




# Perceived Stress and Perceived Vulnerability at Healthcare Workers during COVID-19 Pandemic

Berna Gokkaya<sup>1</sup>, Tuba Nur Yazici<sup>2</sup>, Betül Kargul<sup>3</sup>

<sup>1</sup> Bahcelievler Oral and Dental Health Hospital, Clinic of Pediatric Dentistry, Istanbul, Türkiye.

<sup>2</sup> Uskudar University, Department of Psychology, Istanbul, Türkiye.

<sup>3</sup> Marmara University, Dental School, Department of Pediatric Dentistry, Istanbul, Türkiye.

**Correspondence Author:** Berna Gokkaya

**E-mail:** bernagokkaya78@hotmail.com

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## ABSTRACT

**Objective:** This study evaluated the psychological effects of the COVID-19 pandemic on healthcare workers (HCWs) and determined several risk factors.

**Methods:** An online cross-sectional survey was administered to 244 HCWs recruited via the Google Docs platform. The 36-item questionnaire comprised three domains: demographic details, the Perceived Stress Scale-10 (PSS-10), and the Perceived Vulnerability to Disease Questionnaire (PVDQ). Multiple linear regression analysis was used to determine the risk factors for adverse psychological responses.

**Results:** Overall, 244 HCWs aged between 20 and 60 years old participated in the survey and the mean scores for perceived stress (PS), perceived infectability (PI), and germ aversion (GA) were 20.15, 28.83 and 47.78, respectively. Additionally, they were positively associated with gender. Females' score on PS ( $p=0.001$ ), PI ( $p=0.017$ ), and GA were also significantly higher than men ( $p=0.001$ ). Scores on PSS-10 showed a significant difference between age groups ( $p=0.010$ ) in contrast to GA ( $p=0.515$ ) or PI ( $p=0.346$ ). The regression model showed that the PI scores were higher among men ( $B=3.145$ ) than among women ( $p=0.019$ ). The analysis showed significant effects working during COVID-19 on PI scores ( $B=3.101$ ;  $p=0.006$ ). Furthermore, GA was also significantly related to worsening of the COVID-19 pandemic ( $B=2.73$ ;  $p=0.004$ ) and was higher among females ( $B=4.622$ ;  $p<0.001$ ).

**Conclusion:** According to the results of the study, gender, age, professional experience and knowledge, and working during a pandemic were important factors for PS and PVD. Additionally, supporting the mental health for HCWs obtaining adequate support and taking precautions are essential.

**Keywords:** Perceived stress, perceived vulnerability, COVID-19

## 1. INTRODUCTION

The pandemic has been difficult for some healthcare workers (HCWs) because of the high number of COVID-19 patients and long working hours. On the other hand, others worked less because of public health-related precautions (1). Initially, most countries spread the pandemic but the pandemic is running quickly and includes few waves (2).

Some studies have found that long working hours cause anxiety, depression, and disrupts mental health among physicians and nurses (3-5). Several studies in the previous literature, have examined the relationship between work-related stress and impaired mental health, especially among in doctors and nurses. This is a significant factor because it includes either providing quality service to patients or being professional workers (5-8). During the pandemic, observing and protecting mental health are the primary significant factors for HCWs. Therefore, they should be aware of the

factors that affect their mental health and take preventive measures (9).

With the spread of COVID-19 and under the guidance of the World Health Organization (WHO), people have begun to wash their hands more frequently. Concomitantly, we have become more afraid of infection than ever before. People have begun to disinfect various places and objects using alcohol and to wear masks. These behaviors are based on a heightened perceived vulnerability to disease (PVD). A psychological scale has been developed to measure this tendency (10). Therefore, perceived stress (PS) has been defined as a person's feelings or thoughts about how much stress he or she is under over a given time period. Gonzales et al. (11) explained that the high levels of vulnerability to contracting COVID-19 as perceived by the population over 60 years of age with a baseline disease at the beginning of the

epidemic in Spain and their avoidance of dental care. Zhang et al. (12) explained that quarantine did not increase the perceived stress of participants with existing

chronic diseases. However, it can be more difficult to access medical treatment and medication during quarantine, which may lead to higher stress. It produces a series of mental health problems, such as anxiety, depression, and psychosomatic illness, as well as cardiovascular, metabolic and immune regulatory function damage (13). Additionally, it can severely diminish the quality of one's life.

This study evaluated the levels of PS and PVD among HCWs during the COVID-19 pandemic in Turkey to assess the psychological impact of the pandemic in Turkey and focus on the HCWs' for psychological reverse signs, and provide a guide for implementing measures to prevent public health crises in other countries.

## 2. METHODS

The ethics committee of the Bakirkoy Dr. Sadi Konuk Training and Research Hospital (approval number 2020-179) approved this study. Informed consent was obtained from all participants after informing them about the study based on the provisions of the Declaration of Helsinki regarding research on human subjects.

### 2.1. Study Design and Population

An online cross-sectional survey was administered to HCWs' during the COVID-19 pandemic. The link to the online survey (Google Forms) was provided on behalf of the researcher. Participants' information in the survey was processed anonymously. The survey was sent through e-mails and WhatsApp messages to participants who provided voluntary consent and their personal identifying information was excluded. Data was collected from across various hospitals of Istanbul because of the higher number of COVID-19 cases during the pandemic. Power of the sample size was determined using <http://sampsize.sourceforge.net/iface/>. The power analysis gave a power of 0.95, which showed that the estimated sample size was adequate (n=226).

### 2.2. Instruments

The questionnaire consisted of 36 items under three domains: demographic details, the perceived stress scale-10 (PSS-10), and the perceived vulnerability to disease questionnaire (PVDQ).

The independent variables included in this study were gender, age, health profession (physician, nurse, dentist), years of working experience (0–10, 11–20, 21–30, and 31–40 years), and whether they worked related to COVID-19 (no/yes).

### 2.3. Perceived Stress Scale (PSS-10)

The PSS-10 has been widely used to evaluate perceived stress (14). The Turkish version of the PSS-10 (15) was used to measure the degree of stress perception on a 5-point Likert scale (from 0=never to 4=very often). The total scores ranged from 0 to 40, with higher scores corresponding to higher PS (0–13: low stress level; 14–26: moderate stress level; 27–40: high stress level) (16). In this study, the minimum and maximum scores on this scale were 0 and 35, respectively. Cronbach's coefficient of reliability for the PSS-10 was 0.893.

### 2.4. Perceived Vulnerability to Disease Questionnaire (PVDQ)

The 15-item PVDQ (15) measures two factors: perceived infectability (PI; 7 items), which is related to the beliefs of one's own suspicions of flu, colds, and other infectious diseases and Germ Aversion (GA; 8 items), which is related to the cognizance of disturbance in situations with infection or a pathogen (9). Figure 1 lists each of the 15 items, along with the factor loadings for each factor. The internal consistency (Cronbach's alphas) of these subscales in this study were 0.792 for PI with minimum and maximum scores of 8 and 49, respectively, and 0.727 for GA with minimum and maximum scores of 18 and 56, respectively.

### 2.5. Data Analyses

This cross-sectional study included individuals aged between 20 and 60 years, while considering gender. Analysis of variance (ANOVA) was used since the data was normally distributed. Data analysis was done using SPSS® Statistics for Windows, version 22.0 (IBM, NY, USA). The differences between groups in all variables were analyzed using the Spearman rank correlation, LSD test, Student's *t*-test, and Dunn test. Regression analyses was used for categorical data. Furthermore, Cronbach's  $\alpha$  was calculated for validity and reliability of the scales.

## 3. RESULTS

The final sample consisted of 244 HCWs aged between 20 and 60 years after excluding two participants who provided incomplete or insufficient information. Therefore, the sample comprised 50 (20.5%) men and 194 (79.5%) women.

Table 1 shows the basic demographic characteristics of the HCWs. Three quarter of the study participants were female (79.5%), 77% were married, and 38.1% had 11–20 years of experience. The highest age range of the participants was 41–50 years who were also married. The mean scores for PS, PI, and GA were 20.15, 28.83, and 47.78, respectively. Of these, 68 (27.9%) were general dental practitioners, 67 (27.5%) were nurses, 41(16.8%) were specialist dentists, and 28 (11.5%) were specialists (Table 1).

**Table 1.** Demographic characteristics of participants

Characteristic		N	(%)
<b>Gender</b>	<b>Male</b>	<b>50</b>	<b>20.5</b>
	<b>Female</b>	<b>194</b>	<b>79.5</b>
<b>Age</b>	20-30	32	13.1
	31-40	90	36.9
	41-50	103	42.2
	51-60	19	7.8
<b>Married</b>	<b>no</b>	<b>56</b>	<b>23.0</b>
	<b>yes</b>	<b>188</b>	<b>77.0</b>
<b>Have Children</b>	no	67	27.5
	yes	177	72.5
<b>Healthcare Workers Profession</b>	Specialist	28	11.5
	Physicians	8	3.3
	Specialist Dentists	41	16.8
	General Dental Practitioner	68	27.9
	Nurse	67	27.5
	Others	32	13.1
<b>Clinical experience (years)</b>	<b>0-10</b>	<b>59</b>	<b>24.2</b>
	<b>11-20</b>	<b>93</b>	<b>38.1</b>
	<b>21-30</b>	<b>79</b>	<b>32.4</b>
	<b>31-40</b>	<b>13</b>	<b>5.3</b>
<b>Employed</b>	University	14	5.7
	Hospital	41	16.8
	Pandemia hospital	23	9.4
	Center for Oral Health Care	96	39.3
	Private practice	17	7.0
	<b>Other</b>	<b>53</b>	<b>21.7</b>
<b>Worked during COVID-19 pandemic</b>	<b>No</b>	<b>94</b>	<b>38.7</b>
	<b>Yes</b>	<b>149</b>	<b>61.3</b>
<b>Place of work during COVID-19 pandemic</b>	Filiation	79	48.8
	Intensive care units (ICU)	13	8.0
	Emergency	10	6.2
	Other	47	31.5
<b>COVID-19 test</b>	<b>No</b>	<b>156</b>	<b>63.9</b>
	<b>Yes</b>	<b>88</b>	<b>36.1</b>
<b>Exposed to coronavirus disease</b>	No	69	76.7
	Yes	21	23.3
<b>Psychological response</b>			
<b>Perceived Vulnerability to infection</b>	<b>Mean ±SD</b>		
<b>Infectability subscale</b>	28.83 ± 8.47		
<b>Germ-aversion subscale</b>	47.78 ± 7.34		
<b>PSS-10*</b>	20.15 ± 6.46		

\*Perceived Stress Scale

Significant gender differences were observed in the assessment of the participants. GA, PI, and PS were positively associated with gender. Additionally, females' scores on the PS ( $p=0.001$ ), PI ( $p=0.017$ ), and GA ( $p=0.001$ ) were significantly

higher than those of men. A statistically significant difference was found between the levels of PS according to gender (Table 2). Scores on the PSS-10 showed significant differences between the age groups ( $p=0.010$ ). The scores on the PSS-10 also decreased with age. The PSS-10 scores of the 20–30 and 31–40 years age groups were significantly higher than those aged 51 years and above ( $p=0.022$ ;  $p=0.010$ ). The PSS-10 scores were positively associated with age. There were no significant differences between age groups for either GA ( $p=0.515$ ) or PI ( $p=0.346$ ) (Table 2). The mean PSS-10, PI, and GA scores of participants who worked during the COVID-19 pandemic were  $21.41\pm 6.40$ ,  $29.91\pm 8.51$ , and  $48.87\pm 6.11$ , respectively. All scores were higher in the group of HCWs who worked during the COVID-19 pandemic compared to the non-working group ( $p<0.05$ ) (Table 2).

We found that most HCWs reported moderate levels of stress 138 (56.6%); however, 104 (42.6%) participants reported high stress levels, with scores ranging from 0 to 34. In this study, scores ranging between 14 and 26 were deemed as moderate PS associated with COVID-19. The scores of 27 and above were regarded as high PS associated with COVID-19. About 104 participants (42.6%) scored high on PS, which was significantly related to the HCWs who worked during the COVID-19 pandemic (OR=2.21 %95CI: [1.26–3.89];  $p=0.006$ ). After adjusting for COVID-19 test positivity, the relationship remained significant (OR=3.11 %95CI: [1.01–9.54];  $p=0.047$ ). PI was affected by the type of HCW's profession ( $p=0.007$ ) (Table 3). However, there were no statistically significant differences in the GA ( $p=0.266$ ) and PSS-10 scores ( $p=0.103$ ). No significant difference was observed in the evaluation of the place who worked during the COVID-19 pandemic ( $p>0.05$ ) (Table 3).

Accordingly, PI and GA were positively and significantly related with gender. PS was positively associated with PI in both genders; however, there was no association between GA and PS among men (Table 4). Accordingly, PI and GA were positively and significantly related to COVID-19 test negativity. PS was negatively associated with GA in the COVID-19 test-positive group; however, the difference was not statistically significant ( $p=0.267$ ). There was no positive correlation between PI, GA, and PSS-10 for COVID-19 test positivity (Table 4).

The regression model showed that the PI scores were higher among men ( $B=3.145$ ) than among women ( $p=0.019$ ). The analysis showed significant effects of working during COVID-19 ( $B=3.101$ ) on the PI scores ( $p=0.006$ ). Accordingly, PI scores were negative but not significantly affected by age. Furthermore, GA was significantly related to worsening of the COVID-19 pandemic ( $B=2.733$ ,  $p=0.004$ ) and was higher among females ( $B=4.622$ ;  $p<0.001$ ) (Table 5). Moreover, regression analysis showed significant effects of gender and worsening COVID-19 pandemic on PSS-10 scores ( $p=0.001$  and  $p<0.001$ , respectively) (Table 5).

**Table 2.** Differences in gender, age groups, and worked during the pandemic in PSS-10 and PVDS among HCWs

	GENDER		p	AGE GROUPS				p	WORKED DURING THE PANDEMIC		p
	male	female		20-30	31-40	41-50	51+		Yes	No	
	(n=50)	(n=194)		(n=32)	(n=90)	(n=103)	(n=19)		(n=149)	(n=94)	
	Mean(SD)	Mean(SD)	Mean(SD)	Mean(SD)	Mean(SD)	Mean(SD)	Mean(SD)	Mean(SD)			
PI	26.28±8.88	29.48±8.26	0.017	27.78± 9.66	30.10± 8.14	28.09± 8.54	28.58±7.31	0.346	29.91±8.51	27.07±8.19	0.011
GA	44.22±8.56	48.70±6.71	0.001	47.06± 7.94	48.27± 6.88	47.65± 6.70	47.42± 11.30	0.515	48.87±6.11	46.22±8.61	0.051
PSS-10*	17.38±7.04	20.86±6.13	0.001	21.63± 5.93	21.37± 5.97	19.11± 6.96	17.53± 5.26	<b>0.010*</b>	21.41±6.40	18.12±6.10	0.001

Note\*.PSS-10 Perceived Stress Scale (PSS-10)

**Table 3.** Type of HCWs profession and place of worked differences in PSS-10 and PVDS during the COVID-19 pandemic

HCWs Profession	n	PI	GA	PSS
Specialist	28	26.32±9.46	45.96±10.13	17.89±6.80
Physicians	8	31.00±8.98	50.38±4.69	23.00±5.35
Specialist Dentists	41	26.59±8.51	47.83±7.32	20.05±5.26
General Dental Practitioner	68	26.53±7.26	46.78±6.48	19.04±6.51
Nurse	67	30.91±8.00	48.45±7.88	20.94±6.61
p		0.007*	0.27	0.103
Place of work				
Filiation	79	29.92±8.14	48.75±5.20	21.59±6.06
Intensive care units	13	29.92±10.68	50.38±6.16	21.00±6.73
Emergency units	10	31.40±10.72	49.00±11.96	23.90±7.19
p		0.841	0.28	0.551

**Table 4.** Spearman correlations for all categorical data, gender, and COVID-19 case correlations during pandemic

ALL CATEGORICAL DATA		PI	GA	PSS	
PI	r		0.416	0.42	
	p		0	0	
GA	r	0.416		0.269	
	P	0		0	
PSS	r	0.42	0.269		
	p	0	0		
GENDER	PI	r	0.433	0.389	
		P	<b>0.002</b>	<b>0.005</b>	
	GA	r	0.433	0.273	
		P	<b>0.002</b>	<b>0.055</b>	
	PSS	r	0.389	0.273	
		P	<b>0.005</b>	<b>0.055</b>	
N=50	PI	r	0.383	0.386	
		P	0	0	
	GA	r	0.383	0.203	
		P	0	<b>0.005</b>	
	PSS	r	0.386	0.203	
		P	0	<b>0.005</b>	
COVID-19	negative case	PI*	r	0.639	0.552
		p		0	0
	N=69	GA**	r	0.639	0.516
		P	0		0
	PSS***	r	0.552	0.516	
		p	0	0	
positive case	PI*	r	0.015	0.099	
		p	<b>0.947</b>	<b>0.668</b>	
	N=69	GA**	r	0.015	-0.254
		p	<b>0.947</b>	<b>0.267</b>	
	PSS***	r	0.099	-0.254	
		p			

Note. \*Perceived Infectability (PI) \*\*Germ Aversion(GA) \*\*\*Perceived Stress Scale (PSS-10)

**Table 5:** Regression model for all categorical scores

PI	Unstandardized Coefficients		Standardized Coefficients	P	95.0% Confidence Interval for B	
	B	Std. Error	Beta		Lower Bound	Upper Bound
age	-.085	.740	-.008	.908	-1.544	1.373
gender	3.145	1.335	.150	.019	.515	5.776
Worked in pandemic	3.101	1.117	.178	.006	.900	5.301
a. Dependent Variable: infectability subscale						

GA	Unstandardized Coefficients		Standardized Coefficients	P	95.0% Confidence Interval for B	
	B	Std. Error	Beta		Lower Bound	Upper Bound
age	.266	.623	.030	.670	-.961	1.493
gender	4.622	1.123	.257	.000	2.409	6.834
Worked in pandemic	2.733	.940	.183	.004	.882	4.584
a. Dependent Variable: Germ-aversion subscale						

PSS-10	Unstandardized Coefficients		Standardized Coefficients	P	95.0% Confidence Interval for B	
	B	Std. Error	Beta		Lower Bound	Upper Bound
age	-.609	.541	-.077	.261	-1.674	.456
gender	3.199	.975	.200	.001	1.278	5.119
Worked in pandemic	3.006	.816	.227	.000	1.400	4.613
a. Dependent Variable: PSS						

#### 4. DISCUSSION

Pandemics are periodic facts that have private characteristics in terms of causality, progression, and control precautions (17). All HCWs provide care for patients with COVID-19. The rapid spread of COVID-19 and the severity of symptoms have been extremely stressful for HCWs due to the limits of the healthcare system (9). Therefore, HCWs face a greater risk of exposure, excessive workloads, ethical dilemmas, and a rapidly evolving practice that greatly varies from what they are familiar with (18–20). Additionally, all other problems and challenges continued during the vaccination period.

The results of our study showed that levels of distress among HCWs were high during the COVID-19 pandemic. Increasing anxiety levels can lead to increased recurrent behaviors and precautions among people during the COVID-19 pandemic. People often ignore their psychological health while only supporting their physical health. Therefore, individuals with low PVD levels may prefer to protect their mental well-being at the expense of their physical health. On the other hand, individuals with high PVD levels show high avoidance behaviors that prevent their anxiety (21–23).

The study population comprised 244 HCWs, of which 79.5% were women. Several studies in the literature have unequal gender distribution (24–27). Additionally, our findings indicate that women reported more PS than men. Furthermore, regression analysis was used to reduce the

effect of unequal gender distribution and we found results similar to the previous studies.

Our study results showed that PS, PI, and GA were found more frequently among females than males. One study found no significant gender differences in PI; however, differences existed in the GA (11). Another study reported that either GA or PI was positively associated with both genders (28). When we analyzed our results on the basis of subgroups, we found that similar to previous studies (10, 29, 30), females' scores on PI and GA were significantly higher than those of men.

Coninck et al. (31) reported that age differences were found for GA only: older age categories reported significantly higher GA than younger ones. Another study explained that people with a higher education degree showed higher anxiety levels about the COVID-19 exposure (32). Younger groups are much less likely to have experienced difficult life events compared to older age groups because of which they can have higher stress levels; however, middle-aged and older age groups can manage the current process due to having experienced stressful life events previously. Our study results showed that younger HCWs may have higher PS levels during the COVID-19 pandemic compared with older HCWs. In Turkey, the Ministry of Health declared that older HCWs who had a chronic disease or/and had a threatening illness did not have to work during the pandemic. For this reason, older HCWs who worked during the pandemic had more experience in their jobs and had no illness. Because of that, our study results found that PS decreased with age.

We found that HCWs who worked during the pandemic had significantly higher PS values than those who did not work during the pandemic. Ehrenstein et al (33) found 28% of professionals may abandon work in favour of protecting themselves and their family. Quereshi et al (34) said that the most significant barrier to HCWs' willingness to work was fear for their own and their families' health. Balicer et al (35) anticipate up to 50% of HCWs being unwilling to work, with clinical staff more likely to attend than non-clinical ones.

We also found that PI was affected by the type of HCWs' profession; physicians and nurses were more affected than others. However, GA and PSS-10 scores were not affected by the type of their profession. Therefore, it was a stronger trigger when a pathogen threat was not seen as an immediate environmental threat (36). Du et al. (37) found that frontline HCWs had moderate to severe levels of PS (PSS scores  $\geq 14$ ), and depressive and anxiety symptoms were more common among women.

Lai et al. (24) reported that HCWs from 34 hospitals in different regions of China with direct contact with COVID-19 patients were at significantly higher risk of experiencing symptoms related to post-traumatic stress, depression, anxiety, and insomnia. Another Chinese study (12) reported that non-medical HCWs had a lower prevalence of anxiety, insomnia, depression, and obsessive-compulsive symptoms than HCWs, and they emphasized the need for attention and recovery programs.

Weilenmann et al. (1) reported that female nurses at the frontline who were exposed to COVID-19 patients had higher stress levels compared with male non-frontline physicians who were not exposed to COVID-19 patients. Lai et al. (24) reported that being a woman, having an intermediate professional title, and working in the frontline directly treating patients with COVID-19 were associated with severe symptoms of depression, anxiety, and distress compared with working in second-line positions and working in a tertiary hospital. They found it to be an independent risk factor for all psychiatric symptoms after adjustment. Li et al. (25) declared that the general public and non-frontline nurses had significantly higher vicarious traumatization scores than frontline nurses. Moreover, frontline nurses had higher psychological endurance while non-frontline nurses were more likely to suffer from psychological problems. Finally, the frontline nurses were more knowledgeable about the pandemic, were selected voluntarily and were the primary staff with working experience and psychological capacity compared with non-frontline nurses and the general public. Our study results showed that all scores were higher in the group of HCWs who worked during the COVID-19 pandemic compared to the not-working group. Furthermore, PS score was higher in the emergency unit than the intensive care unit and filiation. Females had higher PS score than males. Our results supported the results of these two previous studies.

In our study, PI was more predictive of both genders whereas GA was more predictive of only women. On the other hand, PI and GA were positively related with COVID-19 test negativity.

One study found that the moderate and low PVD groups did not show significantly less preventive behavior or significantly less knowledge and emotional distress than the high PVD group (32). It was observed that individuals with high PVD scores were more cautious, had more information about the disease, and experienced higher stress than the other groups. PI scores provides information about the disease prevention behaviors of individuals. GA scores provide information about the increase in preventive behaviors and decrease in risky behaviors. In the light of these findings, individuals with high PVD scores are more cautious and more knowledgeable about the issues that may lead to the disease, so that it is possible to avoid the disease.

PS was negatively associated with GA in the COVID test-positive group, but there was no statistical significance. Our results showed that females experienced more PS than men and paid more attention to disease prevention. In the literature, post-traumatic stress, depression, insomnia, and (mental) distress are generally significantly associated with the fear of infection and perception of risk (38–43).

Brier et al. (44) identified four factors that may protect HCWs from developing mental health problems during the pandemic. First, being informed and receiving support from the manager prevented the development of mental health problems. Second, being in quarantine worsened mental health. Third, there was no relationship between job stress and mental health. Fourth, HCWs may suffer from mental health problems because of the risk or fear of becoming infected or infecting others.

Because the pandemic is ongoing and its progress is undetectable, one study suggested the use of monitoring systems for HCWs' mental health and prevention to protect their wellness during the pandemic (45).

### Limitations

This study has a few limitations. The F/M ratio was the first limitation of this study. The regression analysis was used for the reduction of the bias. Future studies should consider the F/M participant ratio.

Second, this study relied on a self-report questionnaire, which is a subjective source of data collection. Therefore, participants may have not provided objective responses to the questionnaire items. However, the results of this study may be useful for special groups.

Third, in this study, participants did not have a history of psychiatric illness; however, we had no opportunity to control the psychological and physical conditions of HCWs due to extraneous factors.

### 5. CONCLUSION

This study assessed the levels of PS and PVD during the COVID-19 pandemic among HCWs. Gender, age, professional experience and knowledge, and working during a pandemic

were important factors for PS and PVD. According to the results of this study, support programs by hospital organizations, social support by colleagues, and a sense of control and coping ability are essential to support the mental health of HCWs. Further research will be required at the end of the pandemic to verify these results among HCWs.

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### Conflicts of interest

None.

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