Respiratory therapists (prevalence 55.9% vs other prevalence 45.8%, hES = 0.20), administration (prevalence 55.7% vs other 44.3%, hES = 0.23), and IT support (prevalence 55.6% vs others prevalence 45.7%, hES = 0.28) felt highly valued (top 2 scores on 4-point scale) most often, while medical assistants (prevalence 35.0% vs other prevalence 46.2%, hES = −0.23) felt valued less often.

In multilevel models, burnout was associated with anxiety/depression (Odds Ratio (OR) 2.17, 95% CIs [2.07,2.28], $p < 0.001$) and work overload (OR 2.17, [2.07, 2.26], $p < 0.001$). Feeling valued was related to lower burnout (OR 0.60, [0.58, 0.63], 40% lower odds of burnout, $p< 0.001$). In post hoc analyses, work overload was significantly associated in a dose response manner with lower odds of feeling valued (OR 0.19, CI [0.17, 0.20]) for highest work overload and lower value, OR 0.40 [0.37, 0.42] for moderate work overload, and OR 0.62 [0.58, 0.66] for being somewhat overloaded). Enhanced meaning and purpose was significantly associated with greater odds of feeling valued, also in a dose related manner (OR 10.21, CI [9.31, 11.20] for increased sense of value with highest levels of purpose, OR 4.31 [3.97, 4.69] for moderate purpose, and OR 2.15 [1.99, 2.33] for somewhat elevated purpose).

Table 4 shows variables and worker roles related to SSSs in two level regressions, including Latinx and female workers, those with fewer years in their role, and those in roles such as nursing assistants, administration, medical assistants, and social workers. These models showed significant associations of roles with SSSs even after adjustment for multiple comparisons, although none reached a Percent of Maximal Possible Change (POMP) of 9% (comparable to a small Cohen's d ES). Feeling valued was strongly related to lower stress (beta coefficient −2.866, POMP 23.9%), while an enhanced sense of meaning and purpose was borderline in terms of its relation to higher stress (beta 1.073, POMP 8.9%). At the organizational level, this multilevel model explained 41% of variance in stress, meaning the model explains 2/5 of what is associated with stress within organizations.

Fig. 2's conceptual model links background variables (demographics, location and role) to mediators (fear, mental health, workload, purpose, and value); these relate to stress (identified by the single-item stress score) and burnout. Structural equation modeling revealed this conceptual model explained 55% of variance in burnout. Stress was highly correlated with burnout (beta coefficient 1.01, $p <$ 0.001). Fear, anxiety/depression and workload showed strong associations with stress, while feeling valued was associated with less stress.

4. Discussion

In this study of 20,947 US healthcare workers, we found higher stress scores among women, Black and Latinx individuals, inpatient workers, and in nursing assistants, medical assistants, and social workers. Almost half of workers indicated burnout, with certain allied health professionals – speech therapists, occupational therapists and social workers – reporting the highest rates. Stress and

Table 2
Stress factors and mitigators by demographics and role location in Coping with COVID study.

	Total (%)	% High Single-Item Stress Measure	% Fear of Exposure	% Anxiety & Depression	% Work Overload	% High Meaning and Purpose	% Feeling Valued	% Burnout	Average Stress Summary Score (SD)
Overall	20,947	29.5%	60.8%	37.7%	42.7%	50.1%	45.9%	49.4%	9.52 (2.82)
Gender (a)									
Male (M)	4,174 (19.9%)	1,122 26.9%	2,254 54.0%	1,104 26.4%	1,572 37.7%	2,059 49.3%	2,317 55.5%	1,733 41.5%	8.88 (2.78)
Female (F)	15,041 (71.8%)	4,268 28.4%	9,201 61.2%	5,904 39.3%	6,344 42.2%	7,683 51.0%	6,903 45.9%	7,425 49.4%	9.53 (2.76)
(M − F)		1.5%	7.2%***	12.9%***	4.5%***	1.8%	9.6%***	7.9%***	.648***
Race/Ethnicity (b)									
White/Caucasian (W)	14,221 (67.9%)	3,861 27.2%	7,976 56.0%	5,064 35.6%	5,717 40.2%	6,491 45.6%	6,648 46.7%	6,904 48.5%	9.25 (2.73)
Latinx/Hispanic (L)	1,271 (6.1%)	425 33.4%	945 74.4%	577 45.4%	612 48.1%	855 67.2%	672 52.8%	576 45.3%	10.12 (2.86)
(W − L)		6.2%***	18.4%***	9.8%***	7.9%***	21.6%***	6.0%***	3.2%*	0.869***
Black/African American (B)	1,199 (5.7%)	351 29.3%	840 70.1%	447 37.2%	474 39.5%	820 68.3%	616 51.4%	501 41.7%	9.60 (2.91)
(W − B)		2.1%	14.1%***	1.6%	0.7%	22.7%***	4.5%**	6.8%***	0.34***
Practice Setting									
Inpatient (I)	10,729 (51.2%)	3,246 30.3%	6,994 65.2%	4,219 39.3%	4,655 43.4%	5,760 53.7%	4,592 42.8%	5,570 51.9%	9.68 (2.61)
Outpatient (O)	5,359 (25.6%)	1,621 30.3%	3,016 56.3%	1,936 36.1%	2,328 43.4%	2,379 44.4%	2,411 45.0%	2,737 51.1%	9.42 (2.83)
(I − O)		0.0%	8.8%***	3.2%	0.1%	9.3%***	2.3%**	0.8%	.262***

FDR adjusted values, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, (a) = prefer not to answer and non-binary gender not included (n = 1,730), Male SSS versus (non-binary + prefer not to answer) SSS: Male mean = 8.88 (SD=2.77) vs non-binary, non-identified mean = 10.88 (SD=2.88) $p < 0.001$. (b) = other races (Native American, Asian, other, and prefer not to answer) not included (n = 4,207). Burnout rates were higher (62%) than others in 2,667 respondents who chose not to identify race or ethnicity. See Supplementary Appendix Table 2A.

burnout were associated with fear of exposure or transmission, self-reported anxiety/depression, and work overload, while less stress was associated with feeling valued. A predictive model including these variables explained 55% of variance in burnout. A four-item stress summary score had good psychometric performance. These data may be of interest due to the large sample, assessment of stress levels in racially minoritized workers, the portrayal of experiences of numerous healthcare team members, and the high stress and burnout noted among those preferring not to identify their race or gender.

Around the world, studies have highlighted pandemic-related stress in China [3], Italy [22] Singapore [23], and other countries. [24–26] Results show mental health concerns, with findings emphasizing the risks to those on the frontlines, such as nurses [27]. Mental health concerns include anxiety (24–68%), depression (12–56%) and stress (30–63%), with stress higher in females, nurses, younger clinicians, and those more exposed to COVID [28]. A recent study similarly found that infection with COVID-19, occurring most frequently in Latinx workers, contributed to mental health symptoms and burnout [8]. Other studies speak to the occurrence of post-traumatic stress [24,25,29] and to fear being especially high among individuals with vulnerable elderly family members at home [24]. Our study addresses gaps in the literature by offering initial US prevalence estimates for stress and burnout during the pandemic, as well as organizational stress scores. In addition, our conceptual model is one of the first to highlight background and mediating variables associated with COVID-related stress and burnout.

As in other studies of COVID-related stress [3,30,31], our study found that female workers were at somewhat higher risk, with adverse scores on fear, anxiety/depression and workload. These findings may reflect their predominance in patient-facing roles. Other factors may include gender-related discrimination, gendered expectations in providing care [32], and lack of attention to “dual shift” work with high workloads at home. Non-binary gender groups and those choosing not to identify gender identity had higher stress and burnout, perhaps due to interruption of important social support networks. Potential reasons for these findings should be explored in future work.

Stress predictors were somewhat higher among Black and Latinx healthcare workers compared to Whites, with 70.1% and 74.4%, respectively, endorsing fear of exposure. In spite of increased stress and fear of exposure, Black and Latinx individuals also endorsed increased meaning and purpose. As Black and Latinx individuals continue to be overrepresented among patients hospitalized with COVID-19 [11–13], racial concordance between workers and patients may relate to both increased fear and meaning. Further, racially minoritized workers disproportionately hold entry-level, patient-facing jobs with few options for advancement [33]. These occupations may lend themselves to increased stress as well as positive aspects of delivering care. Increased stress and fear among Black and Latinx workers may also result from impacts of structural racism, including differential quality of housing, economic opportunity, and healthcare options [34]. Continued violences [35] against these communities may exacerbate community-based traumas. For Black and Latinx workers, the pandemic has posed complex personal, economic, and professional challenges, all of which may have led to amplified fear of exposure and stress.

While causes for lower burnout in Black and Latinx workers in our study are not clear, a recent systematic review suggests that inconsistent burnout findings in underrepresented groups in medicine (UiM) may be due to the failed accounting of structural and systemic barriers that inform UiM's lived experiences including racism, tokenism, and lack of inclusion or social support [36]. High rates of burnout (61.8%) among the large number (2,667) in the “prefer not to indicate” race/ethnicity category may, in part, explain these racial and ethnic differences in burnout, particularly if most of those in this category were minoritized individuals. This large group of non-identified workers appeared to be the most vulnerable group among our respondents, with substantially higher stress scores and burnout rates, and a strikingly lower prevalence of feeling valued. Future studies should re-assess existing burnout metrics in minoritized workers and create study designs that are more inclusive of minoritized individuals and their lived experiences.

Table 3
Stress factors and mitigators by healthcare worker role in US Coping with COVID study.

	Freq (n) (%)	% Female	% Workers of Color	% High stress	% Fear exposure	% Anxiety	% Work Overload	% Purpose	% Valued	% Burnout	Avg Stress score
Overall	20,947	15,041 (71.81%)	4,010 (19.14%)	6,190 (29.55%)	12,728 (60.76%)	7,904 (37.73%)	8,947 (42.71%)	10,498 (50.12%)	9,615 (45.90%)	10,322 (49.28%)	20,947 9.52 (2.81)
Clinicians	9,513 (45.41%)	6,624 (69.63%)	1,532 (16.10%)	2,812 (29.56%)	5,758 (60.53%)	3,393 (35.67%)	3,902 (41.02%)	4,407 (46.33%)	4,100 (43.10%)	4,925 (51.77%)	9.44 (2.78)
Nurse	5,027 (24.04%)	4,249 (84.52%)	810 (16.11%)	1,521 (30.26%)	3,375 (67.14%)	2,135 (42.47%)	2,237 (44.50%)	2,712 (53.95%)	1,945 (38.69%)	2,708 (53.87%)	9.84 (2.80)
Physician	3,128 (14.96%)	1,382 (44.18%)	537 (17.17%)	938 (29.99%)	1,590 (50.83%)	794 (25.38%)	1,167 (37.31%)	1,160 (37.08%)	1,564 (50.00%)	1,493 (47.73%)	8.91 (2.71)
Advanced Practice Provider	1,055 (5.04%)	854 (80.95%)	83 (7.87%)	271 (25.69%)	631 (59.81%)	371 (35.17%)	406 (38.48%)	399 (37.82%)	461 (43.70%)	571 (54.12%)	9.28 (2.62)
Resident/ Fellow	303 (1.45%)	139 (45.87%)	102 (33.66%)	82 (27.06%)	162 (53.47%)	93 (30.69%)	92 (30.36%)	136 (44.88%)	130 (42.90%)	153 (50.50%)	8.87 (2.70)
Allied Health Professionals	2,579 (12.31%)	2,008 (77.86%)	592 (22.95%)	800 (31.02%)	1,726 (66.93%)	1,140 (44.20%)	1,227 (47.58%)	1,456 (56.46%)	1,094 (42.42%)	1,374 (53.28%)	9.90 (2.81)
Medical Assistant	508 (2.43%)	445 (87.60%)	139 (27.36%)	199 (39.17%)	325 (63.98%)	247 (48.62%)	256 (50.39%)	280 (55.12%)	178 (35.04%)	261 (51.38%)	10.11 (2.99)
Social worker	500 (2.39%)	404 (80.80%)	111 (22.20%)	159 (31.80%)	329 (65.80%)	225 (45.00%)	259 (51.80%)	263 (52.60%)	199 (39.80%)	299 (59.80%)	10.04 (2.69)
Nursing Assistant	535 (2.56%)	428 (80.00%)	213 (39.81%)	199 (37.20%)	427 (79.81%)	266 (49.72%)	280 (52.34%)	373 (69.72%)	219 (40.93%)	271 (50.65%)	10.51 (2.91)
Physical Therapist	405 (1.94%)	280 (69.14%)	37 (9.14%)	83 (20.49%)	234 (57.78%)	134 (33.09%)	162 (40.00%)	169 (41.73%)	191 (47.16%)	216 (53.33%)	9.13 (2.48)
Pharmacist	291 (1.39%)	185 (63.57%)	55 (18.90%)	75 (25.77%)	180 (61.86%)	113 (38.83%)	125 (42.96%)	182 (62.54%)	142 (48.80%)	138 (47.42%)	9.39 (2.70)
Respiratory Therapist	152 (0.73%)	104 (68.42%)	25 (16.45%)	46 (30.26%)	108 (71.05%)	66 (43.42%)	68 (44.74%)	96 (63.16%)	85 (55.92%)	75 (49.34%)	9.95 (2.86)
Occupational Therapist	104 (0.50%)	85 (81.73%)	9 (8.65%)	20 (19.23%)	67 (64.42%)	47 (45.19%)	41 (39.42%)	51 (49.04%)	46 (44.23%)	63 (60.58%)	9.55 (2.75)
Speech Therapist	84 (0.40%)	77 (91.67%)	3 (3.57%)	19 (22.62%)	56 (66.67%)	42 (50.00%)	36 (42.86%)	42 (50.00%)	34 (40.48%)	51 (60.71%)	9.64 (2.70)
Medical Technologists	767 (3.66%)	545 (71.06%)	153 (19.95%)	217 (28.29%)	470 (61.28%)	261 (34.03%)	341 (44.46%)	396 (51.63%)	304 (39.63%)	358 (46.68%)	9.52 (2.81)
Lab or X-Ray Tech	420 (2.01%)	283 (67.38%)	59 (14.05%)	103 (24.52%)	265 (63.10%)	131 (31.19%)	176 (41.90%)	204 (48.57%)	160 (38.10%)	196 (46.67%)	9.32 (2.76)
Laboratory staff	347 (1.66%)	262 (75.50%)	94 (27.09%)	114 (32.85%)	205 (59.08%)	130 (37.46%)	165 (47.55%)	192 (55.33%)	144 (41.50%)	162 (46.69%)	9.77 (2.87)
Administrative Staff	4,749 (22.67%)	3,545 (74.65%)	1,059 (22.30%)	1,412 (29.73%)	2,811 (59.19%)	1,836 (38.66%)	2,119 (44.62%)	2,489 (52.41%)	2,498 (52.60%)	2,190 (46.11%)	9.54 (2.81)
Administrative	2,967 (14.19%)	2,288 (77.11%)	602 (20.29%)	882 (29.73%)	1,733 (58.41%)	1,124 (37.88%)	1,344 (45.30%)	1,628 (54.87%)	1,651 (55.65%)	1,383 (46.61%)	9.54 (2.77)
Receptionist/ Scheduler	679 (3.25%)	589 (86.75%)	172 (25.33%)	212 (31.22%)	422 (62.15%)	282 (41.53%)	317 (46.69%)	351 (51.69%)	264 (38.88%)	344 (50.66%)	9.69 (2.99)
Researcher	280 (1.34%)	190 (67.86%)	54 (19.29%)	76 (27.14%)	148 (52.86%)	117 (41.79%)	110 (39.29%)	100 (35.71%)	139 (49.64%)	132 (47.14%)	9.41 (2.62)
Finance	474 (2.27%)	339 (71.52%)	151 (31.86%)	133 (28.06%)	300 (63.29%)	183 (38.61%)	186 (39.24%)	234 (49.37%)	250 (52.74%)	186 (39.24%)	9.43 (2.90)
IT Support	349 (1.67%)	139 (39.83%)	80 (22.92%)	109 (31.23%)	208 (59.60%)	130 (37.25%)	162 (46.42%)	176 (50.43%)	194 (55.59%)	145 (41.55%)	9.46 (2.80)
Non-clinical Staff	193 (0.92%)	131 (67.88%)	47 (24.35%)	58 (30.05%)	123 (63.73%)	78 (40.41%)	80 (41.45%)	126 (65.28%)	86 (44.56%)	81 (41.97%)	9.52 (2.95)
Food Service	132 (0.63%)	100 (75.76%)	26 (19.70%)	34 (25.76%)	85 (64.39%)	54 (40.91%)	48 (36.36%)	80 (60.61%)	55 (41.67%)	53 (40.15%)	9.43 (2.65)
Housekeeping	61 (0.29%)	31 (50.82%)	21 (34.43%)	24 (39.34%)	38 (62.30%)	24 (39.34%)	32 (52.46%)	46 (75.41%)	31 (50.82%)	28 (45.90%)	9.72 (3.53)

Table 4
Two level regression analysis and model parameters assessing correlates of Stress Summary Score (SSS).

	Coef	Std. Error	Z-value	*P*>|z|	FDR	[95% Conf. Interval]		POMP
						Lower	Upper	
Race								
White (REF)								
Latinx	.357	.087	4.10	0.001	0.003	.186	.527	2.97%
Black	−0.091	.090	−1.01	0.313	0.456	−0.268	.086	−0.76%
Sex								
Male (REF)								
Female	.312	.0577	5.41	0.001	0.003	.199	.426	2.60%
Years								
1−5 years (REF)								
6−10 years	.132	.069	1.92	0.055	0.106	−0.002	.268	1.10%
11−15 years	−0.055	.074	−0.74	0.457	0.571	−0.200	.090	−0.45%
16−20 years	−0.140	.079	−1.78	0.075	0.131	−0.295	.014	−1.17%
More than 20 years	−0.533	.059	−8.93	0.001	0.003	−0.649	−0.416	−4.44%
Purpose								
Not at all (REF)								
Somewhat	−0.078	.065	−1.21	0.228	0.347	−0.207	.049	−0.65%
Moderately	.533	.069	7.68	0.001	0.003	.397	.669	4.44%
To a great extent	1.073	.077	13.93	0.001	0.003	.922	1.225	8.94%
Valued								
Not at all (REF)								
Somewhat	−1.370	.063	−21.55	0.001	0.003	−1.495	−1.246	−11.42%
Moderately	−2.130	.067	−31.42	0.001	0.003	−2.263	−1.997	−17.75%
To a great extent	−2.866	.076	−37.34	0.001	0.003	−3.016	−2.715	−23.88%
Role								
Other (REF)								
Physician	.082	.089	0.92	0.355	0.460	−0.092	.258	0.69%
Advanced Practice Provider	−0.076	.106	−0.71	0.475	0.573	−0.285	.132	−0.63%
Nurse	.157	.072	2.18	0.029	0.067	.015	.298	1.31%
Pharmacist	−0.106	.182	−0.58	0.560	0.653	−0.465	.251	−0.88%
Nursing Assistant	.604	.143	4.23	0.001	0.003	.324	.885	5.04%
Housekeeping	.086	.399	0.22	0.828	0.888	−0.696	.870	0.72%
Respiratory Therapist	.611	.249	2.45	0.014	0.035	.121	1.100	5.09%
Physical Therapist	−0.025	.155	−0.16	0.871	0.895	−0.329	.278	−0.21%
Occupational Therapist	.268	.287	0.93	0.351	0.460	−0.295	.831	2.23%
Speech Therapist	.040	.304	0.13	0.895	0.895	−0.556	.636	0.33%
Administrative	.385	.086	4.47	0.001	0.003	.216	.554	3.21%
Medical Assistant	.364	.140	2.60	0.009	0.024	.089	.639	3.03%
Receptionist/Scheduler	.179	.134	1.33	0.183	0.291	−0.084	.443	1.49%
Resident or Fellow	−0.523	.266	−1.96	0.050	0.102	−1.046	−0.0003	−4.36%
Social Worker	.369	.141	2.62	0.009	0.024	.092	.645	3.07%
Lab or X-Ray Technician	−0.332	.154	−2.14	0.032	0.070	−0.635	−0.028	−2.76%
Finance	.098	.180	0.55	0.585	0.660	−0.254	.451	0.82%
Food Service	−0.053	.261	−0.20	0.838	0.888	−0.566	.459	−0.44%
IT Support	.311	.212	1.47	0.142	0.236	−0.104	.727	2.59%
Researcher (without clinical role)	.216	.221	0.98	0.328	0.459	−0.217	.650	1.80%
Laboratory Staff	.322	.176	1.83	0.067	0.123	−0.022	.667	2.68%
Constant	10.456	.127	81.98	0.001	0.003	10.206	10.706	
Random-effects Parameters	Estimate	Std. Err.				[95% Conf. Interval]		
						Lower	Upper	
Organization: Identity								
var(Constant)	.137	.045				.072	.264	
var(Residual)	6.319	.074				6.174	6.468	
Snijders/Bosker R-squared Level 1:	0.151							
Snijders/Bosker R-squared Level 2:	0.413							

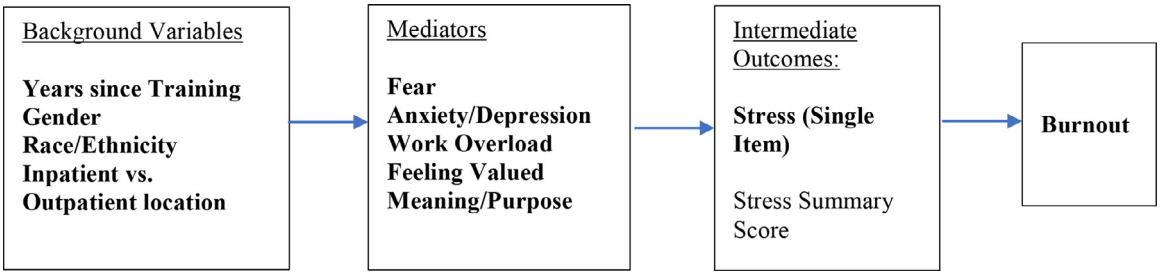

Fig. 2. Conceptual model portraying potential contributors and mitigators of stress and burnout in Coping with COVID survey. Bolded variables assessed in this analysis. R^2, or percent variance in burnout explained by structural model **= 55%.**

Our conceptual model of COVID-related stress is an important contribution of this study. We identified anxiety/depression and work overload as correlates of burnout and found feeling valued to be a critical stress mitigator. Further work will be required to better understand the observed relationships between stress and enhanced sense of meaning and purpose.

Feeling valued was correlated with lower stress in early studies from the Coping with COVID dataset [17]. and was associated with lower burnout, lower workload, and enhanced meaning and purpose in this study. Recent work complements our findings, identifying that higher perceived support from hospital leadership was associated with a lower risk of anxiety, depression, and post-traumatic stress disorder assessed using validated scales [37]. As our current study identified that approximately 50% of workers do not feel valued, organizations might consider exploring the mediators of feeling valued (fear, mental health and workload) in order to address burnout and support the mental wellbeing of their workforces. Interventions aimed at increasing feelings of being valued by one's organization may be of particular benefit to healthcare workers with high levels of stress, including women and minoritized workers. We suggest interventions related to peer support programs, changes in care infrastructure to facilitate support, and improvements in the electronic health record related to increasing telehealth options after the pandemic; we reference several practical modules [38] and a recent study to inform these strategies [39].

Learnings from COVID-19 and past epidemics such as Middle East Respiratory Syndrome suggest that stress and psychosocial adjustments among workers should be monitored throughout the pandemic and afterward, as long-term mental health consequences should be expected [4,24,40,41]. As in the Severe Acute Respiratory Syndrome epidemic, stress and mental health consequences may be distinct for workers of different disciplines [42]. Studies from Italy [43], Saudi Arabia [44], and Norway [25] mirror these findings and illustrate the increased presence of anxiety, depression, secondary trauma, and post-traumatic symptoms. As COVID-19 continues to overwhelm US healthcare systems, the magnitude of its long-term impact on mental health remains to be seen.

Our study has several limitations, including a convenience sample of organizations. The Coping with COVID instrument, with mainly single item questions, has not been fully validated, and thus questions about stress, depression and anxiety as well as SSSs do not represent the medical concepts of stress, depression and anxiety syndromes. However, internal consistency is reasonable for the SSS and several aspects of construct validity (including correlation with the validated single item burnout measure) have been met. Our response rate is relatively low, although comparable to US national physician surveys [45]; and we do not have response rates by worker roles or information on non-respondents. Response rates varied in part due to many organizations still enrolling patients when the dataset was closed; the impact of varying response rates on the study's findings is uncertain. Due to this “rolling enrollment”, several organizations were still enrolling subjects when the dataset was closed on October 1st; a relatively small number of respondents (291) arrived later that day and were not included in the analyses. Two respondents not included in the analysis (<0.01% of total) were found later to have arrived before October 1st. Additionally, a relatively small number of respondents (0.3 to 1.4%) enrolling prior to October 1 may not have been included in the analysis. There are few prior wide distribution studies among healthcare team members to determine if stress and burnout in our sample are rising due to temporal trends or the pandemic. In addition, we had no way of knowing if workers were on “frontlines” or not. Our categorizations of race and gender are also limited and may not have included multiracial and transgender workers. We recognize that our sample, with 19% racially minoritized staff, is not representative of the US population. Further, with only 38 Native respondents, we were unable to analyze the impact of COVID-19 on their stress. Given the brevity of the measure, we are unable to differentiate work-related from non-work related stress. With data spanning two “waves” of COVID-19 surges, our findings may be affected by “COVID fatigue,” but also by greater experience managing COVID-19 patients. Finally, we have no measure of exposure to COVID-19 by institution or individual. Future Coping with COVID survey iterations will seek insight into these variables.

In conclusion, our study found somewhat higher stress and burnout in several health professions, including nursing assistants, medical assistants, housekeeping, and social workers, as well as in female and racially minoritized workers. Fear of exposure or transmission, self-reported anxiety/depression, and work overload were associated with stress and burnout, while a sense of feeling valued was associated with improved outcomes. Workers not identifying race, ethnicity or gender appear to be at high risk of stress and burnout. Future studies should investigate the structural reforms needed to sustain our healthcare workers as valued human beings existing at the intersection of calling and crisis.

Data sharing statement

Requests for access to the study data set should be directed to the AMA and will be considered on a case-by-case basis.

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Contributors

Study concept and design (ML, CS, MS, EG, KP, KC, NN); data acquisition and curation (CM, KC, ST, RB, MB, ML); data analysis (ML, KP, ST, RB, CS); initial drafting of manuscript (KP, ML, RB, CS) All authors contributed to the interpretation of data and review of the manuscript. ML, CS, CM contributed to study supervision.

Declaration of Competing Interest

Dr. Linzer reports being supported by the American Medical Association during the conduct of the study; and grants from American College of Physicians, National Institutes of Health, Institute for Healthcare Improvement, American Board of Internal Medicine (salary support through Hennepin Healthcare) outside the submitted work; consulting for Harvard University on a grant concerning work conditions and diagnostic accuracy, and has received honoraria from Harvard University and University of Chicago for Medical Grand Rounds. Mr. Barbouche is affiliated with Forward Health Group, Inc. during the conduct of the study. Forward Health Group, Inc. (FHG) is the Technology Partner to the American Medical Association (AMA). FHG supports the AMA and its research partners with data, technology, and analytics support. AMA has a contract with FHG to reimburse FHG's services. Ms. Poplau reports salary support through Hennepin Healthcare from American Medical Association during the conduct of the study; and grants from American College of Physicians, the National Institutes of Health, and the American Board of Internal Medicine outside the submitted work. Dr. Goelz reports salary support paid through Hennepin Healthcare from American Medical Association during the conduct of the study; and salary support through Hennepin Healthcare from the Institute for Healthcare Improvement outside the submitted work. Dr. Stillman is supported for his work on burnout prevention by the AMA (salary support paid through Hennepin Healthcare for studying provider stress and burnout). Ms. McLoughlin, Ms. Nankivil, Ms. Cappelucci and Dr. Sinsky work for the AMA. Mr. Taylor worked for the AMA at the time the study was conducted. Ms. Prasad reports personal fees from Hennepin Healthcare Foundation, during the conduct of the study.

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Supplementary materials

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