

# **The COVID-19 Study of Healthcare and Support Personnel (CHAMPS): A Longitudinal Observational Study**

Peter G. Kaufmann, Donna S. Havens, Janell L. Mensinger, Patricia K. Bradley, Heather M. Brom, Linda C. Copel, Alexander Costello, Christine D'Annunzio, Jennifer Dean Durning, Linda Maldonado, Ann Barrow McKenzie, Suzanne C. Smeltzer, Jennifer Yost

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# The COVID-19 Study of Healthcare and Support Personnel (CHAMPS): A Longitudinal Observational Study

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## Abstract

**Background:** Early during the development of the COVID-19 pandemic it was evident that healthcare workers, first responders and other essential workers would face significant stress and workplace demands related to equipment shortages and rapidly growing infections in the general population. Although the effects of other sources of stress on health have been documented, the effects of these unique conditions of the COVID-19 pandemic on long-term health and well-being of the healthcare workforce is not known.

**Objective:** The CHAMPS study will document early and longitudinal effects of the pandemic on the mental and physical health of essential workers engaged in healthcare. We will investigate mediators and moderators of these effects and evaluate the influence of stress exposure, including morbidity and mortality over time. We will also examine the effect of protective factors and resilience on health outcomes.

**Methods:** The study cohort is a convenience sample recruited nationally through communities, professional organizations, networks, social media and snowball sampling. Recruitment takes place for 13 months to attain an estimated sample of 3,000 adults who provide self-reported information administered online through structured questionnaires about their work environment, mental and physical health and psychosocial factors. Follow-up questionnaires are administered after 6 months and annually hereafter to ascertain changes in health, well-being and lifestyle. Consenting participants comprise the CHAMPS Registry, which enables them to enroll in future studies for which they may be eligible.

**Results:** The study was approved by the institutional review board and launched in May 2020, with grants from Travers Therapeutics Inc., McKesson Corporation, anonymous donors and internal funding from the Villanova University M. Louise Fitzpatrick College of Nursing.

**Conclusions:** The CHAMPS Study and Registry enables obtaining detailed data on the effects of extended psychosocial and workplace stress on morbidity and mortality and serves as a platform for ancillary studies related to the COVID-19 pandemic. Clinical Trial: CHAMPS is registered in ClinicalTrials.gov: NCT04370821.

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## Original Manuscript

The COVID-19 Study of Healthcare and Support Personnel (CHAMPS):  
A Longitudinal Observational Study

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## Abstract

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healthcare workers, first responders and other essential workers would face significant stress and workplace demands related to equipment shortages and rapidly growing infections in the general population. Although the effects of other sources of stress on health have been documented, the effects of these unique conditions of the COVID-19 pandemic on long-term health and well-being of the healthcare workforce are not known.

**Objectives:** The CHAMPS study was designed to document early and longitudinal effects of the pandemic on the mental and physical health of essential workers engaged in healthcare. We will investigate mediators and moderators of these effects and evaluate the influence of stress exposure, including morbidity and mortality over time. We will also examine the effect of protective factors and resilience on health outcomes.

**Methods:** The study cohort is a convenience sample recruited nationally through communities, professional organizations, networks, social media and snowball sampling. Recruitment took place for 13 months to attain an estimated sample of 2,762 adults who provided self-reported information administered online through structured questionnaires about their work environment, mental and physical health and psychosocial factors. Follow-up questionnaires will be administered after six months and annually thereafter to ascertain changes in health, well-being, and lifestyle. Participants who consented to be re-contacted form the longitudinal cohort and the CHAMPS Registry and may be contacted to ascertain their interest in ancillary studies for which they may be eligible.

**Results:** The study was approved by the Institutional Review Board and launched in May 2020, with grants from Travele Therapeutics Inc., McKesson Corporation, anonymous donors and internal funding from the Villanova University M. Louise Fitzpatrick College of Nursing. Recruitment ended in June 2021, after enrolling 2762 participants, 1534 of whom agreed to participate in the longitudinal study and the registry, and to be contacted about eligibility for future studies.

**Conclusions:** The CHAMPS Study and Registry enables obtaining detailed data on the effects of extended psychosocial and workplace stress on morbidity and mortality and serves as a platform for ancillary studies related to the COVID-19 pandemic.

**Registration:** CHAMPS is registered in ClinicalTrials.gov: NCT04370821.

**International registered report identifier (irrid):**

**Keywords:** COVID-19; SARS-CoV-2; stress; depression; anxiety; sleep; social support; resilience; mental health; physical illness.

## INTRODUCTION

### Background

Globally, the coronavirus type-2 (SARS-CoV-2) has infected more than 224 million individuals, with more than 41 million cases in the United States (US) [1]. The first report that a new coronavirus was the cause of a spate of pneumonia cases in Wuhan, China was issued in early January 2020 (World Health Organization, 2020), and the first case in the US was reported two weeks later [2]. By early spring of 2020, infections had risen dramatically in several countries and projections suggested that the pandemic could impose severe strains on the ability of US hospitals to deliver care [3]. Experience from the SARS outbreak in 2003 [4,5] suggested that, because of its heavy burden on the healthcare system, the rapidly rising number of COVID-19 cases would have a large impact on the mental and physical health of the healthcare workforce. Such concerns indeed began to emerge early in the spring of 2020 [6]. It also seemed reasonable to expect that laboratory workers, office personnel, first responders and others who were engaged less directly in caring for COVID-19 patients, as compared to healthcare workers, would experience similar strains on their psychological well-being. First responders, including police, fire and emergency medical services, may experience higher rates of exposure to the SARS-CoV-2 virus than the general population [7].

Healthcare systems in numerous countries were overwhelmed by the COVID-19 pandemic, which has caused increased pressure on frontline health workers [8]. Hospitals in New York City, for example, have had to reconfigure patient-care spaces and restructure clinical teams rapidly to address the increase of patients with COVID-19 [9]. The overwhelming workload, increasing number of suspected and confirmed COVID-19 cases, lack of evidence-based treatments and shortages of personal protective equipment (PPE), extensive media coverage, and perceptions of inadequate support may contribute to the mental burden of healthcare workers [10].

Concerns by healthcare workers that they might not only become infected but transmit COVID-19 to family members and friends add to their psychological burden [9]. The combined result is that the COVID-19 pandemic can be expected to have a prolonged impact on the mental health of a broad range of workers who are essential for delivering healthcare [11,12].

### Rationale

In the context of the COVID-19 pandemic, we anticipated that healthcare workers would face anxiety and depressive symptoms due to traumatic patient-care experiences and the risk of SARS-CoV-2 infection to family, friends, and colleagues [13]. Frontline healthcare workers were among the most vulnerable groups at risk of mental health issues during the early phases of the COVID-19 pandemic; however, the numerous risks to the well-being of healthcare workers remain poorly understood [14]. High prevalence of anxiety and depressive symptoms among front-line healthcare workers caring for COVID-19 patients has been reported [14], but their duration and impact on future physical health are not known. The risks to the mental well-being of healthcare workers are likely multifaceted, with a dearth of information regarding who might benefit from preventive interventions [45].

Even under normal circumstances, workplace stress has effects on physical health [15] and these effects increase as decision latitude and control over work decrease [16]. With rapidly increasing caseloads in healthcare facilities, the COVID-19 pandemic seemed ideally constituted to create a high demand, low decision latitude environment. Added to this was the likelihood of a high proportion of adverse outcomes and mortality of patients due to the absence of effective treatments in the first months of the pandemic. Finally, PPE shortages [9,14,17] increased the risk of infection for themselves and those with whom they have a close relationship, including family, household members and others, which has the potential of adding to other sources of stress.

Emotional stress and stressful life events have been shown to contribute to the six leading causes of death in the US - cancer, coronary artery disease, accidents (unintentional injuries), respiratory



disorders, cirrhosis of the liver and suicide as well as Type 2 diabetes, sleep disorders and other health conditions [18]. Workplace stress in particular has been associated with hypertension [19] and coronary heart disease [20]. High workplace demands and low decision latitude, combined with low rewards are prospective risk factors for common mental disorders [21]. The effects of stressful working conditions on short-term mental health of healthcare personnel during this pandemic have already begun to emerge [9,17].

The effects of stress on long-term physical and mental health can take many years to become manifest. Military combat deployment [22,23] and elevated symptoms of post-traumatic stress disorder (PTSD) in civilians have been associated with increased risk of hypertension, myocardial infarction and stroke [24,25]. Longitudinal trends show that the likelihood of developing multiple physical symptoms over time is higher for those who were deployed in combat than those without combat experience [26].

Research on the effects of stress on the COVID-19 workforce [9,17] is under way but is in its early stages [27], with mixed results [28]. Some studies have noted the potential importance of resilience in response to stress, including in healthcare workers [29], but adequate supporting data on the role of resilience in response to stress are lacking [30]. The COVID-19 pandemic experience of essential workers provides an opportunity to develop new information on the influence of sustained stress on short- and long-term physical and mental health of the workforce involved in providing healthcare or to support healthcare personnel, as well as on the potential influence of aspects of resilience and its role in moderating the effects of stress.

Based on the extensive body of literature on psychosocial influences on health, it is likely that the COVID-19 pandemic will have deleterious effects on the health of healthcare workers and support staff in a broad range of professions [31]. Over time, as COVID-19 treatments and management improve, infection rates decrease through public health measures and vaccination, we anticipate that sources of stress will decrease, resulting in a gradient of influence on health among healthcare workers who enroll in CHAMPS during later phases of the pandemic. The CHAMPS Study and Registry is designed to ascertain the time course and magnitude of these changes on long-term mental and physical health of essential workers in the healthcare environment.

## Objectives

The objective of CHAMPS Study and Registry is to assess the short- and long-term physical, social and behavioral health of personnel ("essential workers") involved in supporting or delivering care for COVID-19 patients. Included are first responders, maintenance and support staff working in clinical settings as well as healthcare professionals of all specialties and services. At enrollment, the study obtained baseline data on the working environment, lifestyle, and mental and physical health. Subsequent waves of data collection will obtain follow-up information after six months and then annually through 2024. The study was approved by the Villanova University Institutional Review Board (IRB) in May 2020.

The primary objectives of the CHAMPS study are to 1) determine the extent to which working in healthcare affects future physical and mental health; 2) evaluate trends over the time-course of the evolving pandemic; 3) identify exposure variables that are associated with incident changes in health over time; and 4) identify factors that influence short- and long-term health. Specific hypotheses include:

1. Measures of mental health symptoms of anxiety, traumatic stress, depression, insomnia, disordered eating, resilience, burnout and poor self-reported health will be more prevalent in essential workers than in the general population and greater in magnitude than reported in similar populations before the COVID-19 pandemic.

2. The severity of mental health symptoms will be associated with prevalence of SARS-CoV-2 infection rates in the geographic region in which study participants work.

3. Mental health symptoms will persist longer among study participants with more severe symptoms.

4. Essential workers who report elevated symptoms of anxiety, traumatic stress or depression will experience exacerbation of existing physical health conditions over time and higher incidence of new physical health conditions.

5. Severity and progression of mental and physical health conditions will be exacerbated by the degree of perceived exposure to adverse working environments, such as availability of personal protective equipment, extended working hours and adequacy of staffing levels.

## **METHODS**

CHAMPS consists of three components: a) a cross-sectional study of respondents who consented to participate in a single assessment of health; b) a longitudinal study of participants who consented to repeated waves of data collection and c) a registry comprised of participants who enrolled in the longitudinal study. The registry serves as a source of study participants who may be eligible for future, ancillary observational studies as well as randomized clinical trials.

### **Questionnaires**

To address the specific hypotheses, we selected validated instruments available for mental and physical health variables of interest. They are described in detail under Measures. Demographic, occupation, work environment and geographic questions were written by professionals who work in healthcare.

### **Participants and Recruitment**

Eligible participants were adult essential workers involved in healthcare. For purposes of the CHAMPS Study, essential workers were defined as adult (18 years or older) healthcare personnel, support personnel, and first responders working in any healthcare facility or in the community. Included were those working in facilities that are involved in patient care, such as hospitals, clinics, private practices or screening facilities; those directly involved in patient care (e.g., physicians, nurses, phlebotomists, respiratory therapists, pharmacists); laboratory staff; service employees (office staff, maintenance, housekeeping, food service); individuals working in long-term care facilities; and, first responders (e.g., police officers, firefighters, emergency medical technicians, paramedics). Collectively, we refer to these as “essential workers.” Enrollment took place for 13 months, from May 2020 through June 2021 throughout the US.

Recruitment included advertising through local and national professional and trade organizations, news, social and professional media, alumni organizations, and word of mouth to describe the study and disseminate the internet link that provided access to the informed consent form and study questionnaires. Professional and trade organizations were identified and contacted. Website posts, e-newsletters, and social media were used to reach members of eligible occupations, with news or social media posts either by their group administrators or by the study team. The wider social media universe was reached through posts on university channels on various platforms, university-affiliated influencer posts, and a limited paid media campaign. Social media posts and outreach to organization leaders continued periodically throughout the recruitment period.

### **Informed consent**

An internet link provided access to the informed consent document that described the purpose of the study, time required to complete the questionnaire, duration of the study and options for cross-sectional or longitudinal study participation. An affirmative consent response opened the baseline questionnaire. At the end of the initial survey participants were asked to provide their email contact information for the longitudinal study and registry, which would be used to provide future

questionnaires and information about studies for which they may qualify. The consent form also stated that information would be used only for medical research and shared only with other medical researchers. Participants were informed that they could end participation at any time.

## Measures

The baseline questionnaire consisted of demographic information, occupation and work environment, followed by validated instruments on behavioral health, described below. Instruments were selected to balance validity and brevity. An open-ended question provided an opportunity to describe personal experiences of working during the COVID-19 pandemic and participants' interest to be interviewed. The measures and timepoints of data collection are outlined in Table 1.

*Demographic Data. General Health Status and SARS-CoV-2 infection.* These were ascertained by specific questions related to age, sex, occupation, self-reported general health, and infection status at the time of enrollment.

*Anxiety and Depression.* Anxiety symptoms were assessed by the Generalized Anxiety Disorder 7 (GAD-7) [32] and depressive symptoms by the Patient Health Questionnaire 2 (PHQ-2) [18]. The GAD-7 was validated on 2740 adults, of whom 965 were interviewed by a mental health professional. The PHQ-2 included the first two items of the PHQ-9, whose sensitivity and specificity are associated with the prevalence of depression [33]. These were selected for their performance and brevity.

*Social Support.* The Oslo Social Support Scale-3 (OSSS-3) [34] was used to measure social support. We sought a brief social support scale with good psychometric properties. With a Cronbach's alpha of .640 the three-item OSSS-3 has good internal consistency and acceptable construct validity [34], especially for a short scale. It is scored easily, with normative values available for men and women between the ages of 14 and 91. In a cohort of adults 50-69 years of age who experienced adverse childhood events, moderate to strong perceived social support scores as measured by the OSSS-3 were associated with significantly lower odds of depressive symptoms [35].

*Sleep Quality.* The Insomnia Severity Index-7 (ISI-7) was used to measure sleep quality. The ISI-7 has been validated as a useful clinical tool to quantify perceived insomnia severity for primary as well as secondary insomnia and in young and older patients [36]. It has also been validated for Web-based applications as its psychometric properties were found to be similar to the form version [37]. In a study of medical staff in China following the COVID-19 outbreak, ISI-7 scores were associated with anxiety levels and isolation and moderated by level of education [38].

*Stress.* Stress has been associated with elevated risk of cardiovascular, metabolic, and musculoskeletal disorders [17]. Essential workers may experience stress from numerous sources that are not necessarily related to the pandemic. These may interact with stressors that are related to COVID-19 work life suggesting that both, general stress as well as stress specific to COVID-19 be ascertained. We measured *traumatic stress* with the Impact of Events Scale Revised (IES-R) [39], which assesses the symptoms of post-traumatic stress disorder (PTSD). For *stress specific to COVID-19* we adapted scales from Wu et al [4] and Chong et al [5] to assess the work environment and concerns specifically related to working in a high-risk environment.

*Narrative Response Question.* The last question on the questionnaire is an opportunity to describe in narrative form the participant's service experience during the pandemic for qualitative analysis, with no limits on time or length of the narrative.

## Six-month Follow-up

The first follow-up occurred six months after enrolling and completing the baseline questionnaire. Assessments included resilience, burn-out, eating habits, alcohol and substance use; physical

activity; nutrition; height, weight, and weight discrimination items [40,41]; and a comprehensive health history checklist.

*Resilience* was measured by the Brief Resilience Scale (BRS), designed to assess the ability to bounce back from stress, and to be brief [42]. It includes three positively and three negatively worded items, thought to reduce the effects of social desirability and positive response bias. The scale is unique because it assesses resilience, rather than the attributes that contribute to resilience. Whether any aspects of resilience in middle life predict long-term health outcomes after major life events such as the COVID-19 pandemic remains to be determined.

*Proactive Coping* is defined as a forward-looking strategy to address anticipated stressors or hardships and is measured by the Proactive Coping Subscale of the Proactive Coping Inventory (PCI). We hypothesized that proactive coping would serve as a moderator of the consequences of stress. The Proactive Coping Subscale of the PCI consists of 14 items, combines autonomous goal setting with self-regulatory goal attainment cognitions and behavior. The scale showed high internal consistency as seen in reliability measures of .85 and .80 in two samples during its development [43, 44].

*Burnout* was assessed by the Oldenburg Burnout Inventory (OLBI). Burnout is a psychological condition that follows highly demanding or stressful physical and mental work conditions that may be accompanied by inadequate resources [45,46]. Historically, the most commonly used instrument is the Maslach Burnout Inventory [47], which has been criticized on psychometric grounds because all items in each subscale are unidirectional [45]. We chose the OLBI because it avoids this problem by including positively and negatively framed items in the assessment of exhaustion and disengagement, which are two core features of burnout [45]. Moreover, the OLBI includes a stronger assessment of the cognitive aspect of work, which plays an important role in numerous healthcare functions. Data from the OLBI is also available from previous studies of healthcare workers [45].

*Eating Habits.* Increased caloric intake is a common response to mental stress [48]. We chose the brief, seven-item Loss of Control Over Eating Scale (LOCES) [49] as it maintains a good fit to the data analyzed by the original, twenty-four item LOCES [50]. The quality of the diet is as important as caloric intake. We used a two-question assessment of fruit and vegetable intake that has high specificity, based on correlation with biomarkers in the test population (plasma ascorbic acid, beta-carotene and alpha-tocopherol 24-hour urinary potassium excretion) [51].

*Morphometrics.* Self-reported height and weight were obtained. Weight discrimination history, namely whether the participant experienced any bias based on body weight, was assessed by a single question [40,41].

#### *Alcohol and substance use.*

We hypothesized that alcohol and substance use may increase in response to the stress of workplace demands but thought that a thorough screening would not be in the best interests of the overall study. We decided to limit our data to answers to two questions, namely whether alcohol and substance use was increased, unchanged or decreased since the start of the pandemic.

*Physical activity.* We chose to assess physical activity with two brief questions, one on the amount of time spent in moderate-to-vigorous physical activity, the other on whether the amount of physical activity had changed since the pandemic.

#### *Health history checklist.*

The relationship between stress, major life events and other biopsychosocial factors has a long history of study in epidemiology and public health, with a sound mechanistic basis [52,53]. We

hypothesized that the effects of working in the challenging circumstances of the pandemic would have effects on health over time. We obtained a comprehensive history of mental and physical health during the pandemic to enable prospective evaluation of incident conditions.

### Exposure Assessment

We define and quantify exposure to COVID-19 service burden by summing participants' scores on the Perception of Stress at Work scale developed by Wu and colleagues (2009) during the SARS pandemic and added to that score a point for each of several additional stressors: 1) working more hours since the pandemic; 2) working in a different setting; 3) caring for patients with COVID-19; 4) changed living arrangement; 5) receiving a COVID-19 diagnosis; and, 5) having a close contact (friend/family member/colleague/any loved one) with COVID-19 diagnosis (Table 1).

**Table 1.** Components of exposure to COVID-19 Service Burden algorithm-based score

Component	Scoring
Perception of Stress at Work	Average score of 9-item scale
Working more hours	Yes=1 additional point
Working in a different setting	Yes=1 additional point
Caring for patients with COVID-19	Yes=1 additional point
Changed living arrangement	Yes=1 additional point
Receiving a COVID-19 diagnosis	Yes=1 additional point
Having close contact (friend/family member/colleague/any loved one) with COVID-19 diagnosis	Yes=1 additional point

For this purpose, perceived stress is deemed to be an outcome of exposure but can also be included as an exposure variable in models that ascertain incidence of health conditions over time.

### Annual Follow-up Questionnaires

Annual follow-up questionnaires will include incidence of conditions and diseases, as well as selected instruments from the baseline and six-month follow-up questionnaires. Additional items may be added in response to the evolving research literature on COVID-19 and that of other fields. Table 2 provides the anticipated data collection schedule.

**Table 2.** CHAMPS measures and data collection timepoints. All data are self-reported.

Measure	Instrument	# Of items	T0 (Baseline)	T1 (6mo)	T2 (Yr.1)	T3 (Yr.2)	T4 (Yr.3)	T5 (Yr.4)
Demographic			X					
Anxiety	GAD-7	7	X		X	X	X	X
Depression	PHQ-2	2	X		X	X	X	X
Social support	OSSS-3	3	X					
Sleep	ISI-7	7	X		X	X	X	X
Traumatic stress	IES-R	22	X		X	X	X	X
Stress specific to COVID-19	Based on Wu et al. [4] and Chong et al. [5]	10	X					
Resilience	BRS	6		X	X	X	X	X
Proactive	Proactive	14		X				

Coping	Coping Subscale of the PCI							
Burnout	OLBI	16		X	X	X	X	X
Eating habits	LOCES	7		X	X	X	X	X
Morphometric	Height, Weight	2		X				
Alcohol and substance abuse		2		X				
Physical activity		2		X				
Health history checklist		14		X	X	X	X	X

## Registry and Ancillary Studies

During enrollment participants are given the option of providing contact information for follow-up questionnaires, which also enrolls them in the CHAMPS Registry. The CHAMPS Registry enables recruitment of eligible individuals for clinical trials of interventions relevant to COVID-19 or other disorders or conditions, as well as for ancillary studies of basic behavioral research or observational studies that require new data collection [50,54,55]. Anticipated ancillary studies include a detailed assessment of lifestyle factors, interactions with family life, and wellness interventions. Ancillary study proposals will be reviewed by the CHAMPS Steering Committee for relevance, scientific interest, and participant burden.

## Analysis

*Data Management and Quality.* Data are collected through the web-based Qualtrics system. SPSS and SAS will be used for data analysis. Initially, we will perform exploratory analysis to establish patterns of missingness and distributions of variables being measured. The registry data will be characterized with descriptive analyses including frequency distributions, prevalence rates of COVID testing and SARS-CoV-2 infection and means and standard deviations of scores on the scales measuring work environment, general health status, anxiety, depressive symptoms, social support, traumatic stress, social support, sleep quality, and stress. Multiple logistic and linear regression methods will be used to assess baseline associations of health and well-being with estimates of exposure to COVID-19 infection and COVID-related stress at work. Models will be adjusted for sex, age, race/ethnicity and job classification. Other preliminary explorations of associations between measured variables will be performed to aid with the development of sub-studies from the registry. Follow-up health status questionnaires will enable analysis of associations between incident health events and baseline variables.

Narrative responses to the final question on the questionnaire will be analyzed using a deductive approach and thematic content analysis techniques. Multiple investigators will read the narratives provided by participants to perform coding of the significant statements made by participants. After multiple readings investigators will generate data categories, clusters of statements and develop themes.

*Aim 1.* We will determine whether essential workers with higher COVID-19 service exposure burden will experience higher rates of stress, depression, anxiety and substance use than the general population at the time they enroll in CHAMPS, and higher than in similar populations before COVID. We will compare exposure by type of service, occupation, and place of service (e.g., clinical setting or community), controlling for age, self-reported sex and race. We will conduct analyses to identify

mediators such as racial status, and moderators, such as proactive coping and resilience.

*Aim 2.* We will determine whether the severity of mental health symptoms will be associated with changes in the prevalence of SARS-CoV-2 infections by geographic region.

*Aim 3.* We will ascertain whether exposure to COVID-19 service burden will affect physical and mental health over time and how these are influenced by psychosocial variables (e.g., stress, depression, anxiety, burnout). We will analyze whether longitudinal health outcomes are associated with type of service, with severity of mental health symptoms and their duration, as well as age, sex, race and other variables. We anticipate that some analyses will depend on adequacy of sample sizes in various demographic subgroups.

*Aim 4.* We will obtain longitudinal data to determine whether mental health symptoms will persist longer among participants with more severe symptoms, and to determine whether these will be associated with higher incidence of physical health conditions.

*Aim 5.* We will ascertain the extent to which the thematic contents of the narrative responses to the final question of the questionnaires are correlated with measures of distress (stress, anxiety, depression, burnout) and moderated by measures of resilience. We will ascertain whether thematic content is a moderator or mediator of health outcomes and is associated with retention of participants over time.

## RESULTS

Results: Review of the published literature on relationships between stressful life events and health led to the hypothesis that stress experienced by essential workers during the COVID-19 pandemic would affect their health status over time. In response, the CHAMPS study was designed to ascertain work-life experience during the first year of the pandemic, exposure to stress, and self-reported mental and physical health, as well as to determine effects of service during the pandemic on health over the subsequent five years. The CHAMPS longitudinal cohort serves as a registry for recruiting participants in future, ancillary studies. After IRB approval 2762 participants were enrolled between May 2020 and June 2021, with 1534 providing contact information for future studies and follow-up questionnaires.

## DISCUSSION

The longitudinal CHAMPS Study and Registry will provide important prospective data about relationships between extended healthcare-related service during a global pandemic and future health of the healthcare-related workforce. Of special interest are first responders and service workers, who are less often included in such studies, as well as a broad ethnic diversity. The lengthy enrollment period as the pandemic progresses should result in a sample with a wide range of exposures to various working conditions thereby providing insights into the potential attributes that contribute to changes in health over time. Assessments of an extensive range of psychosocial factors, such as lifestyle habits, resilience and pre-existing conditions will enable assessment of their influence on mental and physical health.

The CHAMPS Registry is designed to provide opportunities for investigating additional questions and potential extension of data collection for specific hypotheses. The CHAMPS Registry anticipates ancillary studies of behavioral and biological mechanisms of action, studies of lifestyle changes and health, the effects of the pandemic on extended families, as well as potential randomized trials of interventions.

Altogether, CHAMPS has the potential for advances in knowledge about the role of chronic stress

on health. The value of the study for some questions, such as identification of associations with various demographic variables depends on availability of a sufficient sample size of participants. We anticipate that, over time, the study findings will inform public health policy relevant to national health emergencies.

## Limitations

This is a convenience sample, which limits generalizability of results to the entire population of essential workers. Some occupation categories will have small sample sizes, thus may not have sufficient representation for individual analyses. Self-selection bias may also be a factor if some individuals decline participating due to reluctance to be perceived as not supportive of their institutions. The measurement of COVID-19 service exposure relies on an algorithm that should be evaluated against an independent data set. Finally, the planned longitudinal analyses depend on retaining a sufficient proportion of participants over time.

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## Supplementary Files