

# Prevalence and Factors Associated with Depression and Anxiety Among Health Care Personnel in the United States During Coronavirus Disease 2019 (COVID-19) Pandemic

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**Abstract:** Introduction: Healthcare personnel (HCP) are at risk of psychological and emotional distress during the coronavirus disease 2019 (COVID-19) pandemic. The aim of the study was to assess the prevalence and explore the factors associated with depression and anxiety among HCP taking care of patients with COVID-19 in the United States (US). Methods: The study is cross-sectional, anonymous, web-based survey of HCP distributed in the US via email and social media between April 14, 2020 and May 5, 2020. Participants were stratified based on their occupation (i.e., registered nurses, other first responders, physicians, respiratory therapists, and nurse practitioners or physician assistants) and specialty. Practice settings were stratified based on hospital type (academic or community-based) and location. Study outcomes were prevalence and factors associated with depression and anxiety using the 9-item Patient Health Questionnaire (PHQ-9; range: 0-27) and the 7-item Generalized Anxiety Disorder (GAD 7; range 0-21) questionnaires, respectively. Results: In all, 1426 HCP submitted surveys, predominantly females (81%), aged 31-40 years, and non-Hispanic white (78%). Overall, the prevalence of depression and anxiety was 57.4% and 56.7%, respectively. Factors associated with depression were HCP with COVID-19 risk factors (odds ratio [OR] = 1.46; 95% confidence interval [CI] = 1.1-1.94; P = .009), exposure (OR = 1.87; 95% CI = 1.44-2.44; P = <.001), and being uncomfortable with hospital infection control policies (OR = 1.87; 95% CI = 1.28-2.71; P = .001). Similarly, factors associated with anxiety included HCP with COVID-19 risk factors (OR = 1.36; CI = 1.03-1.81; P = .03), COVID-19 exposure (OR = 1.43; 95% CI = 1.09-1.86; P = .01), and not being comfortable with the healthcare facility infection control policies (OR = 1.66; 95% CI = 1.14-2.41; P = .008). Conclusion and Relevance: The majority of HCP surveyed had a high burden of depression and anxiety early in the COVID-19 pandemic in the US. Organizations and institutions will need to develop preventive and management strategies to optimize and sustain the mental health of HCP, particularly under pandemic conditions.

**Keywords:** Coronavirus, COVID-19, Pandemic, Health Care Personnel, Depression, Anxiety

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## 1. Introduction

Magnitude of problem: Coronavirus disease (COVID-19), caused by the severe acute respiratory coronavirus-2 (SARS-COV-2), was declared a pandemic on March 11, 2020. [1] Since March 26, 2020, the United States (US) has recorded the highest number of cases in the world, surpassing 5 million by August 2020. [2, 3] An estimated 16 million personnel employed in the

health care industry in the US are involved directly or indirectly in the management of patients with COVID-19. [4]

Pre-pandemic prevalence of burnout among health care personnel (HCP) ranged 35-54%; how the current pandemic may affect burnout and well-being moving forward is unknown. [5] HCP responding to a specific crisis event (e.g., trauma) often face increased work intensity and load, uncertainty due to unprecedented challenges, unpredictability,

and pressure managing time-sensitive situations in addition to their usual work. A pandemic such as COVID-19 may present additional HCP considerations such as choosing between personal health versus providing the care for their patients, a lack of specific therapy, excessive media coverage, concerns surrounding personal protective equipment (PPE), lack of precise timing of when or if the pandemic will affect their community while viewing the effects on others. Prior observations among HCP during the 2003 SARS-CoV-1 outbreak showed significant anxiety, stress, and depression which persisted up to a year later. [6-8] As the US is in the initial stages of the pandemic, the well-being and emotional resilience of HCP are critical components of maintaining essential health care services during the COVID-19 outbreak.

Current Recommendations and study aim/ goal: To our knowledge, the impact of the COVID-19 pandemic on the mental health of HCP in the US is unknown. The study aim was to assess the mental health of HCP in the US by measuring and exploring the factors associated with depression and anxiety.

## 2. Methods

### 2.1. Study Design

Our study is a cross-sectional, anonymous, web-based survey of HCP conducted in the US via a region stratified, cluster sampling from April 14, 2020 to May 5, 2020. The survey was broadly distributed via email and social media. During this period, the total number of confirmed COVID-19 cases in the world was 3.6 million, of which 1.2 million cases were in the US. Survey participation was voluntary, and could be terminated at any time. Informed consent was implied from all subjects by participation. Responses were anonymous, and all data gathered was confidential. The study (# 20-0071) was exempted from review by the Institutional Review Board of University of Texas Medical Branch.

### 2.2. Setting

Our sampling included both inpatient and outpatient clinical settings. Practice settings were stratified based on hospital affiliation (academic or community-based) and geographic location (by zip code).

### 2.3. Participants

Participants were stratified based on their job title (i.e., registered nurses, other first responders, physicians, respiratory therapists, and nurse practitioners or physician assistants) and their primary specialty.

### 2.4. Demographic Data

Demographic data were self-reported by the participants, including age, gender, race, relationship status (in a relationship or not), presence of any COVID-19 risk factors, and COVID-19 exposure. Participants were also asked whether they were on a dedicated COVID-19 care service (i.e., direct contact with at least one COVID-19 patient).

### 2.5. Outcomes and Covariates

The focus of our survey was to assess symptoms of depression and anxiety using previously validated measurement tools. The validated questionnaires used were the 9-item Patient Health Questionnaire (PHQ-9; range, 0-27) and a 7-item Generalized Anxiety Disorder questionnaire (GAD-7; range 0-21), with scores of five and higher for each considered a positive response for depression and anxiety, respectively. [9, 10] Other questions included were the provision of PPE, comfort level with local infection control policy, personal consideration of a leave of absence, and feeling stigmatized by the community.

### 2.6. Statistical Analysis

We summarized each characteristic and general question responses by occupation. Univariate analysis utilizing summary statistics and Chi-square test were performed to show the association of covariates with outcomes. We performed a multivariate analysis with logistic regression for each outcome. A full model was evaluated using Akaike information criterion (AIC). We then developed our final model based on AIC and clinical knowledge. All analyses were conducted using SAS for Windows version 12.2 (SAS Inc., Cary, NC).

## 3. Results

Table 1 shows the characteristics of the surveyed HCP. Respondents were predominantly female (81%), with the majority aged 31-40 years (77%), non-Hispanic whites (78%), without comorbidity or COVID-19 risk factors (72%), and not having received a COVID-19 test (84%). The majority were registered nurses (41%), followed by other first responders (24%) and physicians (24%).

Sixty-two percent were assigned to a dedicated COVID-19 service, and more than half reported exposure to COVID-19. One-third were not comfortable with the infection control policies in place, and one third reported that they were not provided adequate PPE. Two-thirds of those surveyed had concerns regarding their personal or their family health, and a quarter felt stigmatized by their community.

Overall, the prevalence of depression was 57.4% and anxiety was 56.7%. Depression and anxiety were more common in females, HCP younger than 30 years, and registered nurses. HCP with COVID-19 risk factors or exposure, those uncomfortable with infection control policies and those were not provided adequate PPE had a higher likelihood of depression and anxiety. Depression alone was more common among HCP who provided services in the emergency department and anxiety alone was more common in HCP assigned to a dedicated COVID-19 service (Table 2).

Multivariate analysis (Table 3) revealed greater odds of depression among HCP with COVID-19 risk factors (odds ratio [OR] = 1.46; 95% confidence interval [CI] = 1.1–1.94;  $P = .009$ ), COVID-19 exposure (OR = 1.87; 95% CI = 1.44–2.44;  $P = <.001$ ), and those not comfortable with their infection control policies (OR = 1.87; 95% CI = 1.28–2.71;  $P = .001$ ). Similarly increased odds for anxiety were observed among

HCP with COVID-19 risk factors (OR = 1.36; CI = 1.03–1.81; P = .03), COVID-19 exposure (OR = 1.43; 95% CI = 1.09–1.86; P = .01) and those not comfortable with the infection control policies (OR = 1.66; 95% CI = 1.14–2.41; P = .008).

In addition, compared to physicians, other first responders (OR = 1.74; 95% CI = 1.19–2.56; P = .005) and registered nurses (OR = 1.57; 95% CI = 1.13–2.2; P = .008) had higher odds of depression. Compared to physicians, increased odds of anxiety were noted among other first responders (OR = 1.59; 95% CI = 1.08–2.35; P = .02) and registered nurses (OR

= 1.41; 95% CI = 1–1.57; P = .05).

Finally, increased odds of depression was observed among females (OR = 1.5; 95% CI = 1.08–2.09; P = .02), and among HCP younger than 30 years (OR = 3.06; 95% CI = 1.77–5.28; P = <.001) compared to older than 60 years. Similarly, increased odds of anxiety were observed among females (OR = 1.6; 95% CI = 1.15–2.23; P = .005) and among HCP younger than 30 years (OR = 4.04; 95% CI = 2.3–7.08; P = <.001) compared to those aged more than 60 years.

**Table 1.** Demographics and Occupation Characteristics of Health Care Personnel.

Characteristics	Total	Percentage
Overall	1426	100%
Gender		
Female	1158	81%
Male	265	19%
Prefer not to answer	3	0%
Age		
Less than 30	223	16%
31-40	507	36%
41-50	371	26%
51-60	219	15%
More than 60	106	7%
Race		
American Indian or Alaska Native	13	1%
Asian	160	11%
Black or African American	90	6%
Native Hawaiian or Other Pacific Islander	13	1%
White	1112	78%
Job Title		
Nurse practitioners/ Physician assistants	98	7%
Other first responders*	345	24%
Physician	340	24%
Registered Nurses	587	41%
Respiratory therapists	56	4%
Hospital type		
Academic center	675	47%
Community based Center	470	33%
Other	138	10%
Place of work		
Emergency Department	189	13%
Intensive Care Unit	442	31%
Med-Surg	288	20%
Outpatient	369	26%
Others**	388	27%
COVID-19 risk factors^		
Yes	366	26%
No	1025	72%
Dedicated COVID-19 service <sup>‡</sup>		
Yes	877	62%
No	549	38%
COVID-19 exposure		
Yes	747	52%
No	713	50%
Tested for COVID-19		
Positive	19	1%
Negative	205	14%
Not tested	1202	84%
Assigned duties outside specialty		
Yes	65	21%
No	238	79%
Effect on clinical service requirement		
Increased	135	43%
Decreased	75	24%
Same	104	33%

Characteristics	Total	Percentage
Leave of absence		
Considered taking leave of absence		
Yes	294	24%
No	955	76%
Infection control		
Comfortable with infection control policies		
Yes	808	66%
No	420	34%
Provided adequate personal protective equipment		
Yes	832	68%
No	393	32%
Feeling stigmatized by the community		
Yes	335	27%
No	899	73%

Other first responders\*: paramedics, phlebotomist, medical assistants, clinical pharmacists, physical therapists, speech language pathologists, and social workers.

Others\*\*: Interventional radiology, inpatient psychiatry units, labor and delivery, catheterization laboratory, dialysis units, skilled nursing facility.

COVID-19 risk factors^: chronic lung disease, serious heart conditions, immunocompromised, severe obesity, diabetes, chronic kidney disease, liver disease.

Dedicated COVID-19 service<sup>‡</sup>: In direct contact with at least one COVID-19 patient.

**Table 2.** Factors Associated with Depression and Anxiety by Univariate Analysis.

Characteristic	Depression (PHQ-9 $\geq$ 5),	P value	Anxiety (GAD-7 $\geq$ 5),	P value
	Depression symptoms		Anxiety symptoms	
	No. (%) with data		No. (%) with data	
Gender		<.001		<.001
Male	119(44.91)		119(44.91)	
Female	699(60.36)		689(59.5)	
Other/Missing	1(33.33)		1(33.33)	
Age, y		<.001		.001
<30	150(67.26)		154(69.06)	
31-40	284(56.02)		301(59.37)	
41-50	227(61.19)		210(56.6)	
51-60	117(53.42)		106(48.4)	
>60	41(38.68)		38(35.85)	
Race/ Ethnicity		<.001		.002
White	566(61.06)		558(60.19)	
Black	40(47.62)		38(45.24)	
Other	79(45.66)		84(48.55)	
Hispanic	134(55.37)		129(53.31)	
Occupation		<.001		.004
Physician	159(46.76)		167(49.12)	
RN	370(63.03)		363(61.84)	
RT	30(53.57)		28(50)	
NP/PA	60(61.22)		58(59.18)	
Other first responders*	200(57.97)		193(55.94)	
Service in ER		.002		0.12
No	691(55.86)		692(55.94)	
Yes	128(67.72)		117(61.9)	
Service in ICU		.30		.66
No	574(58.33)		562(57.11)	
Yes	245(55.43)		247(55.88)	
Service in Med Surg		.16		.17
No	664(58.35)		656(57.64)	
Yes	155(53.82)		153(53.13)	
Service in Outpatient		.63		.25
No	611(57.81)		609(57.62)	
Yes	208(56.37)		200(54.2)	
COVID-19 service <sup>‡</sup>		.14		<.001
No	302(55.01)		276(50.27)	
Yes	517(58.95)		533(60.78)	
Hospital type		.07		.62
Academic center	376(55.7)		373(55.26)	
Community	288(61.28)		278(59.15)	
Other	83(60.14)		77(55.8)	
Missing	72(50.35)		81(56.64)	
COVID-19 risk factors^		<.001		.01
No	565(55.12)		565(55.12)	

Characteristic	Depression (PHQ-9 ≥ 5), Depression symptoms	P value	Anxiety (GAD-7 ≥ 5), Anxiety symptoms	P value
	No. (%) with data		No. (%) with data	
Yes	240(65.57)		229(62.57)	
missing	14(40)		15(42.86)	
COVID-19 exposure		<.001		<.001
No	329(49.92)		334(50.68)	
Yes	484(64.79)		468(62.65)	
missing	6(30)		7(35)	
Tested for COVID-19		.02		.20
Positive	9(47.37)		9(47.37)	
Negative	135(65.85)		127(61.95)	
Not tested	675(56.16)		673(55.99)	
Effect on clinical service requirement		.09		.07
Increase	82(60.74)		87(64.44)	
Decrease	42(56)		38(50.67)	
Same	48(46.15)		51(49.04)	
Missing	647(58.18)		633(56.92)	
Considered taking leave of absence		<.001		<.001
No	553(57.91)		548(57.38)	
Yes	242(82.31)		249(84.69)	
missing	24(13.56)		12(6.78)	
Comfortable with infection control policies		<.001		<.001
No	324(77.14)		324(77.14)	
Yes	457(56.56)		460(56.93)	
missing	38(19.19)		25(12.63)	
Provided adequate PPE		<.001		<.001
No	297(75.57)		299(76.08)	
Yes	487(58.53)		487(58.53)	
missing	35(17.41)		23(11.44)	
Feeling stigmatized by the community		<.001		<.001
No	517(57.51)		522(58.06)	
Yes	269(80.3)		267(79.7)	
missing	33(17.19)		20(10.42)	

Abbreviations: PHQ-9, 9-item Patient Health Questionnaire-9; GAD-7, 7-item General Anxiety Disorder; RN, Registered Nurse; RT, Respiratory Therapist; NP, Nurse Practitioner; PA, Physician Assistant; PPE, Personal Protective Equipment

Other first responders\*: paramedics, phlebotomist, medical assistants, clinical pharmacists, physical therapists, speech language pathologists, social workers.

Dedicated COVID-19 service<sup>‡</sup>: In direct contact with at least one COVID patient.

COVID risk factors<sup>^</sup>: chronic lung disease, serious heart conditions, immunocompromised, severe obesity, diabetes, chronic kidney disease, liver disease.

**Table 3.** Factors Associated with Depression and Anxiety by Multivariate Analysis.

Variables/ Characteristics	PHQ-9 ≥ 5, Depression symptoms	P value <sup>a</sup>		GAD-7 ≥ 5, Anxiety symptoms	P value <sup>a</sup>	
	Adjusted OR (95% CI)	Category	Overall	Adjusted OR (95% CI)	Category	Overall
Gender						
Female vs Male	1.5 (1.08 - 2.09)		.02	1.6 (1.15 - 2.23)		.005
Age, y						
<30 vs. 31-40	1.5 (1.02 - 2.19)	.04		1.5 (1.01 - 2.24)	.05	
<30 vs. 41-50	1.29 (0.86 - 1.92)	.22	<.001	1.87 (1.24 - 2.83)	.003	<.001
<30 vs. 51-60	1.96 (1.26 - 3.06)	.003		2.91 (1.84 - 4.58)	<.001	
<30 vs. >60	3.06 (1.77 - 5.28)	<.001		4.04 (2.3 - 7.08)	<.001	
Race/ ethnicity						
Black vs White	0.69 (0.42 - 1.14)	.15		0.63 (0.38 - 1.07)	.09	
Hispanic vs White	0.87 (0.62 - 1.22)	.42	.10	0.77 (0.55 - 1.09)	.14	.12
Other vs White	0.66 (0.45 - 0.96)	.03		0.73 (0.49 - 1.07)	.11	
Occupation						
NP/PA vs Physician	1.37 (0.79 - 2.36)	.26		1.23 (0.71 - 2.15)	.46	
Other first responders* vs Physician	1.74 (1.19 - 2.56)	.005	.04	1.59 (1.08 - 2.35)	.02	.14
RN vs Physician	1.57 (1.13 - 2.2)	.008		1.41 (1 - 1.97)	.05	
RT vs Physician	1.08 (0.57 - 2.08)	.81		0.97 (0.51 - 1.85)	.92	
Place of Work						
Emergency Department						
Yes vs No	1.4 (0.95 - 2.07)		.09	0.89 (0.61 - 1.32)		.57
Dedicated COVID-19 service <sup>‡</sup>						
Yes vs No	0.83 (0.63 - 1.1)		.19	1.33 (1 - 1.76)		.05
COVID-19 risk factors <sup>^</sup>						
Yes vs No	1.46 (1.1 - 1.94)		.009	1.36 (1.03 - 1.81)		.03

Variables/ Characteristics	PHQ-9 $\geq$ 5, Depression symptoms	<i>P</i> value <sup>a</sup>	GAD-7 $\geq$ 5, Anxiety symptoms	<i>P</i> value <sup>a</sup>
	Adjusted OR (95% CI)	Category	Adjusted OR (95% CI)	Category
COVID-19 exposure				
Yes vs No	1.87 (1.44 - 2.44)		1.43 (1.09 - 1.86)	.01
Comfortable with infection control policies				
No vs. Yes	1.87 (1.28 - 2.71)	.001	1.66 (1.14 - 2.41)	.008
Provided adequate PPE				
Yes vs No	0.8 (0.55 - 1.16)	.23	0.73 (0.5 - 1.05)	.09

Abbreviations: PHQ-9, 9-item Patient Health Questionnaire-9; GAD-7, 7-item General Anxiety Disorder; NP: Nurse Practitioner; PA: Physician Assistant; RN: Registered Nurse; Respiratory Therapist; PPE: Personal Protective Equipment

<sup>a</sup> Category refers to Chi-square tests that compare each category with reference group; Overall refers to Chi-square that hypothesize individual variables improving the model fitting.

Other first responders\*: paramedics, phlebotomist, medical assistants, clinical pharmacists, physical therapists, speech language pathologists, social workers.

Dedicated COVID-19 service<sup>†</sup>: In direct contact with at least one COVID patient.

COVID risk factors<sup>^</sup>: chronic lung disease, serious heart conditions, immunocompromised, severe obesity, diabetes, chronic kidney disease, liver disease.

## 4. Discussion

This cross-sectional survey of 1426 healthcare personnel (HCP) in the US during the early phase of the COVID-19 pandemic found that the majority had symptoms of depression and anxiety, especially those with COVID-19 risk factors and exposure. Discomfort with infection control policies increased the odds of both depression and anxiety.

Overall, the prevalence of depression was 57.4%, and anxiety was 56.7% among HCP in the US, results consistent with a survey conducted in China among COVID-19 HCP showing a prevalence of 50.4% and 44.6%, respectively. [11] Results of similar surveys revealed not only a high prevalence of depression and anxiety, but also of stress and insomnia among HCP during the current pandemic (Table 4). [12-20] Together, these findings suggest a psychological pandemic among HCP which parallels the infectious pandemic.

**Table 4.** Previous Studies on the Mental Health Outcomes of Healthcare Personnel During the COVID-19 Pandemic.

Study	Time period	Region	Participants	Measure/ Assessment	Findings
Kang et al	January 29 to February 4, 2020.	China	994 Physicians and nurses	PHQ-9	Prevalence of depression: 63%
Xiao et al	January to February 2020	China	180 Physicians and nurses	Self-Rating Anxiety Scale	Increased levels of anxiety, and stress
Cai et al	January to March 2020	China	534 HCW	Study questionnaire assessed: - Feelings of the medical staff during the outbreak - Factors that might induce stress - Factors that might reduce stress - Personal stress coping strategies	-Increased workload and stress - Main factors associated with stress included the perceived risk of infection, patient mortality, infection control guidance and the availability of effective protective equipment
Pappa et al (Meta-analysis)	Literature databases was conducted up to April 17, 2020	China and Singapore	33,062 participants	Variable	Prevalence of: -Depression: 22.8% -Anxiety: 23.2%
Lin et al	January 29 to February 11, 2020	China	2,316 Physicians and nurses	-PHQ-9 -GAD-7 -ISS -IES-R	Prevalence of: -Depression: 46.9% -Anxiety: 41.1% -Insomnia: 32% -Stress: 69.1%
Dong et al	March 2-13, 2020	China	4,618 HCW	Study questionnaires assessed epidemiological exposure; occupational & psychological impact; coping strategies; and the Huaxi Emotional-Distress Index (HEI).	24.2% of respondents experienced high levels of depression &/or anxiety
Tu et al	February 7-25, 2020	China	100 Nurses	-PHQ-9 -GAD-7	Prevalence of: -Depression 46% -Anxiety 40%
Xing	January 25 to February 16, 2020	China	548 HCW	Symptom Checklist-90	Higher anxiety in HCW compared to general population
Rossi et al	March 27-31, 2020	Italy	1379 HCW	Italian version of: -Global Psycho-trauma Screen (GPS) -PHQ-9 -GAD-7 -ISS -10- item Perceived Stress Scale	Prevalence of: -PTSD: 49.38% -Depression: 24.73% -Anxiety: 19.80% -Insomnia: 8.27% -High perceived stress: 21.90%

Abbreviations: PHQ-9, 9-item Patient Health Questionnaire-9; HCW, Healthcare workers; GAD-7, 7-item General Anxiety Disorder; ISS, Insomnia severity index; IES-R, The Impact of Event Scale-Revised; PTSD, Post-traumatic stress disorder

COVID-19 morbidity and mortality is associated with increasing age and the presence of comorbidity (chronic lung disease, serious heart conditions, immunocompromise, severe obesity, diabetes, chronic kidney disease, and liver disease) [21-23]. In our study, the presence of COVID-19 risk factors among HCP was associated with increased odds of depression and anxiety. The Centers for Disease Control and Prevention (CDC) suggests limiting the participation of HCP with risk factors in higher risk aerosol-generating procedures involving COVID-19 patients. [24] Other measures include having organizational policies that allow these HCP to work in low-risk exposure areas, such as telemedicine services and patient advice lines. [25]

HCP directly caring for patients with COVID-19 and working for long hours have an increased risk of acquiring the virus. [12, 26] Our survey revealed higher odds of depression and anxiety among respondents with exposure to patients with COVID-19 and in those not comfortable with their facility's infection control policies. Strict adherence to the CDC recommended guidelines to prevent transmission and manage exposures are required to ensure the safety of HCP [27]. HCP must be provided with adequate PPE and information and resources to help them avoid taking the infection home to family members. They should be educated on infection control policies, which should include basic knowledge of epidemiology and viral transmission, preventive strategies for infections, and training in the use of PPE. [28, 29] HCP should have rapid access to occupational health resources, with efficient evaluation and testing, and work restrictions if they develop symptoms or have exposure to infected persons [30]. HCP themselves must self-monitor, report signs of illness, and not engage in patient care while exhibiting infectious symptoms [25]. A shortcoming in any one of these areas can lead adverse effects in personal and physical well-being.

During the COVID-19 pandemic, various organizations like the CDC, the American Medical Association, and the National Center for Post-traumatic stress disorder (PTSD) have published guidelines for HCP on how to cope with stress. [30-32] HCP should be educated to recognize the symptoms of stress, which may include feelings of irritation, anger, denial, nervousness, anxiety, helplessness, lack of motivation, tiredness, being overwhelmed, sadness, or trouble sleeping or concentrating. [30] Communication with the coworkers, supervisors, and employees about work factors that cause stress and how to access mental health resources should be promoted. [30] HCP should be encouraged to increase their sense of control by keeping a consistent daily routine when possible, with adequate sleep, healthy meals, and exercise. [30] At work, HCP should be able to take breaks during work shifts to rest, stretch, and check-in with supportive colleagues, friends, and family. [32] HCP should avoid negative coping strategies such as the use of alcohol, illicit drugs, or excessive amounts of prescription drugs. If stress persists they should consider seeking out formal mental health treatment. [32]

Organizational support is required for HCP to successfully navigate the challenges of the pandemic and effectively care for their patients [31]. HCP may be affected by the stigma of voicing their concerns and the fear of contact of others. Employers should provide an encouraging and supportive atmosphere free of stigma, coercion, and fear of negative consequences. [32] Health care facilities must include plans to support the physical, emotional, and psychosocial needs of the workforce [31]. Regular screening for stress, depression, and anxiety should be performed among medical personnel involved in the treatment and diagnosis of patients with COVID-19. [32]

## 5. Strengths and Limitations

To our knowledge, this is the first survey among US HCP to assess mental health outcomes during the COVID-19 pandemic. There are several limitations to our study.

First, the survey was voluntary, and thus, there is the possibility of selection bias (i.e., respondents may have been different from non-respondents). Second, the questionnaires used, PHQ-9 and GAD-7, are not specifically validated for use in HCP or during exceptional situations like a pandemic. Third, the response rate is unknown, and there is a possibility that HCP from the areas most affected may not have completed the survey due to time restraints or competing interests; however, we found that 73% of respondents were from areas with the highest prevalence of COVID-19 cases at that time. Fourth, the survey did not distinguish HCP with baseline anxiety, depression, or other mental health disorder(s). Therefore, it is unknown if results were consistent with the development of new mental health symptoms or worsening of a pre-existing condition.

## 6. Conclusion

A high burden of depression and anxiety was observed among US HCP early in the COVID-19 pandemic. These conditions were associated with COVID-19 risk factors, exposure, and discomfort with local infection control policies. Since the pandemic has continued with increasing numbers of infected individuals and deaths related to COVID-19, the mental health problems and distress may increase as well. Continued monitoring of HCP and the allocation of resources, along with the implementation of preventive and management strategies are needed to optimize the mental health during this stressful time.

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## References

- [1] Cucinotta D, Vanelli M. WHO Declares COVID-19 a Pandemic [published online Mar 19, 2020]. *Acta Biomed.* 2020; 91 (1): 157-160. doi: 10.23750/abm.v91i1.9397.
- [2] European Centre for Disease Prevention and Control. COVID-19 situation update worldwide, as of 18 August 2020. Published August 18, 2020. Accessed August 18, 2020. <https://www.ecdc.europa.eu/en/geographical-distribution-2019-ncov-cases>
- [3] Centers for Disease Control and Prevention. Cases in the U.S. Updated August 17, 2020. Accessed August 18, 2020. <https://www.cdc.gov/coronavirus/2019-ncov/cases-updates/cases-in-us.html>
- [4] Kaiser Family Foundation. Total Health Care Employment. Published May 2018. Accessed August 10, 2020. <https://www.kff.org/other/state-indicator/total-health-care-employment>.
- [5] National Academies of Sciences, Engineering, and Medicine. 2019. *Taking action against clinician burnout: A systems approach to professional well-being*. Washington, DC: The National Academies Press. doi: 10.17226/25521.
- [6] Maunder R, Hunter J, Vincent L, et al. The immediate psychological and occupational impact of the 2003 SARS outbreak in a teaching hospital. *CMAJ.* 2003; 168 (10): 1245-1251.
- [7] Lee AM, Wong JG, McAlonan GM, et al. Stress and psychological distress among SARS survivors 1 year after the outbreak. *Can J Psychiatry.* 2007; 52 (4): 233-240. doi: 10.1177/070674370705200405.
- [8] Bai Y, Lin CC, Lin CY, Chen JY, Chue CM, Chou P. Survey of stress reactions among health care workers involved with the SARS outbreak. *Psychiatry Serv.* 2004; 55 (9): 1055-1057. doi: 10.1176/appi.ps.55.9.1055.
- [9] Kroenke K, Spitzer RL, Williams JB. The PHQ-9: validity of a brief depression severity measure. *J Gen Intern Med.* 2001; 16 (9): 606-613. doi: 10.1046/j.1525-1497.2001.016009606.x.
- [10] Kroenke K, Spitzer RL, Williams JB, Monahan PO, Löwe B. Anxiety disorders in primary care: prevalence, impairment, comorbidity, and detection. *Ann Intern Med.* 2007; 146 (5): 317-325. doi: 10.7326/0003-4819-146-5-200703060-00004.
- [11] Lai J, Ma S, Wang Y, et al. Factors Associated With Mental Health Outcomes Among Health Care Workers Exposed to Coronavirus Disease 2019. *JAMA Netw Open.* 2020; 3 (3): e203976. doi: 10.1001/jamanetworkopen.2020.3976.
- [12] Kang L, Ma S, Chen M, et al. Impact on mental health and perceptions of psychological care among medical and nursing staff in Wuhan during the 2019 novel coronavirus disease outbreak: A cross-sectional study. *Brain Behav Immun.* 2020; 87: 11-17. doi: 10.1016/j.bbi.2020.03.028.
- [13] Xiao H, Zhang Y, Kong D, Li S, Yang N. The Effects of Social Support on Sleep Quality of Medical Staff Treating Patients with Coronavirus Disease 2019 (COVID-19) in January and February 2020 in China. *Med Sci Monit.* 2020; 26: e923549. doi: 10.12659/MSM.923549.
- [14] Cai H, Tu B, Ma J, et al. Psychological Impact and Coping Strategies of Frontline Medical Staff in Hunan Between January and March 2020 During the Outbreak of Coronavirus Disease 2019 (COVID19) in Hubei, China. *Med Sci Monit.* 2020; 26: e924171. doi: 10.12659/MSM.924171.
- [15] Pappa S, Ntella V, Giannakas T, Giannakoulis VG, Papoutsis E, Katsaounou P. Prevalence of depression, anxiety, and insomnia among healthcare workers during the COVID-19 pandemic: A systematic review and meta-analysis. *Brain Behav Immun.* 2020. doi: 10.1016/j.bbi.2020.05.026.
- [16] Lin K, Yang BX, Luo D, et al. The Mental Health Effects of COVID-19 on Health Care Providers in China. *Am J Psychiatry.* 2020; 177 (7): 635-636. doi: 10.1176/appi.ajp.2020.20040374.
- [17] Dong ZQ, Ma J, Hao YN, et al. The social psychological impact of the COVID-19 pandemic on medical staff in China: A cross-sectional study. *Eur Psychiatry.* 2020; 63 (1): e65. doi: 10.1192/j.eurpsy.2020.59.
- [18] Tu ZH, He JW, Zhou N. Sleep quality and mood symptoms in conscripted frontline nurse in Wuhan, China during COVID-19 outbreak: A cross-sectional study. *Medicine (Baltimore).* 2020; 99 (26): e20769. doi: 10.1097/MD.00000000000020769.
- [19] Xing J, Sun N, Xu J, Geng S, Li Y. Study of the mental health status of medical personnel dealing with new coronavirus pneumonia. *PLoS One.* 2020; 15 (5): e0233145. doi: 10.1371/journal.pone.0233145.
- [20] Rossi R, Soggi V, Pacitti F, et al. Mental Health Outcomes Among Frontline and Second-Line Health Care Workers During the Coronavirus Disease 2019 (COVID-19) Pandemic in Italy. *JAMA Netw Open.* 2020; 3 (5): e2010185. doi: 10.1001/jamanetworkopen.2020.10185.
- [21] Richardson S, Hirsch JS, Narasimhan M, et al. Presenting Characteristics, Comorbidities, and Outcomes Among 5700 Patients Hospitalized With COVID-19 in the New York City Area. *JAMA.* 2020. doi: 10.1001/jama.2020.6775.
- [22] Petrilli CM, Jones SA, Yang J, et al. Factors associated with hospital admission and critical illness among 5279 people with coronavirus disease 2019 in New York City: prospective cohort study. *BMJ.* 2020; 369: m1966. doi: 10.1136/bmj.m1966.
- [23] Zhou F, Yu T, Du R, et al. Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. *The Lancet.* 2020; 395 (10229): 1054-1062. doi: 10.1016/S0140-6736(20)30566-3.
- [24] Centers for Disease Control and Prevention. Information for Healthcare Professionals about Coronavirus (COVID-19). Updated August 16, 2020. Accessed August 18, 2020. <https://www.cdc.gov/coronavirus/2019-ncov/hcp/index.html>
- [25] Adams JG, Walls RM. Supporting the Health Care Workforce During the COVID-19 Global Epidemic. *JAMA.* 2020. doi: 10.1001/jama.2020.3972.
- [26] Ran L, Chen X, Wang Y, Wu W, Zhang L, Tan X. Risk Factors of Healthcare Workers with Corona Virus Disease 2019: A Retrospective Cohort Study in a Designated Hospital of Wuhan in China [published online ahead of print, 2020 Mar 17]. *Clin Infect Dis.* 2020; ciaa 287. doi: 10.1093/cid/ciaa287.
- [27] Centers for Disease Control and Prevention. Information for Healthcare Professionals about Coronavirus (COVID-19). Published July 22, 2020. Accessed August 10, 2020. <https://www.cdc.gov/coronavirus/2019-ncov/hcp/index.html>.

- [28] Shanafelt T, Ripp J, Trockel M. Understanding and Addressing Sources of Anxiety Among Health Care Professionals During the COVID-19 Pandemic. *JAMA*. 2020. doi: 10.1001/jama.2020.5893.
- [29] Bolyard EA, Tablan OC, Williams WW, Pearson ML, Shapiro CN, Deitchman SD. Guideline for Infection Control in Healthcare Personnel, 1998. *Infection Control & Hospital Epidemiology*. 1998; 19 (6): 407-463. doi: 10.2307/30142429.
- [30] Centers for Disease Control and Prevention. Healthcare Personnel and First Responders: How to Cope with Stress and Build Resilience During the COVID-19 Pandemic. Published May 5, 2020. Accessed August 10, 2020. <https://www.cdc.gov/coronavirus/2019-ncov/hcp/mental-health-healthcare.html>
- [31] Shanafelt T, Ripp J, Brown M, Sinsky C. Caring for the Health Care Workforce During Crisis. *American Medical Association*. 2020.
- [32] Managing Healthcare Workers' Stress Associated with the COVID-19 Virus Outbreak. National Center for PTSD. Published March 9, 2020. Accessed July 22, 2020. [https://www.ptsd.va.gov/covid/COVID\\_healthcare\\_workers.asp](https://www.ptsd.va.gov/covid/COVID_healthcare_workers.asp)