

## Posttraumatic Stress Disorder Among Health Care Workers During the COVID-19 Pandemic

**Background:** Coronavirus disease 2019 (COVID-19) has taken a significant toll on people worldwide, and in particular, on the health care workers (HCWs) who have worked on the frontlines in the fight against the pandemic. The goal of this study was to investigate the prevalence of posttraumatic stress disorder (PTSD) and related factors in HCWs in the era of COVID-19.

**Methods:** This cross-sectional survey study was conducted between September 15, and October 15, 2020, among HCWs in Turkey. The survey consisted of self-administered questionnaires, which included questions about sociodemographic variables, experiences caring for patients with COVID-19, and the Posttraumatic Stress Disorder Checklist for DSM-5 (PCL-5), a trauma screening tool. The online survey was completed by 1833 HCWs. Univariate and multivariate logistic regression analyses were used to identify independent predictors of PTSD.

**Results:** The mean age of the participants was  $32.7 \pm 7.0$  years; 81.9% were physicians, and 56.5% were female. The rates of COVID-19 history in the respondents, a family member, or a coworker were 13.6%, 32.3%, and 12.6%, respectively. Among the HCWs who participated, 39.9% met the criteria for PTSD. Compared with the physicians, the nonphysician HCWs had a higher rate of PTSD (49.5% vs. 36%) ( $P < 0.001$ ) and higher PCL-5 scores ( $53.31 \pm 19.6$  vs.  $42.5 \pm 20.3$ ) ( $P < 0.001$ ). In addition, 9.7% of the surveyed HCWs reported having suicidal ideation during the COVID-19 pandemic. Independent predictors of PTSD in HCWs were working on a COVID-19 unit, feeling isolated, suicidal ideation, being a nonphysician HCW, fear of spreading coronavirus to family, female sex, and a history of having COVID-19.

**Conclusions:** HCWs were at risk for impairment in mental well-being in the era of COVID-19, with a significant number experiencing PTSD as well as suicidal ideation. Therefore, HCWs, especially

those who are working on a COVID-19 unit and are female, should be monitored regularly for PTSD.

(*Journal of Psychiatric Practice* 2022;28;354–361)

**KEY WORDS:** COVID-19, posttraumatic stress disorder (PTSD), health care workers, isolation, suicidal ideation, female, physicians, nonphysicians

The first case of coronavirus disease 2019 (COVID-19) was identified in December 2019, and the World Health Organization (WHO) first announced the novel coronavirus in January 2020.<sup>1</sup> Despite unprecedented restrictions and precautions, the disease spread across the world in a few months. The WHO announced a COVID-19 pandemic in March 2020.<sup>1</sup>

This article describes the results of an online cross-sectional survey study of health care workers (HCWs) conducted between September 15, and October 15, 2020. As of November 29, 2020, shortly after the survey was completed, > 62 million people had tested positive for COVID-19 globally, with nearly 1.4 million deaths.<sup>2</sup> Currently, in July 2022, as this article goes to press, over 577 million people have tested positive and over 6 million have died from COVID-19 globally.<sup>2</sup>

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The authors declare no conflicts of interest.

DOI: 10.1097/PRA.0000000000000661

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HCWs have been working on the frontlines in the fight against the COVID-19 pandemic since the very beginning. A study published in September 2020 reported that, based on data collected in March and April 2020 in the United States and the United Kingdom, HCWs were almost 12 times more likely to be infected with COVID-19 than were individuals in the general community.<sup>3</sup> Furthermore, according to the Centers for Disease Control and Prevention (CDC), more than half of the ~9000 HCWs who tested positive for COVID-19 in the United States between February and April 2020 had had contact with a COVID-19 patient only in a health care setting.<sup>4</sup> By November 29, 2020, the number of HCWs in the United States who had tested positive for COVID-19 was 242,366, 857 of whom had died of COVID-19.<sup>5</sup>

This pandemic has also had consequences beyond the immediate health impact of COVID-19. Studies concerning survivors of previous coronavirus epidemics, such as survivors of the severe acute respiratory syndrome (SARS) epidemic, found a relationship between these epidemics and mental illness,<sup>6</sup> with posttraumatic stress disorder (PTSD) reported to be more common among HCWs than in the general population during the SARS epidemic.<sup>7</sup> Early in the COVID-19 pandemic, few studies had examined the impact of the pandemic on mental well-being. However, a number of studies that collected data in the first half of 2020 did report that HCWs were experiencing significant psychological impairment, such as depression and anxiety, during the COVID-19 pandemic.<sup>8-11</sup> However, in contrast, a controversial result was reported from the same time period in the Philippines indicating that HCWs were less likely to be psychologically affected than the general population.<sup>12</sup> However, as those researchers noted, they conducted their study at the beginning of the pandemic when COVID-19 cases were few and the health care system was not overwhelmed. At the same time that these early studies were being conducted, researchers stressed the importance of continued investigation of the impact of psychological trauma in the era of the COVID-19 pandemic, especially concerning effects on frontline HCWs.<sup>13,14</sup> Therefore, our goal in this study was to investigate PTSD in HCWs in the era of COVID-19.

Psychological trauma experienced by HCWs during the COVID-19 pandemic can cause PTSD.<sup>13,14</sup> To receive a PTSD diagnosis, an individual must

have been exposed to a traumatic event that involved actual or threatened death to oneself or others.<sup>15</sup> In the most recent edition of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5), the American Psychiatric Association broadened the description of the trauma to include “experiencing repeated or extreme exposure to aversive details of the traumatic event(s).”<sup>15(p271)</sup> Thus, working on COVID-19 units could be considered traumatic, especially since HCWs faced a considerable risk of becoming infected with COVID-19 in the first phases of the pandemic due to limited resources (ie, lack of treatments, vaccines, and guidelines, as well as shortages of personal protective equipment), in addition to being exposed to the suffering and deaths of patients with COVID-19.<sup>12,13</sup> These sources of distress were compounded by fears of getting infected and dying of COVID-19 or transmitting the disease to one’s family as well as by the strict restrictions (ie, lockdown and social isolation) associated with the pandemic, which hindered essential coping methods such as socializing.

## METHODS

### Participant Sample and Data Collection

This was an online cross-sectional survey study conducted between September 15, and October 15, 2020, among HCWs in Turkey. The online survey, created with Google Forms, consisted of self-administered questionnaires which included questions about sociodemographic variables and experiences caring for patients with COVID-19, as well as the Posttraumatic Stress Disorder Checklist for DSM-5 (PCL-5), a PTSD screening tool. The collected sociodemographic data included age, sex (male, female, nonbinary), occupation (physician, nurse, emergency medical services), marital status (single, married, divorced), having children (yes or no), work shift (day/night), history of COVID-19 positivity (self, family member, coworker), feeling isolated (yes/no), fear of spreading the infection to family (yes/no), history of PTSD (yes/no), and suicidal ideation (SI) (yes/no). Questions on the COVID-19 patient care experience form included whether respondents had direct contact with COVID-19 patients, had witnessed the death of a COVID-19 patient, had provided CPR for a COVID-19 patient, the unit where they saw COVID-19 patients, telemedicine use, and worry about being assaulted by a

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patient. The survey took ~12 minutes to complete. Ethical approval for the study was obtained from Gazi Yasargil State Hospital Ethical Committee.

We asked 74 health care organizations to distribute the survey to HCWs (physicians, nurses, and emergency medical staff) by email. We also asked the HCWs who received the survey to send it to their colleagues. All participants were informed about the study content at the beginning of the survey, and electronic consent was obtained. Respondents confirmed that they worked at a hospital and were taking care of patients at the time that the study was conducted. Inclusion criteria were age between 18 and 65 years, actively working in a hospital during the COVID-19 pandemic, and agreeing to enroll in the study. Exclusion criteria were: age below 18 years or older than 65 years, refusing to answer the questions, or a previous diagnosis of PTSD. The survey was anonymous, but participants had the opportunity to engage with a psychiatry clinic following the study to get help for mental well-being.

Overall, 1909 responses were recorded during the study; 16 declined to answer, and 60 were excluded due to a previous PTSD diagnosis. Although HCWs from all of the cities in Turkey enrolled in the study, more than half of the participants were from metropolitan areas such as Istanbul, Ankara, and Diyarbakir. Deidentified information was used for statistical analysis. Data collected from 1833 respondents were used in the statistical analysis.

### Measures

PCL-5 is a 20-item questionnaire that employs a Likert-type 5-point rating scale ranging from 0 (“not bothered at all”) to 4 (“bothered extremely”), with responses to be based on the past month’s experiences. Total scores range from 0 to 80. The PCL-5 scale was developed by Weathers et al,<sup>16</sup> who reported a cutoff value of 33. However, Boysan et al,<sup>17</sup> who demonstrated the validity and reliability of the Turkish version of PCL-5, reported a cutoff value of 48 in the Turkish population; therefore, we accepted the cutoff value as 48. The PCL-5 and a sociodemographic form and questionnaire about experiences caring for patients with COVID-19 created by the authors of this study were entered into an online survey format. Using the PCL-5, we asked the participants about the symptoms that they had experienced in the last

month related to the COVID-19 pandemic. As noted above, criterion A for PTSD was modified in the DSM-5 to include “experiencing repeated or extreme exposure to aversive details of the traumatic event(s).”<sup>15</sup> Therefore, in this study, HCWs who were directly involved in caring for COVID-19 patients were accepted as frontline HCWs and considered to meet DSM-5 PTSD criterion A,<sup>15</sup> due to close and frequent exposure to COVID-19 patients, experiencing direct exposure to the suffering and death of patients on the COVID-19 unit, and managing care with limited resources while fearing being infected and spreading the virus to their loved ones.<sup>12,13</sup> In addition to meeting criterion A, at least 1 “intrusion” symptom (PCL-5 items 1 to 5), 1 “avoidance” symptom (PCL-5 items 6 and 7), 2 “negative alterations in cognitions and mood” (PCL-5 items 8 to 14), and 2 “alterations in arousal and reactivity” (PCL-5 items 15 to 20) rated as 2 (moderately bothered) or higher on the PCL-5 are required to make a provisional PTSD diagnosis.<sup>18</sup> A provisional PTSD diagnosis was obtained if the HCWs were involved in COVID-19 patient care, met the above criteria, and had a PCL-5 score > 48.<sup>17,18</sup>

### Data Analysis

The statistical analysis was conducted using the Statistical Package for the Social Sciences (released 2013, IBM SPSS Statistics for Windows, Version 22.0; IBM Corp., Armonk, NY). Descriptive data were presented as mean  $\pm$  SD, frequency, and rate. Independent-sample *t* tests were used to compare continuous variables that were normally distributed, and  $\chi^2$  tests were used to compare frequencies. The Spearman test was used to assess correlations. Univariate and multivariate logistic regression analyses were used to identify independent predictors of PTSD. The level of statistical significance was set at *P* value < 0.05.

## RESULTS

### Demographics and Practice Patterns of the Sample

In this study, 1833 HCWs were enrolled. Because we did not know the number of HCWs who had received the survey, we were unable to calculate the response rate. The mean age of participants

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was  $32.7 \pm 7.0$  years, 81.9% were physicians, 56.5% were female, 41.7% were single, and 50.8% had no child. The rates of COVID-19 history in the HCW respondents, a family member, or a coworker were 13.6%, 32.3%, and 12.6%, respectively. Of the participants, 59.7% felt isolated, and 95.8% reported fears of spreading coronavirus to their families. Moreover, 9.7% of the HCWs reported having SI during the COVID-19 pandemic. The rates of involvement in the direct care of COVID-19 patients were 42% in physicians and 69.4% in nonphysician HCWs.

### Effect of the Pandemic on the Mental Well-being of the HCWs

We did further analyses to better understand the effect of the pandemic on the mental well-being of the HCWs. First, we compared HCWs who worked on a COVID-19 unit with those who did not. We did not find any difference in rates of PTSD between the 2 groups, but the HCWs who worked on COVID-19 units did have higher severity scores on hyperarousal ( $14.2 \pm 6.5$  vs.  $13.2 \pm 6.9$ , possible range of scores 0 to 24;  $P = 0.009$ ). In addition, HCWs who worked on COVID-19 units gave significantly higher ratings to feeling isolated (60.3% vs. 54.6%,  $P = 0.046$ ), having SI (10.4% vs. 6.2%,  $P = 0.01$ ), and worrying about being assaulted (44.7% vs. 32.2%,  $P < 0.001$ ). Working on a COVID-19 unit was also significantly correlated with SI ( $\rho = 0.058$ ,  $P = 0.01$ ). Interestingly, there was no difference in a history of COVID-19 in self or family members between those who worked on a COVID-19 unit and those who did not ( $P > 0.05$ ). However, COVID-19 positivity was significantly higher among coworkers of HCWs who worked on a COVID-19 unit than among those who did not (91.8% vs. 71.4%,  $P < 0.001$ ).

Second, we compared HCWs with and without a history of having tested positive for COVID-19. We found that HCWs with a history of COVID-19 had a significantly higher rate of PTSD (52.2% vs. 37.2%) and SI (6% vs. 1%) than those without a history of COVID-19. All other findings regarding this comparison are presented in Table 1.

Finally, we compared the HCWs in terms of having PTSD or not. The PTSD rate among HCWs was 39.3%. The HCWs who were female, single, nonphysicians, felt isolated, and had SI had higher rates of PTSD than those who did not. Nonphysician HCWs

had a higher rate of PTSD (49.5% vs. 36%) ( $\chi^2$ : 25.637, 2-sided,  $P < 0.001$ ) and higher PCL-5 scores ( $53.31 \pm 19.6$  vs.  $42.5 \pm 20.3$ ) (2-sided,  $t$  score: 9.81, 95% confidence interval: 8.64-12.96,  $P < 0.001$ ) than physicians. The PCL-5 score was significantly negatively correlated with the age of the HCW ( $\rho = 0.166$ ,  $P < 0.001$ ) and occupational experience in years ( $\rho = 0.112$ ,  $P < 0.001$ ), and positively correlated with the duration working on a COVID-19 unit ( $\rho = 0.096$ ,  $P < 0.001$ ). Other significant findings from this comparison are presented in Table 2.

### Regression Analysis

We did regression analyses to identify predictors of PTSD in HCWs during the pandemic. We found that working on a COVID-19 unit, feeling isolated, and having SI were the most significant predictors of PTSD (Table 3). In conducting the regression analysis, we took into consideration both the sex and occupation of the participants, and we found that being female and being a nonphysician HCW were each independent risk factors for developing PTSD.

### DISCUSSION

In this study, we found a high point-prevalence of PTSD (39.4%) among HCWs in Turkey ~6 months after the beginning of the COVID-19 pandemic. To our knowledge, this is the first study reporting rates of PTSD among Turkish HCWs in association with COVID-19. In a similar study, Johnson et al<sup>19</sup> investigated rates of PTSD in HCWs and public services providers in Norway in early April 2020 using the same scale (ie, the PCL-5). They found that 28.9% of their sample had clinical or subclinical symptoms of PTSD, with a higher rate of 36.5% among frontline HCWs (those who worked directly with COVID-19 patients). In addition, they also found that nonphysician HCWs had a higher rate of PTSD than physicians,<sup>19</sup> which is consistent with the results of our study. Dobson et al<sup>20</sup> found a 29% rate of PTSD in HCWs in Australia in a study conducted in April to May 2020. Two studies conducted in China<sup>9</sup> and Pakistan<sup>11</sup> in the early months of the pandemic also reported that HCWs experienced high levels of stress, with rates varying between 55.3% and 71.5%. Studies conducted during previous coronavirus epidemics (SARS, middle east respiratory syndrome) also found high rates of PTSD

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**TABLE 1. Comparison of HCWs With and Without a History of Testing Positive for COVID-19**

	<i>COVID-19-positive HCWs (N = 249) (%)</i>	<i>COVID-19-negative HCWs (N = 1584) (%)</i>	<i>Statistics</i>	
			$\chi^2$	<i>P</i>
Sex (male)	50	42	5.208	0.022
Night shift	71.5	61.2	9.77	0.002
COVID-19 in family	63.1	26.8	130.852	<0.001
COVID-19 in coworker	95.2	86.3	15.521	<0.001
Feeling isolated	67.4	57.8	8.728	0.004
Worry about being assaulted	35.3	43.1	5.426	0.02
Suicidal ideation	6	1	4.141	0.042
Rate of PTSD	52.2	37.2	20.55	<0.001

COVID-19 indicates coronavirus disease 2019; HCW, health care worker; PTSD, posttraumatic stress disorder.

among HCWs ranging between 9.4% and 47.8%,<sup>7,21-23</sup> which is consistent with our findings.

Our study demonstrated that the COVID-19 pandemic has not only caused infection and threatened the physical health of HCWs but has also adversely affected the mental well-being of HCWs, highlighting the need to monitor the mental well-being of frontline HCWs.

### Risk Factors for PTSD Among HCWs During the COVID-19 Pandemic

One goal of our study was to identify which HCWs were at the highest risk for developing PTSD during the COVID-19 pandemic. According to our results, the strongest predictors of PTSD among HCWs in association with COVID-19 were working on a

**TABLE 2. Comparison of Health Care Workers With and Without PTSD**

	<i>PTSD Positive (N = 720) (%)</i>	<i>PTSD Negative (N = 1113) (%)</i>	<i>Statistics</i>	
			$\chi^2$	<i>P</i>
Sex (female)	66.3	50	46.18	<0.001
Marital status (single)	46.6	38.3	12.4	<0.001
No children	58.3	45.6	26.05	<0.001
Occupation (nonphysicians)	30	20	25.63	<0.001
Night shift	73	55	58.60	<0.001
COVID-19 in coworkers	92.2	84.4	24.117	<0.001
Feeling isolated	79.1	46.1	196.84	<0.001
Fear of spreading to the family	98.4	94.1	20.45	<0.001
Suicidal ideation	18	3	102.67	<0.001
	(Mean ± SD)	(Mean ± SD)	<i>t</i>	<i>P</i>
Age (y)	31.5 ± 6.2	33.3 ± 7.5	5.47	<0.001
Work experience (y)	7.66 ± 6.13	9.2 ± 7.44	4.64	<0.001

COVID-19 indicates coronavirus disease 2019; PTSD, posttraumatic stress disorder.

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**TABLE 3. Regression Analysis of Risk Factors for Developing Posttraumatic Stress Disorder in HCWs**

	$\beta$	Wald	Odds Ratio (95% CI)	P
History of COVID-19 (positive)	0.703	17.478	2.021 (1.453-2.810)	< 0.001
Sex (female)	0.861	44.400	2.365 (1.836-3.047)	< 0.001
Occupation (nonphysician HCWs)	1.084	46.428	2.956 (2.164-4.038)	< 0.001
Feeling isolated	1.459	133.271	4.301 (3.358-5.510)	< 0.001
Fear of spreading to family	0.923	4.930	2.517 (1.114-5.685)	0.026
Working on a COVID-19 unit	2.328	66.359	10.262 (5.860-17.969)	< 0.001
Duration on a COVID-19 unit	0.082	7.782	1.085 (1.025-1.150)	0.005
Suicidal ideation	1.453	43.972	4.276 (2.783-6.570)	< 0.001

CI indicates confidence interval; COVID-19, coronavirus disease 2019; HCW, health care worker.

COVID-19 unit, feeling socially isolated, experiencing SI, being a nonphysician HCW, being female, and having a history of being COVID-19 positive.

On the basis of a number of studies, being female appeared to be the most commonly indicated risk factor for PTSD during the pandemic.<sup>9,19,20,24</sup> A meta-analysis reported that females were more likely to meet PTSD criteria despite a lower likelihood of experiencing traumatic events,<sup>25</sup> with the higher rate of PTSD related to the higher rate of fear-and anxiety-based disorders in females.<sup>25</sup> It has also been suggested that females have higher rates of peritraumatic fear, horror, panic, helplessness, physical anxiety sensitivity, and dissociation, increasing the risk of PTSD.<sup>26</sup>

Our study also found that nonphysician HCWs were at significantly higher risk than physicians for developing PTSD. Johnson et al<sup>19</sup> also found that nurses and social workers had more severe PTSD symptoms than physicians during the early months of the COVID-19 pandemic in Norway. Higher levels of education were found to be inversely associated with PTSD among emergency services personnel in a hospital in Italy,<sup>27</sup> and we can assume that physicians have a higher level of education. However, we conducted a further analysis and found that the nonphysician group contained a higher proportion of females than the physician group (68% vs. 52%) and that more of the nonphysician group were involved in providing direct care for COVID-19 patients than were the physicians (69.4% vs. 42%). Thus, heterogeneity between physician and non-physician HCWs might account for the difference in PTSD rates between these groups.

Loneliness was also reported to be another significant risk factor for PTSD in the early months of the COVID-19 pandemic in a Spanish study.<sup>28</sup> Social isolation has been one of the most important outcomes of the COVID-19 pandemic, because quarantining and social distancing are essential in preventing the spread of the infection. For example, home quarantine has been linked to poor mental health outcomes during the COVID-19 pandemic.<sup>12</sup> While HCWs were trying to stay away from their loved ones while dealing with providing care for patients with COVID-19, they often found it challenging to maintain their mental well-being.

Finally, nearly 1 in 10 of the HCWs we surveyed reported experiencing SI. Since we did not have baseline data from before the COVID-19 pandemic for the respondents, we do not know if the prevalence of SI increased during the early days of the pandemic. However, suicidality in the aftermath of trauma is not uncommon.<sup>29</sup> Carmassi et al<sup>30</sup> reported that 8.8% of earthquake survivors reported SI, a rate that is comparable to our findings. Several studies have reported that survivors of natural disasters had higher rates of stress-related disorders such as PTSD and suicide attempts.<sup>29,31</sup> Although the causal relationship between PTSD and SI is not clear, the HCWs with PTSD in our study had a significantly higher rate of SI than those without PTSD (Table 2).

In summary, our study demonstrated that the COVID-19 pandemic, per se, has caused significant psychological trauma in HCWs. Carmassi et al<sup>13</sup> hypothesized that the unprecedented number of patients, the course of the disease, high mortality

rates, and lack of effective treatment might be contributing to the distress of HCWs during this pandemic.<sup>13</sup> In addition, fear of becoming infected due to proximity to patients and fear of spreading the infection to family members might be other factors contributing to the HCWs' distress.<sup>32</sup> Frequently witnessing trauma and death, managing critical situations, and highly stressful work-related situations are other factors that can contribute to distress.<sup>13,33</sup>

### Recommendations for Promoting Mental Well-being in HCWs

HCWs are essential personnel, and maintaining their mental well-being is crucial in dealing with the COVID-19 pandemic.<sup>34</sup> It is vital to investigate traumatic stress in HCWs because PTSD can dramatically impact work and social life of HCWs, leading to problems such as having negative thoughts about their work colleagues, impairing their relationships, and leading to poor work performance.<sup>35</sup> Hospitals can create an environment for HCWs where distance from patients can be controlled and socialization can take place safely. Hospital should also provide proper psychiatric and psychological interventions, such as counseling, psychoeducation, and psychosocial support via telemedicine, and make these resources available to all HCWs. Chen et al<sup>36</sup> recommended setting up a team of counselors in the hospital to support HCWs experiencing stress related to COVID-19, and they described provision of a workshop on the topic of self-care.<sup>36</sup> Screening HCWs periodically may also help identify vulnerable personnel, such as young, female, less experienced HCWs. Chen et al<sup>36</sup> suggested that this could be an opportunity to reach out to more people via social media as the importance of well-being is recognized, to eliminate or mitigate stigma and promote help-seeking. Kaplan et al<sup>37</sup> reported that mindfulness-based training could improve resilience and help prevent burnout among first responders. Finally, we found that having less experience and working for a longer period on a COVID-19 unit were positively correlated with severity of PTSD. Thus, rotating physicians who work on COVID-19 teams and adjusting work schedules to prevent less experienced staff from working alone could be helpful. Other recommendations are to enhance social support and to encourage HCWs to maintain their everyday lives under safe conditions.<sup>38</sup>

### Limitations

The findings of this study should be considered in light of some limitations. First, there was no control group from the general population, and the results cannot be generalized. Second, it was a cross-sectional study that did not tell us about the cause and effect of the pandemic and PTSD and the course of PTSD in HCWs. Although the frontline HCWs were assumed to meet PTSD criterion A, it is not known if they experienced another trauma during the pandemic. Since we asked participants to whom the survey was sent to also send it out to their colleagues, we do not know the response rate. Finally, more studies are needed to investigate the long-term psychological impacts of the pandemic on HCWs. Nevertheless, this study had a large sample size and significant findings that indicated the pandemic's dramatic effect on HCWs.

### CONCLUSIONS

Our study found that HCWs who had been working on the frontlines since the COVID-19 pandemic broke out had significantly higher rates of PTSD that found in the general population during the first phase of the pandemic. These findings highlight the need to provide mental health support for HCWs, especially for those working on COVID-19 units who are female, nonphysicians, and younger. Future studies should follow-up HCWs who had PTSD during the COVID-19 pandemic and report on their long-term outcomes.

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