Acute Stress, Worry, and Impairment in Health care and Non-Health care Essential Workers during the COVID-19 Pandemic

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Authors' Note

Abstract

Objective: Healthcare and non-healthcare essential workers working in face-to-face interactions during COVID-19 may be vulnerable to psychosocial distress. Limited empirical research on COVID-19-related psychosocial outcomes has utilized probability-based samples including both healthcare and non-healthcare essential workers.

Method: We surveyed a sample of 1,821 United States self-identified essential workers, collected using probability-based methods, working in face-to-face interactions during the early phase of the COVID-19 outbreak (3/18/20-4/18/20), in three consecutive 10-day cohorts. We assessed acute stress, health-related worries, and functional impairment. Demographics, secondary stressors (lack of childcare or healthcare, lost wages), and pre-COVID-19 mental and physical health were examined as predictors of psychological outcomes.

Results: Acute stress (β=.07, *p*=.003), health-related worries (β=21, *p*=.001), and functional impairment (β=.09, *p*=.09) increased over time in the early weeks of the outbreak. Non-healthcare-essential workers reported greater functional impairment (β= -.06, *p*=.009) and acute stress (β =-.05, *p*=.02) compared to healthcare-essential workers. Across the sample, prior mental and physical health ailments, inability to obtain health insurance, lost wages, younger age, female gender, and Hispanic ethnicity were associated with acute stress (βs=.07-.14, *p*s<.006), health-related worries (βs=.09-.29, *p*s≤.001), and functional impairment (βs=.06-.16, *p*s≤.006). Lack of childcare (β=.14, *p*<.001) was positively associated with acute stress.

Conclusion: Non-healthcare essential workers may be vulnerable to negative psychosocial outcomes. Targeted training and support may help facilitate coping with the effects of working in-person during the ongoing COVID-19 pandemic. Findings may help inform intervention efforts, critical as COVID-19 becomes endemic and society must learn to live with its evolving variants.

Keywords: COVID-19, acute stress, essential workers, mental health, functional impairment

Clinical Impact Statement

Prior literature has documented healthcare essential workers' adverse psychological responses during viral outbreaks including COVID-19; non-healthcare essential workers have been understudied. Between March 18, 2020 and April 18, 2020, we surveyed 1,821 United States residents (a subsample of a nationally representative sample of 6,514) still working in-person during the COVID-19 pandemic. Demographics, secondary stressors, non-healthcare occupation, and mental/physical health history were positively associated with acute stress, health-related worries, and functional impairment. As society adapts to COVID-19 and its evolving variants, essential workers may continue to be vulnerable. Adequate protection, targeted psychosocial services, and appropriate preparation for future outbreaks is crucial.

Acute Stress, Worry, and Impairment in Healthcare and Non-Healthcare Essential

Workers during the COVID-19 Pandemic

On March 13, 2020, the White House declared the COVID-19 outbreak a national emergency, its protracted duration and associated psychosocial impact unforeseeable. State officials issued sweeping stay-at-home orders that exempted essential workers including healthcare workers, caregivers, and grocery store employees, as well as workers in other sectors whose jobs required in-person interactions with social distancing guidelines difficult or impossible to maintain (Lai et al., 2020; Shanafelt et al., 2020). The empirical literature on psychosocial responses to COVID-19 among essential workers has primarily focused on caregivers and healthcare workers (Lai et al., 2020; Shanafelt et al., 2020), largely neglecting the experiences of non-healthcare essential workers.

Even during the most stringent COVID-19-related restrictions, many essential workers continued in-person work, often due to lack of job security or paid leave, and sometimes without health insurance, amplifying COVID-19-relevant worries about one's health and safety (Shanafelt et al., 2020). Despite the increasing availability of vaccines, COVID-19 has remained a threat, due to emerging variants such as the Delta variant (Christie et al., 2021) and vaccine hesitancy (Kofman et al., 2021). As COVID-19 becomes endemic, those on the front lines will be forced to adapt and respond to the ongoing threat of COVID-19 (Kofman et al., 2021).

Research conducted during COVID-19 has demonstrated that healthcare workers are at risk for psychosocial maladies (Benfante & Tella, 2020), particularly those working on the front lines (Lai et al., 2020). While this relationship has been demonstrated during prior viral outbreaks (Cabarkapa et al., 2020), during COVID-19 these concerns have been exacerbated for non-healthcare, public-facing occupations as well: like healthcare workers, essential workers from other industries are at increased risk for COVID-19 infection due to frequent interactions with the public (Baker et al., 2020). Thus, there has been a growing concern to manage the physical and psychological health of all frontline workers (Sim, 2020), critical for effective

workplace performance (Wright & Cropanzano, 2000) when essential tasks must be sustained. In sum, it is important to understand the psychosocial experience of workers from both healthcare and non-healthcare sectors critical for societal functioning during the COVID-19 pandemic and as society prepares for future viral threats, which science suggest will increase in the years ahead (Rogalski et al., 2017).

Healthcare Essential Workers

Research on psychosocial outcomes in healthcare essential workers during COVID-19 has proliferated, yet a clearer understanding of specific risk factors associated with psychosocial maladies may further guide research and recommendations. Meta-analytic findings regarding mental health in healthcare workers (including doctors, nurses, and other medical personnel) during the early phase of COVID-19 (e.g., before mid-April, 2020) reported a 23% prevalence of clinically significant anxiety, although these rates were comparable to that of the general public, and at the lower end of what was reported in healthcare workers during the MERS and SARS outbreaks (Pappa et al., 2020). In a rapid review of COVID-19's impact on healthcare worker's mental health, concerns over family health and safety, in addition to fear of infection, were risk factors for adverse mental health outcomes (De Kock et al., 2021). A recent literature review of the mental health of frontline healthcare workers employed during viral outbreaks revealed that persistent, generalized stress was associated with subsequent downstream problems including panic attacks, insomnia, and burnout (Magill et al., 2020). Internationally, healthcare essential workers who continued working during the pandemic also screened positive for moderate to extremely severe stress, psychological distress (Chew et al., 2020a), and PTSD (Tan et al., 2021). While data has illustrated that factors associated with patient care (e.g., direct work with COVID-19 patients) are associated with psychological burdens such as anxiety in healthcare workers (Lai et al., 2020), few samples have been drawn from representative samples or included comparisons with non-healthcare essential workers.

Research on healthcare worker mental health during prior viral epidemics revealed mental health ailments like acute stress disorder increased in frequency, particularly when certain sociodemographic (i.e., younger age and female gender) and occupational (i.e., high-risk roles) factors were present (Serrano-Ripoll et al., 2020). More recently, history of poor physical health (Chew et al., 2020b; De Kock et al., 2021; Tan et al., 2020) and prior psychiatric diagnoses (Elbay et al., 2020) have been recognized as additional risk factors for COVID-19-related psychological distress in healthcare workers, which may have implications for present functioning and downstream physical and mental health (Garfin et al., 2018).

Non-healthcare Essential Workers

During strict stay-at-home restrictions in the U.S. during Spring, 2020, many non-healthcare essential workers (e.g., food service or transportation workers) continued to engage with the public, at times with little work flexibility and high risk of contracting COVID-19 (Sim, 2020). Such employees often work with less stringent protective protocols (Steege et al., 2009) than healthcare sector workers. As the economy remains open, vaccine hesitancy persists, (Sallam, 2021), vaccination rates are well-below targets, and new variants impose increasing risk to frontline works (Christie et al., 2021), understanding predictors of distress and impairment in essential workers is critical. Global research using non-probability-based samples found non-healthcare workers have continually reported adverse psychosocial outcomes during the COVID-19 pandemic. For example, up to 50% of Indian migrant workers screened positive for anxiety (Kumar et al., 2020) and 65.1% of Spanish non-healthcare essential workers endorsed psychological distress (i.e., constantly feeling overwhelmed and stressed) during the early phase of the COVID-19 pandemic (Ruiz-Frutos et al., 2021). Moreover, non-healthcare essential workers have also reported health-related worries, with loved ones dying from COVID-19 and the health and well-being of family/loved ones indicated as top COVID-19-related concerns (Toh et al., 2021). Research using representative probability-based samples could strengthen inferences and elucidate key predictors of such maladies.

Some empirical literature suggests that non-healthcare essential workers actively employed during the COVID-19 pandemic are also at risk for psychological maladies, and in some cases potentially at greater risk than healthcare workers. Recent research on COVID-19 has demonstrated that some those in non-healthcare occupations (i.e., agricultural workers) report higher generalized distress symptom scores compared to other groups, including those working in healthcare industries (Tian et al., 2020). Similarly, in a sample of Australian workers, Australian non-healthcare workers reported significantly higher levels of anxiety, stress, and significantly lower quality of life compared to healthcare workers (Toh et al., 2021). Yet a community-based sample in Turkey indicated healthcare workers were more distressed than the general public (Hacimusalar et al., 2020). The present study seeks to extend this work in a U.S. sample by using a methodologically rigorous design (i.e., probability-based sampling), drawing from prior literature on disaster psychology to account for additional risk factors.

Secondary Stressors

Secondary stressors are individual-level events (e.g., personal injury or illness, loss of a job) that occur as part of a disaster cascade (Garfin et al., 2014). Exposure to greater numbers of secondary stressors has been associated with greater psychological distress following prior collective traumas including earthquakes (Garfin et al., 2014), hurricanes (Galea et al., 2007), and other natural disasters (Kessler et al., 2012). Less is known about how exposure to secondary stressors during a collective trauma like the COVID-19 pandemic may exacerbate psychosocial responses, particularly among essential workers. Data collected during the early phase of COVID-19 found some secondary stressors occurred for a substantial minority of respondents; for example, inability to obtain healthcare was associated with serious psychological distress (i.e., feeling nervous, restless, or hopeless) (McGinty et al., 2020). In a community-based sample that included healthcare and non-healthcare workers, secondary stressors including difficulties finding childcare were positively associated with anxiety (Hacimusalar et al., 2020). Early research also highlighted economic stressors as an additional

risk factor for distress, such as financial loss, which during the early phases of the pandemic appeared to amplify psychological distress in the general population (Zheng et al., 2021). As the COVID-19 pandemic persisted, those unable to work from home may have been vulnerable to these stressors, which may have correlated with adverse psychosocial outcomes.

Pre-existing Mental and Physical Health Vulnerabilities

Elevated risk of severe COVID-19-related complications and mortality for individuals with pre-existing physical health conditions has been highly publicized (Flaherty et al., 2020), potentially eliciting worry, distress and impairment in those with such vulnerabilities. This was evident during prior viral outbreaks: in a systematic review on the impact of viral epidemics on mental health outcomes, chronic illness was identified as a high-risk factor for experiencing psychiatric symptoms (Luo et al., 2020). Pre-event mental health diagnoses (e.g., anxiety disorders and mood disorders) may also portended greater problems: for example, prior mental health ailments were associated with psychological distress and functional impairment following the 2014 Ebola public health crisis (Thompson et al., 2017). During COVID-19 specifically, such ailments were associated with COVID-19 related stress and traumatic stress symptoms, respectively, among American and Canadian adults (Asmundson et al., 2020). In healthcare workers, pre-COVID-19 psychological treatment increased the risk for developing COVID-19-related post-traumatic distress and anxiety by 2.5 times (Asmundson et al., 2020). These findings demonstrate the importance of evaluating pre-existing physical and mental health ailments as potential risk factors for maladaptive psychosocial outcomes during COVID-19.

Demographic Risk Factors

Demographic risk factors may also correlate with psychological distress and impairment in essential workers, potentially exacerbating existing health disparities (Kantamneni, 2020). For example, racial/ethnic minorities often encounter more COVID-19 related occupational inequalities (e.g., high-exposure occupations) and discrimination (Kantamneni, 2020), potentially leading to worse mental health outcomes. Lower income negatively correlates with

deleterious psychosocial outcomes; for example, individuals who lost income due to COVID-19 reported higher hopelessness and anxiety compared to those who did not lose income (Hacimusalar et al., 2020). Low educational attainment may also place low-wage workers at more physical risk during COVID-19 (Gallagher et al., 2021). Finally, research demonstrates female healthcare essential workers face higher risks for maladaptive mental health outcomes during COVID-19 compared to their male counterparts (Cabarkapa et al., 2020; Elbay et al., 2020; Lai et al., 2020; Pappa et al., 2020).

Other demographic indicators may also portend increased vulnerability to psychosocial maladies. Despite reports that older frontline workers actively working during COVID-19 were more vulnerable to death and infection (Ghilarducci & Farmand, 2020), research has consistently shown younger workers report higher psychological distress compared to older workers (Ruiz-Frutos et al., 2021). Regional variation, a potential proxy for level of community transmission and severity of the outbreak (e.g., hospitalization and death rates), may also differentially predict psychosocial distress. Specifically, as the epidemic first spread across the United States, medical personnel in the New York Metropolitan Area were overwhelmed due to an influx of infected individuals and a lack of resources to support them (Konda et al., 2020).

The Present Study

As society continues to struggle to protect workers during the ongoing and continually evolving COVID-19 pandemic (Kofman et al., 2021), it is critical to understand experiences of essential workers who engage with the public and are at increased risk for infection. As such, the objective of the present study was to examine key theoretically and empirically derived predictors of psychosocial responses during COVID-19 among a sample of U.S. healthcare and non-healthcare essential workers still working in face-to-face interaction in the first months of the pandemic. We sought to improve upon the limited extant research by utilizing a probability-based sample, collected as the pandemic escalated in the U.S. We had one hypothesis and one exploratory aim. We hypothesized that pre-existing physical and mental health ailments and key

secondary stressors would be associated with greater health-related worry, functional impairment, and acute stress, controlling for demographic risk factors. Given prior mixed research, as an exploratory aim we examined whether healthcare essential workers would report worse outcomes than non-healthcare essential workers.

Method

Sample and Procedure

Our study was conducted among a national sample of Americans using the NORC AmeriSpeak Panel, a probability-based panel of 35,000 U.S. households. NORC's AmeriSpeak Panel randomly selected participants from their panel to form a representative sample of U.S. households. Sample stratification promoted representativeness for age, gender, race/ethnicity, and education. NORC notified participants via email when the confidential, 20-minute survey was available. Three consecutive cohorts of panelists participated in the study. There was a 10-day fielding period among each of three cohorts: Cohort 1 (3/18/20-3/28/20), Cohort 2 (3/29/20-4/7/20), and Cohort 3 (4/8/20-4/18/20). In total, 6,514 participants completed the survey (58.5% completion rate) across all cohorts with 85% responding within three days through computers (44%), smartphones (54%), and tablets (2%). interview. Some procedures helped ensure valid survey responses. Respondents were removed from the main survey if they completed the survey in under 1/3 of the median duration and/or skipped more than 50% of the questions shown to them. Three respondents from Cohort 2 were removed since they completed the survey during the Cohort 1 timeframe and were not counted toward the total number of interviews delivered. All procedures were approved by the Institutional Review Board of University of California, Irvine; informed consent was obtained. A small compensation was provided (cash equivalent $4). See appendix for full list of measures used in these analyses.

From the full sample, a subsample of healthcare and non-healthcare essential workers was identified based on responses to several items. First, a subsample of healthcare workers was identified. As part of the profile data collected by NORC, panelist identify their employment

type based on U.S. Bureau of Labor statistics identified 24 categories, including "Healthcare

Practitioners and Technical Occupations." Occupations include physicians, paramedics,

psychiatrists, nurses, surgical assistants, and physician assistants. (Full list of included

occupations is available at https://www.bls.gov/oes/current/oes290000.htm.) Next, participants

reported whether their job required in-person interaction and they were still working (*n*=1,525).

Participants also reported whether they were an essential worker asked to work extra hours

(*n*=981). Six hundred eighty-five participants endorsed both items, generating a final sample of

"essential workers" (*n*=1,821), of which 9.28% (*n*=169) identified as healthcare workers.

Independent Variables

  Secondary stressors. Three items assessed COVID-19 related secondary stressors:

lost wages, needing childcare due to COVID-19-related school closures, and lack of healthcare

due to COVID-19. Items were coded 0 (not experienced) or 1 (experienced).

  Prior physical and mental health ailments. NORC collected health information history

from participants prior to January 2020, before the official U.S. COVID-19 outbreak

announcement. Respondents were asked whether they had been diagnosed with physical

health ailments (i.e., diagnoses of high cholesterol, hypertension, diabetes/high blood sugar,

heart disease, stroke, cancer, lung disease, and other diagnoses). Prior physical health

diagnoses were summed into an 8-item count variable. Respondents also reported previous

mental health diagnoses (anxiety, depression, or any other emotional, nervous, or psychiatric

diagnosis). Prior mental health diagnoses were coded 0 (none) or 1 (prior anxiety, depression,

or other emotional/nervous/psychiatric diagnosis). These variables have been used in prior

research (Holman et al., 2020).

  Demographics. NORC collected demographic information (age, race/ethnicity,

education, gender, income, and geographic region of residence) when participants enrolled into

in the AmeriSpeak panel (updated annually for accuracy). Race/ethnicity was coded White,

Black (non-Hispanic), Other (two or more, non-Hispanic), and Hispanic. Education was coded

less than high school, high school diploma, some college, and Bachelor's degree and up.

Income was classified as one of eight categories, consistent with prior analyses (Holman et al.,

2020). Geographic regions of residence included Northeast, Midwest, South, and West.

Dependent Variables

Health-related worries. Health-related worries were assessed by asking participants

how often they "had fears that you will get very sick or die from the Coronavirus outbreak?" and

"worried that someone you care about (e.g., family, close friends) will get very sick or die from

the Coronavirus outbreak?" Items were assessed using a five-point scale from 1 (never) to 5 (all

the time). Internal consistency was very good ($\alpha=.81$).

Functional impairment. Prior week functional impairment was assessed using four SF-

36 items that measured physical and emotional impairment (Hays et al., 1993), on a five-point

scale from 1 (none of the time) to 5 (all of the time). Internal consistency was very good ($\alpha=.87$).

COVID-19-related acute stress. COVID-19 outbreak-related acute stress symptoms

were assessed using a 10-item modified version of the Acute Stress Disorder Scale 5 (Bryant et

al., 2000). Items assessed symptoms from the previous week via a five-point scale from 1 (none

at all) to 5 (a great deal). Internal consistency was very good ($\alpha=.87$).

Statistical analysis

All analyses were conducted using STATA 16. Bivariate comparisons (*t*-tests for

continuous variables and chi-square tests for categorical variables) illustrated significant

differences between healthcare and non-healthcare essential workers. Three multivariate

Ordinary Least Squares (OLS) regression analyses examined predictors of COVID-19-related

health-related worries, functional impairment, and acute stress. Predictors were: healthcare

worker status (healthcare worker=1; other essential worker=0), secondary stressors (lack of

childcare due to COVID-19 school closures, lack of healthcare, lost wages; each coded 0=did

not occur; 1=occurred), demographics (i.e., age, ethnicity, education, female gender, income),

residential region, and cohort. Since the amount of missing data was extremely low (less than

1.5% in covariate-adjusted models) and Little's Missing Completely at Random test was not significant (χ^2[9]=4.19, p=.89), listwise deletion was implemented. Post-hoc, interaction terms between key predictors and essential worker status (healthcare or non-healthcare) were examined; each was examined separately in individual models to conserve sample size, although results were identical when added into a combined model with all interaction terms.

Results

Table 1 presents descriptive statistics and between-group differences for demographic indicators and key covariates. Among all essential workers, difficulty meeting childcare needs was reported by 9.39% (n=169); 9.26% (n=167) reported inability to obtain necessary healthcare; and 21.96% (n=396) reported COVID-19-related lost or reduced wages. The means for acute stress, health-related worries, and functional impairment were 1.84 (SD= 0.71, range= 1-5), 2.53 (SD=1.04, range=1-5) and 1.58 (SD=0.81, range=1-5), respectively.

Tables 2, 3, and 4 present unadjusted and covariate-adjusted associations between predictors of health-related worries, functional impairment, and acute stress, respectively. In adjusted models, inability to obtain health insurance, lost wages, prior mental or physical health ailments, younger age, Hispanic ethnicity, and female gender were associated with acute stress, health-related worries, and functional impairment. Healthcare essential workers reported less functional impairment and acute stress compared to non-healthcare essential workers. Need for childcare was positively associated with acute stress symptoms, although not associated with health-related worries or functional impairment. Residents in the Northeast reported more health-related worries and acute stress than residents in the South. Those who completed the survey later reported more health-related worries, functional impairment, and acute stress compared to those who completed the survey in the earlier phases of the COVID-19 outbreak. Several interaction terms were significant. For functional impairment, need for childcare was moderated by essential worker status (b=-.50, 95% CI, -0.90, -0.11). For health-related worries and acute stress, lost wages was moderated by essential worker status, (b=-.42,

95% CI, -0.77, -0.07) and (b=-0.37, 95% CI, -0.60, -0.13), respectively. See supplemental

materials for full results including tables (Tables S1-S2) and graphs (Figures S1-S3).

Discussion

We explored predictors of psychosocial outcomes in healthcare and non-healthcare

essential workers working in face-to-face interactions during the early phase of the COVID-19

outbreak in the U.S. Results indicated secondary stressors (inability to obtain health insurance,

lost wages), prior mental-health ailments, prior physical-health diagnoses, and demographic

indicators (younger age, female gender, Hispanic ethnicity) were associated with greater

functional impairment, ongoing worry, and acute stress. Effect sizes were largest for difficulty

obtaining healthcare, lost wages, low income, and prior mental health for acute stress; inability

to obtain healthcare, prior mental and physical health ailments, Hispanic ethnicity for functional

impairment; and inability to obtain healthcare, Hispanic ethnicity, and female gender for health-

related worries. Contrary to our hypothesis, non-healthcare essential workers reported more

functional impairment and acute stress than healthcare workers, yet effect sizes were relatiely

modest compared to other factors. Moreover, two stressors (needed childcare and lost wages)

exhibited moderating effects, with negative outcomes exacerbated for non-healthcare workers.

Overall, distress and impairment was relatively low, indicating that while some reported

distress and impairment, resilience early in the pandemic was common, in alignment with prior

disaster research (Silver & Garfin, 2016). Indeed, people reported functional impairment, on

average, between "not at all" and "a little of the time," perhaps not surprising since these

individuals were still working at the time of the assessment. Participants reported acute stress

symptoms, on average, "just a little;" the mean for health related worries was highest of the

variables assessed, with participants reporting these symptoms, on average, around the

midpoint of the scale (i.e., between "rarely" and "sometimes"). Of note, the range and standard

deviations indicate that despite resilience in many, some indiviudals reported distress and

impairment at the scale maximums.

In a recent rapid review of research on healthcare workers employed during the COVID-19 pandemic, 24 studies identified risk factors for maladaptive psychological outcomes of healthcare workers – many of which paralleled the significant indicators presented herein, including female gender, younger age, and prior physical illness (De Kock et al., 2021). We expand this research by using data drawn from a probability-based sample of Americans that included both healthcare and non-healthcare essential workers. In the present study, female essential workers reported significantly higher amounts of all three psychosocial concerns compared to men, echoing previous studies conducted with COVID-19 healthcare workers (Tan et al., 2020) and viral epidemics (Serrano-Ripoll et al., 2020). As in prior epidemics, history of mental health ailments was associated with negative outcomes (Asmundson et al., 2020; Elbay et al., 2020); however, present analyses highlight the additional role of preexisting physical health conditions on psychosocial responses. Age was negatively correlated with health-related worries, functional impairment, and acute stress, potentially due to fewer years of work experience and preparation, such as medical students entering the workforce early (Konda et al., 2020), nurses with junior titles (Steege et al., 2009), or other entry-level jobs (Elbay et al., 2020). Outcomes among all essential workers worsened as the pandemic advanced, suggesting psychosocial difficulties mirrored the outbreak's U.S. progression.

Residents from the U.S. Northeast experienced more health-related worries than Southern residents, aligning with regional outbreak severity during March and April 2020 when the data were collected (Konda et al., 2020). Hispanic ethnicity was positively associated with health-related worries, functional impairment, and acute stress. This aligns with data showing Hispanics, compared to other ethnicities, were more likely to live in a home where at least one worker was unable to work from home (Selden & Berdahl, 2020). Lack of childcare due to COVID-19 school closures was associated with higher acute stress symptoms, paralleling findings among a general sample that included healthcare workers that childcare concerns were associated with heighted anxiety and other worries (Hacimusalar et al., 2020). Notably,

healthcare workers reported significantly *less* acute stress and functional impairment than non-healthcare essential workers, perhaps because healthcare workers have more protocols for working with infectious diseases, greater meaning in their work, or more experience on the job. Indeed, physicians in Izmir/Turkey who were actively treating COVID-19 had lower burnout and higher feelings of accomplishments compared to physicians treating other conditions (Dinibutun, 2020). Moreover, adequate protection training for nurses in China was associated with lower anxiety, acute stress, and depression in nurses during early phases of COVID-19 (Cai et al., 2020). These factors may be more likely explanations than job experience, as burnout and stress often increases in healthcare workers over their career trajectory (Cull et al., 2019).

Strengths and Limitations

Key strengths of this study include a large sample of U.S. essential workers, derived from an overall representative group of Americans recruited during COVID-19's early progression in the U.S. Given the dearth of data on non-healthcare essential workers actively employed during COVID-19, our contributions to the literature demonstrate that this group may be critical to target with mental health recourses and outreach efforts. This is particularly crucial as society enters a new phase of the COVID-19 pandemic, where emerging variants are more contagious and community transmission remains high (Christie et al., 2021), yet essential workers are still required to engage in face-to-face interactions, potentially with fewer protections (e.g., relaxed mask mandates). Our analyses included pre-pandemic physical and mental health diagnosis data, allowing us to draw comparisons between prior diagnoses and present psychological symptomatology without the bias inherent in retrospective reporting.

We acknowledge several limitations. Our data on exposure and symptoms were collected concurrently. While the overall sample of Americans we surveyed was representative of the U.S and the subsample of essential workers we surveyed is likely proportional to their representation in the general population, we cannot consider this to be a representative sample of essential workers. While physical and mental health data were collected in advance of the

pandemic, physical health data was available as count of potential ailments and mental health was available as a dichotomous yet/no variable. Finally, we did not assess specific job, seniority, or workplace safety precautions, which may further explain variability in outcomes.

Conclusions and Future Directions

To our knowledge, this is the first study evaluating psychosocial outcomes in both healthcare and non-healthcare U.S. essential workers during the COVID-19 pandemic using a probability-based design. While many workplaces have implemented COVID-19 mitigation strategies, health and safety concerns remain, and may be associated with psychosocial difficulties. Indeed, acute psychosocial responses to stress may portend deleterious downstream mental and physical health effects, including depression, anxiety, and cardiovascular problems, as well as reduced working capacity and lower self-reported overall health (Garfin et al., 2018). COVID-19-related psychological and occupational impairment could be eased by implementing reliable public health workplace policies (Tan et al., 2020) that encourage healthy coping strategies. Some hospitals have implemented innovative mental health and resilience-building centers for healthcare workers in response to the pandemic (DePierro et al., 2020), which non-healthcare sectors should consider enacting. Workers should be provided adequate benefits like health insurance and paid sick leave. The COVID-19 pandemic also ushered in advances in telehealth and online resources to improve self-care; these include individual and group psychotherapy and wellness apps that can be utilized on mobile devices (Garfin, 2020). Such resources may be valuable for workers as they allow for the safe delivery of interventions and greater convenience for scheduling around work hours. Attention should be paid to non-healthcare essential workers in addition to healthcare essential workers, as their likelihood for functional impairment may be heightened without corresponding supports. As COVID-19 becomes endemic, appropriate resources should be provided for workers who are most vulnerable to COVID-19 and as we strive to prepare for future outbreaks.

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Table 1. *Characteristics of the sample (N= 1,821)*

Essential worker characteristics	Healthcare essential workers (*n*= 169)	Non-healthcare essential workers (*n*=1,652)	Test of between-group differences (non-healthcare vs healthcare essential workers)	Effect size Cohen's *d* (95% CI) or Cramér's *V*
	M(SD)	*M(SD)*		
Age	42.37(12.96)	43.88(13.27)	$t(1819)=1.41$	*d*=0.11(-0.05, 0.27)
	n(%)	*n(%)*		
Race/Ethnicity				
White, Non-Hispanic	128(75.74%)	1181(71.49%)		
Black, Non-Hispanic	16(9.47%)	170(10.29%)		
Other/2+ races, Non-Hispanic	12(7.10%)	139(8.41%)		
Hispanic	13(7.69%)	162(9.81%)	$\chi^2(3)=1.52$	*V*=0.03
Education				
Less than high school	0(0%)	37(2.24%)		
High school graduate	5(2.96%)	279(16.89%)		
Some college	58(34.32%)	750(45.40)		
BA and above	106(62.72%)	586(35.47%)	$\chi^2(3)=57.06**$	*V*=0.18
Gender				
Male	44(26.04%)	751(45.46%)		
Female	125(73.96%)	901(54.54%)	$\chi^2(1)=23.52**$	*V*=0.11
Income				
Less than $10,000	2(1.18%)	66(4.00%)		
$10,000-$24,999	5(2.96%)	191(11.56%)		
$25,000-$49,000	21(12.43%)	403(24.39%)		
$50,000-$74,999	40(23.67%)	356(21.55%)		
$75,000-$99,999	32(18.93%)	272(16.46%)		

$100,000-$124,999	39(23.08%)	207(12.53%)		
$125,000-$149,999	15(8.88%)	89(5.39%)		
$150,000+	15(8.87%)	68(4.12%)	$\chi^2(7)=47.61^{**}$	$V=0.16$
Region				
Northeast	37(21.89%)	224(13.56%)		
Midwest	48(28.40%)	466(28.21%)		
South	45(26.63%)	550(33.29%)		
West	39(23.08%)	412(24.94%)	$\chi^2(3)=9.73^*$	$V=0.07$
Cohort				
Cohort 1: 3/18/20-3/28/20	57(33.73%)	587(35.53%)		
Cohort 2: 3/29/20-4/7/20	61(36.09%)	533(32.26%)		
Cohort 3: 4/8/20-4/18/20	51(30.18%)	532(32.20%)	$\chi^2(2)=1.03$	$V=0.02$
Secondary stressors				
Needed childcare for child because they were out of school	7(4.52%)	131(2.91%)	$\chi^2(1)=1.24$	$V=0.02$
I lost wages	27(17.42%)	880(19.56%)	$\chi^2(1)=0.44$	$V=-0.01$
Unable to obtain necessary healthcare	14(9.03%)	378(8.40%)	$\chi^2(1)=0.08$	$V=0.004$
Pre-pandemic mental health problems	23(13.61%)	282(17.97%)	$\chi^2(1)=1.31$	$V=-0.03$
	_M(SD)_	_M(SD)_		
Pre-pandemic physical health problems	0.65(0.89)	0.83(1.03)	$t(1819)=2.15^*$	$d=0.17(0.01, 0.33)$

* $p<.05$, ** $p<.001$
Note: Cohen's _d_ is presented for t-tests; Cramér's _V_ for $\chi2$
Pre-pandemic mental health problems=motional/nervous/psychiatric problem, anxiety disorder, depression (0=none; 1=one or more)
Pre-pandemic physical health problems= high cholesterol, hypertension, diabetes/high blood sugar, heart disease, stroke, cancer, lung disease, other diagnoses (0-8);

Table 2. *Predictors of health-related worries in essential workers during COVID-19 (N=1,821)*

	Bivariate Associations				Adjusted Multivariate Model			
Variable	**Beta**	**b**	**95% CI**	**p**	**beta**	**b**	**95% CI**	**p**
Healthcare worker[a]	0.01	0.03	-0.14, 0.19	.741	-0.01	-0.05	-0.21, 0.12	.564
Needed childcare	0.07	0.25	0.09, 0.41	.003	0.04	0.13	-0.04, 0.29	.126
Unable to obtain healthcare	0.16	0.56	0.39, 0.23	<.001	0.12	0.41	0.25, 0.58	<.001
Lost wages	0.11	0.29	0.17, 0.40	<.001	0.09	0.22	0.10, 0.33	<.001
Prior mental health dx[b]	0.14	0.38	0.25, 0.50	<.001	0.09	0.24	0.12, 0.37	<.001
Prior physical health dx[c]	0.04	0.04	-0.004. 0.09	.074	0.09	0.10	0.05, 0.15	<.001
Age	-0.10	0.01	-0.01, -0.004	<.001	-0.09	-0.01	-0.01, 0.00	.001
Race/Ethnicity[d]								
Black, Non-Hispanic	0.02	0.08	-0.08, 0.24	.352	0.03	0.01	-0.13, 0.20	.673
Other/2+ races, Non-Hispanic	0.06	0.24	0.07, 0.42	.007	0.15	0.04	-0.02, 0.32	.094
Hispanic	0.09	0.34	0.17, 0.50	<.001	0.29	0.08	0.13, 0.46	.001
Education[e]								
High school graduate	-0.16	-0.47	0.83, -0.11	.011	-0.25	-0.09	-0.60, 0.10	.155
Some college	-0.25	-0.52	-0.87, -0.18	.003	-0.33	-0.16	-0.67, 0.00	.051
BA or above	-0.22	-0.48	-0.83, -0.13	.007	-0.25	-0.12	-0.59, 0.09	.154
Female gender	0.16	0.33	0.24, 0.43	<.001	0.29	0.14	0.20, 0.39	<.001
Income	-0.05	-0.03	-0.06, -0.005	.022	0.00	0.01	-0.03, 0.03	.828
Region[f]								
Midwest	-0.07	-0.16	-0.31, -0.002	.047	-0.13	-0.06	-0.28, 0.02	.085
South	-0.08	-0.18	-0.34, -0.03	.018	-0.21	-0.09	-0.35, -0.06	.006
West	-0.04	-0.10	-0.26, 0.05	.199	-0.14	-0.06	-0.30, 0.01	.070
Cohort[g]								
3/29/20-4/7/20	0.11	0.25	0.14, 0.37	<.001	0.21	0.10	0.10, 0.32	<.001
4/8/20-4/18/20	0.11	0.24	0.12, 0.35	<.001	0.19	0.09	0.08, 0.30	.001
Constant	-	-	-	-		2.80	2.28, 3.08	<.001
Model statistics					*F*(20, 1779)=10.24, *p*<.001, *R*^{2}=.09			

[a]Non-healthcare essential worker=0; [b]emotional/nervous/psychiatric problem, anxiety disorder, depression (0=none; 1=one or more); [c]high cholesterol, hypertension, diabetes/high blood sugar, heart disease, stroke, cancer, lung disease, other diagnoses (0-8); [d]White=0; [e]<high school=0; [f]Northeast=0; [g]Cohort 1: 3/18/20-3/28/20=0

Table 3. *Predictors of functional impairment in essential workers during COVID-19 (N=1,821)*

Variable	Bivariate Associations				Adjusted Multivariate Model			
	Beta	b	95% CI	*p*	Beta	b	95% CI	*p*
Healthcare worker[a]	-0.06	-0.17	-0.29, -0.04	.010	-0.06	-0.17	-0.30, -0.04	.009
Needed childcare	0.07	0.19	0.06, 0.32	.003	0.03	0.09	-0.03, 0.22	.145
Unable to obtain healthcare	0.21	0.59	0.46, 0.71	<.001	0.16	0.46	0.33, 0.58	<.001
Lost wages	0.09	0.19	0.10, 0.29	<.001	0.06	0.12	0.04, 0.21	.006
Prior mental health dx[b]	0.20	0.44	0.34, 0.54	<.001	0.16	0.35	0.25, 0.45	<.001
Prior physical health dx[c]	0.09	0.07	0.03, 0.11	<.001	0.12	0.10	0.06, 0.14	<.001
Age	-0.09	-0.01	-0.01, -0.003	<.001	-0.08	-0.01	-0.01, 0.00	.001
Race/Ethnicity[d]								
Black, Non-Hispanic	0.05	0.14	0.01, 0.26	.029	0.04	0.10	-0.03, 0.22	.133
Other/2+ races, Non-Hispanic	0.09	0.27	0.14, 0.41	<.001	0.05	0.15	0.02, 0.28	.027
Hispanic	0.12	0.34	0.22, 0.47	<.001	0.10	0.28	0.15, 0.41	<.001
Education[e]								
High school graduate	-0.12	-0.27	-0.55, 0.01	.062	-0.12	0.14	-0.39, 0.15	.391
Some college	-0.16	-0.26	-0.54, 0.01	.061	-0.13	0.13	-0.39, 0.13	.339
BA or above	-0.17	-0.29	-0.56, 0.01	.041	-0.09	0.14	-0.36, 0.17	.495
Female gender	0.09	0.16	0.08, 0.23	<.001	0.12	0.07	0.04, 0.19	.002
Income	-0.09	-0.04	-0.07, -0.02	<.001	-0.01	-0.02	-0.03, 0.02	.522
Region[f]								
Midwest	-0.02	-0.04	-0.17, 0.08	.479	-0.04	-0.02	-0.15, 0.08	.542
South	-0.01	-0.01	-0.13, 0.11	.839	-0.05	-0.03	-0.17, 0.06	.362
West	0.04	0.07	-0.05, 0.19	.251	0.01	0.01	-0.11, 0.13	.857
Cohort[g]								
3/29/20-4/7/20	0.05	0.09	-0.004, 0.18	.063	0.06	0.03	-0.03, 0.14	.215
4/8/20-4/18/20	0.07	0.13	0.04, 0.22	.005	0.09	0.05	0.01, 0.18	.034
Constant	-	-	-	-	1.60	1.29, 1.92		<.001
Model statistics					$F(20, 1797)=12.64$, $p<.001$, $R^2=.12$			

[a]Non-healthcare essential worker=0; [b]emotional/nervous/psychiatric problem, anxiety disorder, depression (0=none; 1=one or more);
[c]high cholesterol, hypertension, diabetes/high blood sugar, heart disease, stroke, cancer, lung disease, other diagnoses (0-8);
[d]White=0; [e]<high school=0; [f]Northeast=0; [g]Cohort 3/18/20-3/28/20=0

Table 4. *Predictors of acute stress in essential workers during COVID-19 (N=1,821)*

Variable	Bivariate Associations				Adjusted Multivariate Model			
	beta	b	95% CI	p	beta	b	95% CI	P
Healthcare worker[a]	-0.02	-0.05	-0.16, 0.06	.400	-0.05	-0.13	-0.24, -0.02	.020
Needed childcare	0.13	0.33	0.22, 0.44	<.001	0.09	0.22	0.11, 0.32	<.001
Unable to obtain healthcare	0.19	0.47	0.36, 0.58	<.001	0.14	0.34	0.24, 0.45	<.001
Lost wages	0.16	0.28	0.20, 0.35	<.001	0.13	0.22	0.14, 0.29	<.001
Prior mental health dx[b]	0.20	0.38	0.29, 0.46	<.001	0.14	0.27	0.18, 0.35	<.001
Prior physical health dx[c]	0.01	0.01	-0.02, 0.04	.618	0.07	0.05	0.02, 0.08	<.001
Age	-0.15	0.12	-0.15, -0.08	<.001	-0.12	-0.10	-0.13, -0.06	<.001
Race/Ethnicity[d]								
Black, Non-Hispanic	0.01	0.02	-0.09, 0.13	.746	0.01	0.02	-0.09, 0.13	.700
Other/2+ races, Non-Hispanic	0.05	0.13	0.01, 0.25	.036	0.02	0.06	-0.06, 0.17	.341
Hispanic	0.09	0.22	0.11, 0.33	<.001	0.08	0.200	0.09, 0.31	<.001
Education[e]								
High school graduate	-0.02	-0.05	-0.14, 0.04	.299	-0.09	-0.18	-0.40, 0.05	.122
Some college	-0.04	-0.05	-0.12, 0.01	.109	-0.13	-0.19	-0.40, 0.03	.094
BA or above	0.04	0.06	-0.01, 0.12	.106	-0.05	-0.08	-0.30, 0.15	.488
Female gender	0.16	0.23	0.16, 0.29	<.001	0.13	0.19	0.13, 0.25	<.001
Income	-0.05	-0.02	-0.04, -0.00	.023	0.02	0.01	-0.01, 0.03	.550
Region[f]								
Midwest	-0.02	-0.03	-0.11, 0.04	.357	-0.05	-0.08	-0.18, 0.02	.106
South	-0.04	-0.06	-0.13, 0.01	.080	-0.09	-0.13	-0.23, -0.03	.009
West	0.04	0.06	-0.02, 0.14	.127	-0.04	-0.06	-0.16, 0.04	.263
Cohort[g]								
3/29/20-4/7/20	0.03	0.05	-0.02, 0.12	.148	0.06	0.09	0.01, 0.16	.023
4/8/20-4/18/20	0.06	0.09	0.02, 0.16	.014	0.07	0.11	0.04, 0.19	.003
Constant						1.89	1.63, 2.15	<.001
Model statistics					$F(20, 1782)=15.84, p<.001, R^2=.15$			

[a]Non-healthcare essential worker=0; [b]emotional/nervous/psychiatric problem, anxiety disorder, depression (0=none; 1=one or more); [c]high cholesterol, hypertension, diabetes/high blood sugar, heart disease, stroke, cancer, lung disease, other diagnoses (0-8); [d]White=0; [e]<high school=0; [f]Northeast=0; [g]Cohort 3/18/20-3/28/20=0

Table S1. *Multivariate ordinary least squares regression on functional impairment, including interaction between type of essential worker and needed childcare*

Adjusted Multivariate Model

Variable	beta	b	95% CI	p
Healthcare worker[a]	-0.04	-0.12	-0.25, 0.02	.094
Needed childcare	0.05	0.15	0.02, 0.28	.027
Unable to obtain healthcare	0.16	0.45	0.33, 0.58	<.001
Lost wages	0.07	0.13	0.04, 0.22	.004
Prior mental health dx[b]	0.16	0.35	0.25, 0.45	<.001
Prior physical health dx[c]	0.12	0.10	0.06, 0.14	<.001
Age	-0.08	-0.00	-0.01, -0.00	.002
Race/Ethnicity[d]				
Black, Non-Hispanic	0.03	0.09	-0.03, 0.22	.157
Other/2+ races, Non-Hispanic	0.05	0.15	0.02, 0.29	.025
Hispanic	0.10	0.28	0.15, 0.40	.001
Education[e]				
High school graduate	-0.05	-0.11	-0.38, 0.15	.403
Some college	-0.08	-0.12	-0.38, 0.14	.349
BA or above	-0.05	-0.09	-0.35, 0.18	.510
Female gender	0.07	0.12	0.04, 0.19	.002
Income	-0.02	0.00	-0.03, 0.02	.526
Region[f]				
Midwest	-0.02	-0.03	-0.14, 0.08	-.145
South	-0.03	-0.05	-0.16, 0.07	.416
West	0.01	-0.02	-0.10, 0.14	.777
Cohort[g]				
3/29/20-4/7/20	0.03	0.06	-0.03, 0.14	.199
4/8/20-4/18/20	0.05	0.09	0.00, 0.18	.039
Healthcare worker x needed childcare	-0.06	-0.50	-0.90, -0.11	0.12
Constant		1.59	1.27, 1.90	<.001
Model statistics		$F(21, 1775)=12.38$, $p<.001$, $R^2=.13$		

[a]Non-healthcare essential worker=0; [b]emotional/nervous/psychiatric problem, anxiety disorder, depression (0=none; 1=one or more); [c]high cholesterol, hypertension, diabetes/high blood sugar, heart disease, stroke, cancer, lung disease, other diagnoses (0-8); [d]White=0; [e]<high school=0; [f]Northeast=0; [g]Cohort 1: 3/18/20-3/28/20=0

Table S2. Multivariate ordinary least squares regression on health-related worries, including interaction between type of essential worker and lost wages

Adjusted Multivariate Model

Variable	beta	b	95% CI	*p*
Healthcare worker[a]	0.02	-0.08	-0.12, 0.27	.443
Needed childcare	0.38	0.13	-0.03, 0.30	.100
Unable to obtain healthcare	0.11	0.41	0.26, 0.58	<.001
Lost wages	0.12	0.27	0.15, 0.39	<.001
Prior mental health dx[b]	0.09	0.28	0.11, 0.36	<.001
Prior physical health dx[c]	0.09	0.09	0.05, 0.14	<.001
Age	-0.08	-0.01	-0.01, 0.00	.002
Race/Ethnicity[d]				
Black, Non-Hispanic	0.01	0.03	-0.13, 0.19	.751
Other/2+ races, Non-Hispanic	0.04	0.15	-0.03, 0.32	.096
Hispanic	0.83	0.29	0.13, 0.46	<.001
Education[e]				
High school graduate	-0.08	-0.24	-0.59, 0.10	.169
Some college	-0.15	-0.32	-0.66, 0.01	.061
BA or above	-0.11	-0.23	-0.58, 0.11	.177
Female gender	0.14	0.29	0.20, 0.39	<.001
Income	0.00	0.00	-0.03, 0.03	.858
Region[f]				
Midwest	-0.05	-0.13	-0.28, 0.02	.099
South	-0.09	-0.20	-0.35, -0.05	.007
West	-0.06	-0.14	-0.30, 0.01	.070
Cohort[g]				
3/29/20-4/7/20	0.09	0.21	0.10, 0.32	<.001
4/8/20-4/18/20	0.09	0.19	0.08, 0.30	.001
Healthcare worker x lost wages	-0.07	-0.42	-0.77, -0.07	.018
Constant		2.64	2.24, 3.04	<.001
Model statistics			$F(21, 1778)=10.05$, $p<.001$, $R^2=.11$	

[a]Non-healthcare essential worker=0; [b]emotional/nervous/psychiatric problem, anxiety disorder, depression (0=none; 1=one or more); [c]high cholesterol, hypertension, diabetes/high blood sugar, heart disease, stroke, cancer, lung disease, other diagnoses (0-8); [d]White=0; [e]<high school=0; [f]Northeast=0; [g]Cohort 1: 3/18/20-3/28/20=0

Table S3. Multivariate ordinary least squares regression on acute stress scores, including interaction between type of essential worker and lost wages

Adjusted Multivariate Model

Variable	beta	b	95% CI	*P*
Healthcare worker[a]	-0.01	-0.02	-0.15, 0.10	.718
Needed childcare	0.09	0.21	0.11, 0.32	<.001
Unable to obtain healthcare	0.14	0.35	0.24, 0.45	<.001
Lost wages	0.15	0.26	0.18, 0.34	<.001
Prior mental health dx[b]	0.14	0.26	0.17, 0.34	<.001
Prior physical health dx[c]	0.08	0.06	0.24, 0.09	.001
Age	-0.12	-0.01	-0.01, 0.00	<.001
Race/Ethnicity[d]				
Black, Non-Hispanic	0.01	0.01	-0.09, 0.12	.803
Other/2+ races, Non-Hispanic	0.02	0.05	-0.06, 0.17	.360
Hispanic	0.08	0.20	0.09, 0.30	<.001
Education[e]				
High school graduate	-0.08	-0.16	-0.39, 0.06	.158
Some college	-0.12	-0.17	-0.39, 0.05	.130
BA or above	-0.04	-0.06	-0.28, 0.16	.596
Female gender	0.13	0.19	0.13, 0.25	<.001
Income	0.02	0.01	-0.01, 0.03	.505
Region[f]				
Midwest	-0.05	-0.08	-0.18, 0.02	.122
South	-0.08	-0.13	-0.22, -0.03	.010
West	-0.04	-0.06	-0.16, 0.04	.255
Cohort[g]				
3/29/20-4/7/20	0.06	0.09	0.01, 0.16	.021
4/8/20-4/18/20	0.07	0.11	0.04, 0.19	.003
Healthcare worker x lost wages	-0.09	-0.37	-0.60, -0.13	.002
Constant		1.94	1.68, 2.21	<.001
Model statistics			$F(21, 1781)=15.99, p<.001, R^2=.16$	

[a]Non-healthcare essential worker=0; [b]emotional/nervous/psychiatric problem, anxiety disorder, depression (0=none; 1=one or more); [c]high cholesterol, hypertension, diabetes/high blood sugar, heart disease, stroke, cancer, lung disease, other diagnoses (0-8); [d]White=0; [e]<high school=0; [f]Northeast=0; [g]Cohort 3/18/20-3/28/20=0
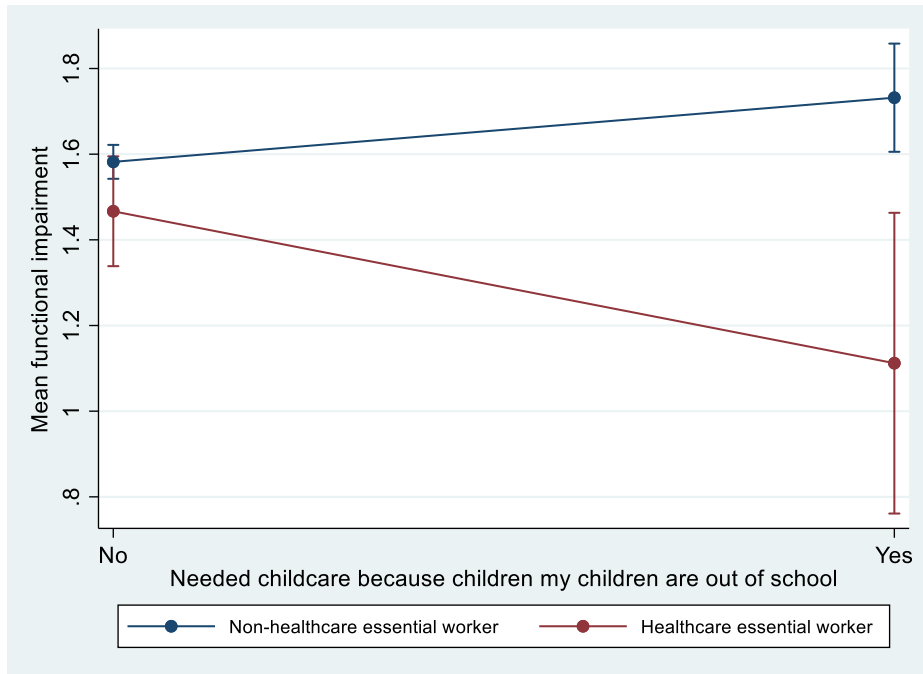
Figure S1. *Interaction between type of essential worker and needed childcare on functional impairment, adjusted for covariates*
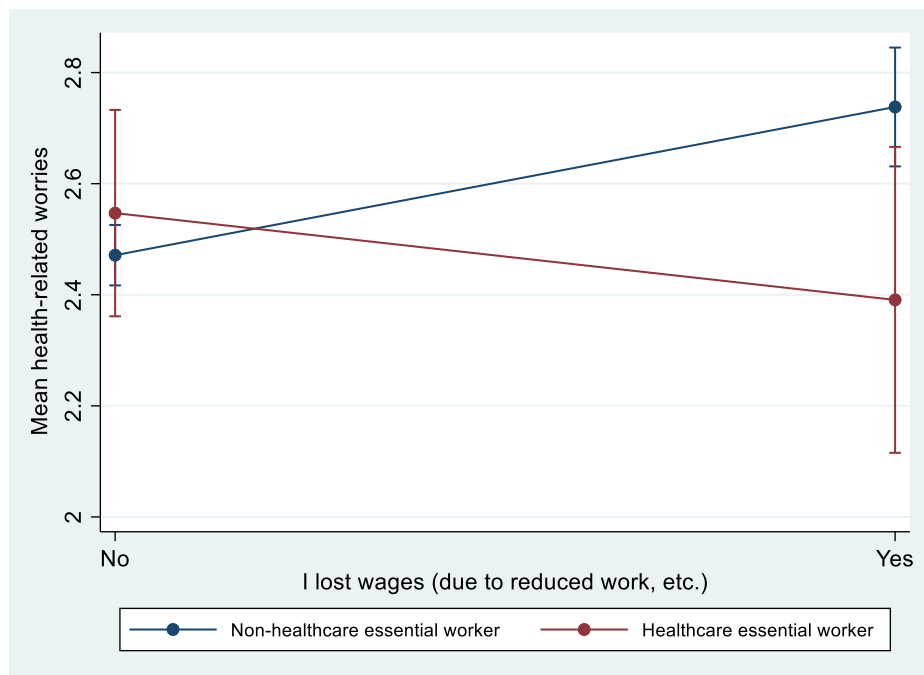

Figure S2. *Interaction between type of essential worker and lost wages on health-related worries, adjusted for covariates*
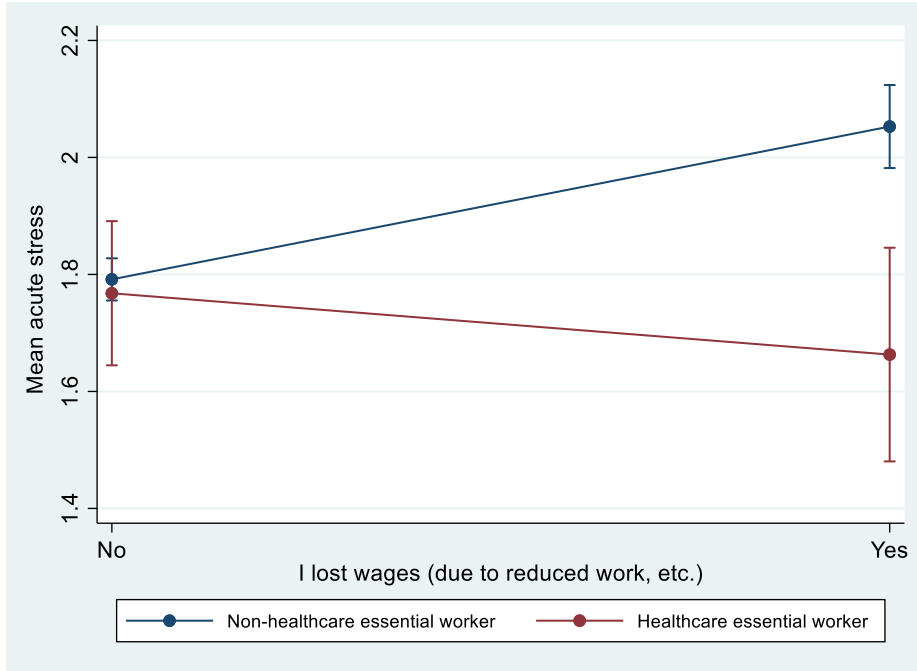
Figure S3. *Interaction between type of essential worker and lost wages on acute stress scores, adjusted for covariates*