


# The Continuing Effect of COVID-19 Pandemic on Physical Well-Being and Mental Health of ICU Healthcare Workers in Turkey: A Single-Centre Cross-Sectional Later-Phase Study

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## Abstract

**Background:** This study aimed to evaluate the effect of COVID-19 pandemic on physical well-being and mental health of ICU healthcare workers (HCWs).

**Methods:** A total of 51 ICU HCWs working at a tertiary care hospital were included in this cross-sectional study conducted before (January 2019-January 2020) and during (January 2021-April 2021) COVID-19 pandemic. Data on sociodemographic and work-related characteristics, COVID 19 history and current mental health issues via Hospital Anxiety-Depression Scale (HADS), Pittsburgh Sleep Quality Index (PSQI), Eating Attitudes Test (EAT-40), Suicidal Ideation Scale (SIS) and Maslach Burnout Inventory (MBI) were recorded.

**Results:** Overall, 62.7% of participants were nurses, heavy workload (working  $\geq 200$  h/month) was reported by 76.5% of participants and previous history of COVID-19 was confirmed by 62.7%. Current mental health issues involved poor sleep quality in majority (96.1%) of participants, anxiety (51.0%), depression (51.0%) in at least half of them and a moderate degree of emotional exhaustion. Heavy workload was associated with more remarkable decrease in sleep duration (median change:  $-0.5$  vs.  $-1.0$  h/day,  $P = .020$ ), Vit B12 (median change:  $60[-48-293]$  vs.  $-65[-371-262]$  pg/mL,  $P < .001$ ) and Vit D (median change:  $-1.6[-13.1-20]$  vs.  $-9.7[-39.7-21.8]$  ng/mL,  $P = .004$ ) during pandemic, while working hours per month were also significantly higher in those with versus without anxiety ( $264[150-390]$  vs.  $240[150-264]$  h,  $P = .003$ ) and with versus without depression ( $264[150-390]$  vs.  $240[150-264]$  h,  $P = .037$ ).

**Conclusion:** Our findings indicate high prevalence of mental health issues including anxiety and depression as well as poor sleep quality and emotional burnout among ICU HCWs, particularly those with heavy workload.

## Keywords

COVID-19, ICU staff, physical well-being, mental health issues, burnout, workload

## Introduction

Growing evidence indicate that healthcare workers (HCWs), particularly the frontline HCWs providing direct assistance to infected patients, have been exposed to myriad of psychological stressors while working during the coronavirus disease-2019 (COVID-19) pandemic globally.<sup>1-3</sup>

In this regard, ICU staff is considered to be at higher risk of developing mental health difficulties (ie anxiety, depression, insomnia, psychological distress and posttraumatic stress symptoms) due to challenging working conditions along with the fears of contracting the virus and endangering their loved ones, reports of deaths among colleagues and loss of patient lives despite their best efforts.<sup>4-8</sup>

The psychological side of the pandemic and the factors related to mental health in the workplace have become less extensively studied than its medical or economic implications,

despite their potential to have a significant long-term impact on people's mental health and psychological impact on the whole population.<sup>9,10</sup>

Given that ICU HCWs are considered to be at high risk for burnout and mental health issues event in pre-COVID practice environment,<sup>7,10</sup> the screening for mental health issues among ICU HCWs during pandemic is considered an immediate

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priority to implement tailored interventions in this vulnerable population.<sup>7,8,10</sup>

This study was designed, at a later phase of the COVID-19 pandemic (January-April 2021), to evaluate physical well-being and current mental health status (anxiety, depression, sleep disorder, eating disorder, burnout, suicidal ideation) among ICU HCWs in relation to COVID-19 positivity and sociodemographic, laboratory and work-related factors.

## Methods

### Study Population

A total of 51 ICU HCWs (mean  $\pm$  SD age  $32.8 \pm 8.3$  years, 82.4% were females) working at a tertiary care hospital were included in this cross-sectional study conducted before (January 2019-January 2020) and during (January 2021-April 2021) COVID-19 pandemic in Turkey. Being a HCW employed in the ICU and having available data for the related study variables on both time periods of the study were the inclusion criteria.

Written informed consent was obtained from each subject following a detailed explanation of the objectives and protocol of the study which was conducted in accordance with the ethical principles stated in the "Declaration of Helsinki" and approved by the institutional ethics committee.

### Assessments

Data on patient demographics (age, gender), occupation, marital status, educational status, and years in practice, working hours per month, COVID 19 history and current mental health issues via Hospital Anxiety-Depression Scale (HADS), Pittsburgh Sleep Quality Index (PSQI), Eating Attitudes Test (EAT-40), Suicidal Ideation Scale (SIS) and Maslach Burnout Inventory (MBI) were recorded. Data on smoking, alcohol consumption and sleep duration and laboratory parameters including white blood cell (WBC) ( $\times 10^9/L$ ), neutrophil (cells/ $mm^3$ ), lymphocyte (cells/ $\mu L$ ) and platelet (cells/ $mm^3$ ) counts, hemoglobin (g/dL), ferritin (ng/mL), vitamin B12 (pg/mL), vitamin D (ng/mL) and thyroid stimulating hormone (TSH) (mIU/L) levels were evaluated before versus during the COVID-19 pandemic. Sociodemographic and laboratory variables were also evaluated according to previous COVID-19 history (infected vs. non-infected), working hours (heavy workload [ $\geq 200$  h/month] vs.  $< 200$  h/month) and current mental health status.

### Hospital Anxiety-Depression Scale (HADS)

The HADS, developed by Zigmond and Snaith<sup>11</sup> is a fourteen item [seven relate to anxiety (HADS-A) and seven relate to depression (HADS-D)] scale used to screen anxiety and depression in medical outpatient settings.<sup>11</sup> Each item on the questionnaire is scored from 0 to 3 leading overall score to range between 0 and 21 for either anxiety or depression as categorized

into normal (scores 0-7), borderline abnormal (scores 8-10) and abnormal (scores 11-21) status.<sup>11</sup> HADS was adapted to Turkish by Aydemir<sup>12</sup> with cut-off points of 10 and 7 defined for HADS-A and HADS-D subscales, respectively.

### Suicidal Ideation Scale (SIS)

The SIS, developed by Levine et al. in 1989, is a 17-item self-report measure that assesses the risk of suicide.<sup>13</sup> Total score varies from 0 to 17 with higher total scores representing greater suicidal risk. The validity and reliability of the Turkish scale was established by Dilbaz et al.<sup>14</sup>

### Maslach Burnout Inventory (MBI)

MBI is a 22-item self-report measure developed by Maslach in 1981<sup>15</sup> to assess the level of burnout, based on three component scales including emotional exhaustion (9 items), depersonalization (5 items) and personal achievement (8 items). Each item is scored via 1 to 5 Likert scale and each scale measures its own unique dimension of burnout based on item scoring that range from a lowest (score 1) to highest (score 5) levels. Higher scores on emotional exhaustion and depersonalization, whereas lower scores on personal achievement indicate a higher level of burnout.<sup>15</sup> The validity and reliability of the Turkish scale was established by Ergin et al. in 1993.<sup>16</sup>

### Eating Attitudes Test (EAT-40)

EAT-40 was developed by Garner and Garfinkel in 1979<sup>17</sup> to assess eating attitudes indicating risk of eating disorder with the scores higher than the cut-off ( $\geq 30$ ) indicating an eating disorder. The validity and reliability of the Turkish scale was established by Savasir and Erol in 1989.<sup>18</sup>

### Pittsburgh Sleep Quality Index (PSQI)

The PSQI was developed by Buysse et al.<sup>19</sup> as a self-rated questionnaire which assesses several dimensions of sleep quality over a one-month time period. The scale consists of 18 items, that yield seven component scores including subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medications and daytime dysfunction. Each component is scored between 0 and 3 and the sum of the component scores yields a global score (range 0-21) that reflects the composite severity of sleep disturbance. A total score under 5 indicates "good sleep quality", while a score above 5 shows "poor sleep quality". Turkish validation of PSQI was performed by Agargun et al.<sup>20</sup>

### Statistical Analysis

Statistical analysis was made using MedCalc® Statistical Software version 19.7.2 (MedCalc Software Ltd, Ostend, Belgium; <https://www.medcalc.org>; 2021). Chi square test, Yates Continuity Correction and Fisher Exact test were used

for analysis of categorical data. Mann-Whitney U test were used for analysis of the parametric variables and change over time was evaluated by Wilcoxon Signed Rank test. Correlation analysis was performed with Spearman Rho correlation test. Data were expressed as “mean  $\pm$  standard deviation (SD), median (min-max) and percent (%) where appropriate.  $P < .05$  was considered statistically significant.

## Results

### Sociodemographic Characteristics and Mental Health Issues

Overall, 62.7% of participants were nurses, 58.8% were married and 66.7% were university graduates. Heavy workload (working  $\geq 200$  h/month) was reported by 76.5% of participants and previous history of COVID-19 was confirmed by 62.7% (Table 1).

Current mental health issues involved poor sleep quality in majority (96.1%) of participants, anxiety (51.0%), depression (51.0%) in at least half of them and a moderate degree of burnout in terms of emotional exhaustion (median score: 20), while eating disorder was evident in 19.6% of participants and SIS scores indicate absence of suicidal ideation (Table 1).

### Cigarette and Alcohol Consumption, Sleep Duration and Laboratory Parameters Before and During Pandemic

When compared to pre-pandemic period, participants reported significant increase in daily cigarette consumption (mean 0.4 vs. 0.7 packs/day,  $P = .012$ ) during COVID-19 pandemic, while a significant decrease was noted in sleep duration (median 8.1 vs. 7.0 h,  $P < .001$ ), WBC counts ( $10.1 \pm 12.2$  vs  $7.8 \pm 2.1 \times 10^9/L$ ,  $P = .026$ ), Vit B12 ( $300.7 \pm 87.7$  vs.  $268.7 \pm 112.7$  pg/mL,  $P = .031$ ) and Vit D ( $22.4 \pm 10.2$  vs.  $16 \pm 7.7$  ng/mL,  $P = .001$ ) levels during the pandemic (Table 2).

### Sociodemographic and Laboratory Variables According to COVID-19 History and Heavy Workload

Apart from higher percentage of married versus single individuals (84.2 vs. 15.8%,  $P = .019$ ) in the absence versus presence of previous COVID-19 infection, no significant difference was noted between participants with versus without previous COVID-19 infection in terms of study parameters (Table 3).

Heavy workload (working  $\geq 200$  h/month) as compared with working less than 200 h/month was associated with greater increase in smoking (mean change:  $-0.3$  vs.  $0.4$  packs/day,  $P = .001$ ), and more remarkable decrease in sleep duration (median change:  $-0.5$  vs.  $-1.0$  h/day,  $P = .020$ ), Vit B12 (median change:  $60[-48-293]$  vs.  $-65[-371-262]$  pg/mL,  $P < .001$ ) and Vit D (median change:  $-1.6[-13.1-20]$  vs.  $-9.7[-39.7-21.8]$  ng/mL,  $P = .004$ ) during pandemic (Table 4).

**Table 1.** Sociodemographic Characteristics and Mental Health Issues.

Age (year), mean $\pm$ SD (min-max)	32.8 $\pm$ 8.3 (20-50)
Gender, n(%)	
Female	42(82.4)
Male	9(17.6)
Job title, n(%)	
Physician	8(15.7)
Nurse	32(62.7)
Non-medical staff	7(13.8)
Nursing assistant	4(7.8)
Marital status, n(%)	
Single	20(41.2)
Married	31(58.8)
Educational status, n(%)	
Primary school	2(3.9)
High school	15(29.4)
University	34(66.7)
Years in practice, median (min-max)	6(1-25)
Working hours per month	median (min-max) $\geq 200$ h/month, n(%) $< 200$ h/month, n(%)
	240(150-390) 39(76.5) 12(23.5)
COVID 19 history, n(%)	
Not infected	19(37.3)
Infected	32(62.7)
Current mental health issues, n(%)	
HADS-A	Total score Anxiety absent ( $< 11$ ) Anxiety present ( $> 11$ )
	11(2-19) 25(49.0) 26(51.0)
HADS-D	Total score Depression absent ( $< 8$ ) Depression present ( $> 8$ )
	8(2-18) 25(49) 26(51.0)
PSQI	Total score Good sleep quality Poor sleep quality ( $\geq 5$ )
	10(2-18) 2(3.9) 49(96.1)
EAT-40	Total score Eating disorder absent Eating disorder present
	16(3-41) 41(80.4) 10(19.6)
MBI, median(min-max)	Emotional exhaustion Depersonalization Personal achievement
	20(4-30) 8(0-15) 21(3-32)
SIS, median(min-max)	0(0-9)

Abbreviations: HADS, hospital anxiety-depression scale (HADS); PSQI, pittsburgh sleep quality index; EAT-40, eating attitudes test; SIS, suicidal ideation scale (SIS); MBI, Maslach burnout inventory.

### Sociodemographic and Laboratory Variables According to Current Psychiatric status

No significant difference was noted in age, gender, marital status and years in practice according to presence of anxiety, depression or eating disorder (Table 5).

Working hours per month were significantly higher in those with anxiety (median [min-max]  $264[150-390]$  vs.  $240[150-264]$  h,  $P = .003$ ) and depression (median [min-max]  $264[150-390]$  vs.  $240[150-264]$  h,  $P = .037$ ) compared to those without anxiety and depression, respectively (Table 5).

Change in platelet levels were negatively correlated with PSQI scores ( $r = -0.292$ ,  $P = .037$ ) and change in Vit D

**Table 2.** Cigarette and Alcohol Consumption, Sleep Duration and Laboratory Parameters Before Versus During COVID Pandemic.

		Before pandemic	During pandemic	P value
Cigarette smoking (packs /day)	mean $\pm$ SD	0.4 $\pm$ 0.5	0.7 $\pm$ 0.8	<b>.012<sup>a</sup></b>
	median (min-max)	0(0-1)	0(0-2)	
Alcohol consumption (per week), median (min-max)		0(0-2)	0(0-2)	.564 <sup>a</sup>
Sleep duration, median (min-max)		8.1(7-12)	7(5-12)	<b>&lt;.001<sup>a</sup></b>
Laboratory parameters, mean $\pm$ SD				
Hemoglobin (g/dL)		13.2 $\pm$ 1.3	13.3 $\pm$ 1.1	.691 <sup>b</sup>
WBC ( $\times 10^9/L$ )		10.1 $\pm$ 12.2	7.8 $\pm$ 2.1	<b>.026<sup>a</sup></b>
Neutrophil (cells/mm <sup>3</sup> )		4.8 $\pm$ 1.6	4.4 $\pm$ 1.5	.185 <sup>a</sup>
Lymphocyte (cells/ $\mu$ L)		2.4 $\pm$ 0.7	2.5 $\pm$ 0.8	.651 <sup>b</sup>
Platelet cells/mm <sup>3</sup>		260 $\pm$ 69.1	256.6 $\pm$ 55.1	.269 <sup>a</sup>
Ferritin (ng/mL)		48.4 $\pm$ 42.3	53.3 $\pm$ 56.9	.656 <sup>a</sup>
Vit B12 (pg/mL)		300.7 $\pm$ 87.7	268.7 $\pm$ 112.7	<b>.031<sup>a</sup></b>
Vit D (ng/mL)		22.4 $\pm$ 10.2	16 $\pm$ 7.7	<b>.001<sup>a</sup></b>
TSH (mIU/L)		1.9 $\pm$ 0.8	1.7 $\pm$ 1.1	.066 <sup>a</sup>

Abbreviations: WBC, white blood cell; Vit, vitamin; TSH, thyroid stimulating hormone.

<sup>a</sup>Wilcoxon Signed Rank test, <sup>b</sup>Paired t test.

**Table 3.** Sociodemographic and Laboratory Variables According to COVID-19 History.

	COVID-19 history		P value <sup>a</sup>	
	Not infected (n = 19)	Infected (n = 32)		
Age (year), median (min-max)	33(20-46)	29.5(21-50)	.899	
Gender, n(%)				
Female	13(68.4)	29(90.6)	.062 <sup>b</sup>	
Male	6(31.6)	3(9.4)		
Marital status n(%)				
Single	3(15.8)	17 (53.1)	<b>.019<sup>c</sup></b>	
Married	6(84.2)	15 (46.9)		
Years in practice, median (min-max)	7(1-21)	.984		
Monthly working (h)	Total, median (min-max)	230(150-390)	240(150-264)	.266
	Heavy workload (>200 h), n(%)	12(30.8)	27(69.2)	.101
	<200 h, n(%)	7(58.3)	5(41.7)	
Change in cigarette smoking (packs/day), mean $\pm$ SD, median (min-max)	0(-1-1)	0(-1-2)	.746	
Change in alcohol consumption per week, median (min-max)	0(-2-1)	0(-1-1)	.906	
Change in sleep duration per day, median (min-max)	-2(-3-0)	-1(-3-0)	.752	
Change in lab parameters, median(min-max)				
Hemoglobin (g/dL)	0.1(-2-2.6)	-0.2(-2-4.1)	.254	
WBC ( $\times 10^9/L$ )	-0.2(-4.9-5.6)	-0.5(-88.3-2.1)	.726	
Neutrophil (cells/mm <sup>3</sup> )	-0.1(-4.9-5.4)	-0.2(-4.8-3.5)	.915	
Lymphocyte (cells/ $\mu$ L)	0.7(-1.7-1.4)	-1(-1.2-1.4)	.380	
Platelet cells/mm <sup>3</sup>	-2(-85-120)	-13(-136-197)	.212	
Ferritin (ng/mL)	-2.4(-47-50.1)	-1.2(-166.1-288.4)	.899	
Vit B12 (pg/mL)	-25(-186-262)	-56.5(-371-293)	.198	
Vit D (ng/mL)	-.1(-28.2-21.8)	-8.6(-39.7-18.5)	.350	
TSH (mIU/L)	0(-2.2-2.9)	-0.2(-2.2-2.6)	.396	

Abbreviations: WBC, white blood cell; Vit, vitamin; TSH, thyroid stimulating hormone.

<sup>a</sup>Mann-Whitney U test, <sup>b</sup>Fisher Exact test, <sup>c</sup>Yates Continuity Correction.

levels were positively correlated with SIS scores ( $r=0.381$ ,  $P=.006$ ) (Table 6).

## Discussion

Representing the period of COVID-19 pandemic from January to April 2021, our findings revealed the presence of poor sleep

quality, anxiety, depression and emotional exhaustion in a considerable portion of ICU HCWs. In addition, when compared to pre-pandemic values, a decrease in sleep duration, WBC counts, Vit B12 and Vit D levels along with an increase in daily cigarette consumption were noted in ICU HCWs, particularly in those with heavy workload (working  $\geq 200$  h/month). Overall, 62.7% of participant had been infected with

**Table 4.** Cigarette and Alcohol Consumption, Sleep Duration and Laboratory Variables According to Heavy Workload.

	Heavy workload during pandemic		P value
	No (n = 12)	Yes (n = 39)	
Change in cigarette smoking (packs/day), mean $\pm$ SD, median (min-max)	-0.3 $\pm$ 0.7, 0(-1-1)	0.4 $\pm$ 0.6, 0(-1-2)	<b>.001</b>
Change in alcohol consumption per week, median (min-max)	0(0-1)	0(-2-1)	.841
Change in sleep duration per day, median (min-max)	-0.5(-2-0)	-1.0(-3-0)	<b>.020</b>
Change in lab parameters, median(min-max)			
Hemoglobin (g/dL)	0.8(-0.9-2)	-0.2(-3-4.1)	<b>.035</b>
WBC ( $\times 10^9/L$ )	-0.2(-4.3-1.3)	-0.4(-88.3-5.6)	.919
Neutrophil (cells/mm <sup>3</sup> )	-0.2(-4.9-1.8)	-0.1(-4.9-5.4)	.617
Lymphocyte (cells/ $\mu$ L)	0.3(-0.6-1.4)	-0.1(-1.7-1.4)	.142
Platelet cells/mm <sup>3</sup>	6(-25-120)	-13(-136-197)	.110
Ferritin (ng/mL)	2.4(-26-89.2)	-2.4(-166.1-288.4)	.665
Vit B12 (pg/mL)	60(-48-293)	-65(-371-262)	<b>&lt;.001</b>
Vit D (ng/mL)	-1.6(-13.1-20)	-9.7(-39.7-21.8)	<b>.004</b>
TSH (mIU/L)	-0.6(-2.2-0.4)	-0.1(-2-2.9)	.142

Abbreviations: WBC, white blood cell; Vit, vitamin; TSH, thyroid stimulating hormone.  
Mann-Whitney U test.

**Table 5.** Sociodemographic Variables According to Current Mental Health Status.

	Current mental status								
	Anxiety (HADS-A)			Depression (HADS-D)			Eating disorder (EAT-40)		
	No	Yes	P <sup>a</sup>	No	Yes	P	No	Yes	P <sup>a</sup>
Age (year), median (min-max)	33(20-48)	31(21-50)	.671	33(20-48)	31(21-50)	.671	33(20-50)	25.5(21-44)	.117
Gender, n(%)									
Female	22(80)	20(76.9)	.465 <sup>b</sup>	21(84)	21(80.8)	1.00 <sup>b</sup>	33(80.5)	9(90)	.667 <sup>b</sup>
Male	3(12)	6(23.1)		4(16)	5(19.2)		8(19.5)	1(10)	
Marital status n(%)									
Single	9(36)	11(42.3)	.862 <sup>c</sup>	9(36)	11(42.3)	.862 <sup>b</sup>	16(39)	4(40)	1.00 <sup>b</sup>
Married	16(64)	15(57.7)		16(64)	15(57.7)		25(61)	6(60)	
Years in practice, median (min-max)	8(1-25)	4.5(1-21)	.214	8(1-25)	4.5(1-21)	.297	7(1-25)	3.5(1-21)	.201
Working hours per month, median (min-max)	240(150-264)	264(150-390)	<b>.003</b>	240(150-264)	264(150-390)	<b>.037</b>	240(150-264)	264(150-390)	.263
Change in cigarette smoking (packs/day), mean $\pm$ SD, median (min-max)	-0.04 $\pm$ 0.6, 0(-1-1)	0.5 $\pm$ 0.6, 1(-1-2)	<b>.003</b>	0(-1-2)	0(-1-1)	.146	0.1 $\pm$ 0.7, 0(-1-2)	0.02 $\pm$ 0.5, 0(-2-1)	<b>.013</b>
Change in alcohol consumption per week, median (min-max)	1(-1-2)	0(-2-1)	.723	0(-1-1)	0(-2-1)	.680	1(0-1)	0(0-1)	.748
Change in sleep duration per day, median (min-max)	-1(-3-0)	-1(-3-0)	.708	-1(-3-0)	-1(-3-0)	.643	-1(-3-0)	-1(-3-0)	.862

Abbreviations: HADS, hospital anxiety-depression scale; EAT-40, eating attitudes test.

<sup>a</sup>Mann Whitney u test, <sup>b</sup>Fisher Exact test, <sup>c</sup>Yates Continuity Correction.

COVID-19 and no significant difference was noted between those with versus without history of COVID-19 positivity in terms of demographics, years in practice, monthly working hours or changes in sleep duration, smoking or laboratory parameters during the pandemic.

In a meta-analysis of 66 studies with 221 970 participants regarding the prevalence of mental health problems during the COVID-19 pandemic in different populations, the overall pooled prevalence of depression, anxiety, distress, and insomnia was reported to be 31.4%, 31.9%, 41.1% and 37.9%,

**Table 6.** Correlation Between Change in Laboratory Parameters and Mental Health Scale Scores.

Laboratory parameters		HADS-A	HADS-D	EAT-40	PSQI	SIS	MBI		
							Emotional exhaustion	Depersonalization	Personal achievement
Hemoglobin									.011
	<i>P</i>	<b>&lt;.001</b>	.121	.057	.14	<b>.011</b>	<b>.007</b>	<b>.002</b>	.937
WBC	<i>r</i>	0.125	0.108	-0.22	-0.021	0.057	0.015	0.098	0.036
	<i>P</i>	.385	.455	.125	.886	.694	.917	.498	.804
Neutrophil	<i>r</i>	0.088	0.200	-0.02	0.027	0.246	0.180	-0.044	0.167
	<i>P</i>	.541	.159	.889	.85	.082	.206	.761	.241
Lymphocyte	<i>r</i>	-0.137	-0.153	-0.134	-0.143	-0.092	-0.252	-0.002	0.013
	<i>P</i>	.337	.285	.350	.317	.522	.074	.990	.929
Platelet	<i>r</i>	0.056	0.107	0.096	-0.292	-0.221	-0.075	-0.001	-0.066
	<i>P</i>	.699	.456	.505	<b>.037</b>	.12	.599	.994	.644
Ferritin	<i>r</i>	-0.211	-0.182	-0.001	0.194	-0.228	-0.133	-0.125	0.097
	<i>P</i>	.137	.201	.993	.172	.107	.352	.383	.497
Vit B12	<i>r</i>	-0.23	-0.169	-0.115	0.180	-0.242	-0.058	-0.184	0.191
	<i>P</i>	.104	.235	.422	.206	.088	.685	.195	.179
Vit D	<i>r</i>	-0.161	-0.056	0.001	0.114	0.381	0.049	-0.091	0.074
	<i>P</i>	.258	.698	.995	.425	<b>.006</b>	.734	.524	.605
TSH	<i>r</i>	0.250	0.023	0.095	0.001	-0.094	-0.159	0.101	0.075
	<i>P</i>	.077	.873	.506	.993	.514	.265	.480	.603

Abbreviations: HADS, hospital anxiety-depression scale; PSQI, pittsburgh sleep quality index; EAT-40, eating attitudes test; SIS, suicidal ideation scale (SIS); MBI, Maslach burnout inventory; WBC, white blood cell; Vit, vitamin; TSH, thyroid stimulating hormone. Spearman correlation analysis, *r*: correlation coefficient.

respectively.<sup>21</sup> The authors also noted the higher risk of depression and anxiety in noninfectious chronic disease patients, quarantined persons, and COVID-19 patients, lower risk of distress in general population and non-medical staff and higher prevalence of insomnia in physicians, nurses, and non-medical staff than other populations.<sup>21</sup>

Our findings related to presence of anxiety or depression in half of ICU HCWs and poor sleep quality in as high as 96.1% are in line with data from other studies indicated that physicians and nurses as front-line medical personnel experienced significant mental health problems in association with COVID-19, particularly the sleep disturbances<sup>4,21-23</sup> with eventual development of depression, anxiety, and work-related problems.<sup>23,24</sup>

At the very beginning of COVID-19 pandemic, in a study by Lai et al. among 1257 HCWs in China, depression, anxiety, insomnia and distress were reported in 50.4%, 44.6%, 34.0% and 75.0% of HCWs, respectively.<sup>3</sup> In a systematic review and meta-analysis of later studies (*n* = 13) in China among a total of 33 062 HCWs, the pooled prevalence of anxiety, depression and insomnia was concluded to be 23.2%, 22.8% and 38.9%, respectively, along with higher rates of affective symptoms in female versus male HCWs and in nurses versus medical staff.<sup>8</sup>

In a past study by Greenberg et al on the rates of probable mental health disorder in ICU HCWs (*n* = 709, 41% doctors, 49% nurses) in nine English hospitals during June and July 2020, substantial rates of probable mental health disorders was reported in 45% of participants (particularly among nurses), including severe depression (6%), PTSD (40%), thoughts of self-harm (13%), severe anxiety (11%) or problem drinking (7%).<sup>4</sup>

Notably, in a past study by Sahin et al on the prevalence of depression, anxiety, distress, and insomnia and related factors in 939 HCWs (61.8% physicians, 60.6% frontline HCWs) during April to May 2020 in Turkey, authors reported the prevalence of depression, anxiety, insomnia, and distress symptoms among the HCWs in the study were 77.6%, 60.2%, 50.4%, and 76.4%, respectively.<sup>6</sup> The authors also emphasized that HCWs serving in Turkey during the COVID-19 pandemic experienced high levels of depression, anxiety, insomnia, and distress symptoms<sup>6</sup> with rates being higher than those reported by similar studies conducted in other countries.<sup>3,25,26</sup> In addition, they also reported that female gender, being a nurse, working on the front line, history of psychiatric illness, and being tested for COVID-19 were identified as risk factors for increased likelihood of mental health problems among HCWs.<sup>6</sup>

In a past study among 1139 HCWs conducted by Alshekaili et al. in April 2020 in Oman, the rates for depression, anxiety, stress and insomnia were 32.3%, 34.1%, 23.8% and 18.5%, respectively, while HCWs in the frontline group were reported to be 1.5 times more likely to report anxiety (OR = 1.557), stress (OR = 1.506) and insomnia (OR = 1.586) as compared with those in the non-frontline group.<sup>9</sup> The authors suggest that frontline and non-frontline HCWs are disproportionately affected and thus mental healthcare should first be directed to frontline HCWs.<sup>15</sup> Other studies also reported more severe depression, higher rate of anxiety and distress symptoms, poor sleep quality and higher burnout among nurses, females, and front-line HCWs including emergency, ICU and isolation wards.<sup>3,8,22,27</sup>

Accordingly, the high rates for anxiety and depression and poor sleep quality reported by ICU HCWs in the current study,

despite being conducted at a later phase (January to April 2021) of pandemic, seem to be related to the fact that the current study was composed entirely of ICU HCWs, while females and nurses comprised the majority of our study population, and 62.7% of participants had history of COVID-19 positivity.

Although no significant differences were noted in mental health status or history of COVID-19 positivity according to gender or occupational subgroups in the current study, the maintenance of high rates for mental health issues among ICU HCWs during a later phase of pandemic seems to emphasize lack of sufficient provision of psychological support. Notably, data from 245 HCWs in Turkey in 2021 revealed the prevalence of depression, anxiety, and stress symptoms among the HCWs to be 12.7%, 9.40%, and 6.1% and authors considered the low rates to be associated with the fact that the psychological support units were activated at the very beginning of the pandemic in their hospital.<sup>5</sup>

The increased likelihood of experiencing mental health difficulties (ie anxiety, depression, insomnia) by ICU nurses than doctors or other ICU staff has been suggested to be associated with the fact that nurses are mostly female and thus to probably reflect the already established gender gap for anxious and depressive symptoms.<sup>4,8,28</sup> However, besides being vulnerable to mental ill-health by virtue of demographic risk factors, nursing profession itself is also considered likely to be associated with increased risk of suffering poor mental health and burnout during pandemic, given a greater risk of exposure to COVID-19 patients due to closer contact with risky patients, providing direct care to patients along with nurses' workloads and night shifts.<sup>4,6,8,29,30</sup> Likewise, in a past study by Barrett et al authors reported that HCWs have a significantly higher risk of SARS-CoV-2 infection than the general population, with most of the infected healthcare workers being nurses.<sup>31</sup> In a systematic review and meta-analysis of 97 studies, the estimated prevalence of SARS-CoV-2 infection from HCWs' samples, using reverse transcription-polymerase chain reaction and the presence of antibodies, was 11% and 7%, respectively, while the most frequently affected personnel were nurses (48%).<sup>32</sup>

In a past study with 85 ICU nurses during COVID 19 pandemic, the main psychological problems were reported to be the decreased appetite or indigestion (59%), fatigue (55%), difficulty sleeping (45%), nervousness (28%), frequent crying (26%), and even suicidal thoughts (2%).<sup>33</sup> The authors also considered the likelihood of decline in immunity and increased risk of COVID-19 infection when these problems are not solved effectively.<sup>33</sup>

This seems notable given that in addition to high rates of mental health issues, previous history for COVID 19 positivity was evident in as much as 62.7% of our study population. Notably, high rates of infection among HCWs and reports of deaths among colleagues itself is considered to have an adverse mental impact on HCWs as associated with a high level of perceived stress, PTSD, depression, and insomnia symptoms.<sup>6,26</sup> Moreover, experiencing stigma towards COVID-19 positivity in the workplace has also been considered to increase

the risk of psychopathology, particularly among HCWs resulting in an increased risk of burnout, psychological distress, emotional exhaustion, anxiety and depressive symptoms.<sup>23</sup>

Given that heavy workload was associated with higher rate of anxiety, depression, shortened sleep duration besides the laboratory abnormalities and increased amount of daily smoking, our findings support the significant impact of work environment and work-related behaviors on mental health and psychological well-being and the likelihood of adverse effects of pandemic on work-life to modify the mental health outcomes of HCWs.<sup>18</sup> Similarly, the increased workload was reported to be an independent risk factor of anxiety and depression among HCWs.<sup>34</sup>

In addition, heavy workload was associated with greater reduction in Vit B12 and Vit D levels from pre-pandemic to pandemic period in the current study, while a significant correlation was noted between reduction in Vit D levels and increased risk of suicidal ideation in our ICU HCWs. These findings seem also notable given that low vitamin D levels and low Vit B12 levels are considered among the potential risk factors for more severe COVID-19<sup>35-38</sup> and Vit D deficiency was significantly associated with the risk of suicidal ideation in healthy adults.<sup>39</sup>

Accordingly, support for HCWs in the ICU through immediate interventions such as provision of timely and appropriately tailored mental health support, resilience training programs, mindfulness and team-building exercises, limitation of shift hours, reduction of working time and validation and evaluation of the contribution of frontline healthcare personnel are essential to reduce perceived stress and to prevent the exhausted physical or mental status, enabling better performance and well-being of HCWs.<sup>7,8,23,27,34,40</sup>

Certain limitations to this study should be considered. First, potential lack of generalizability is an important limitation due to single-centre study design with relatively small sample size. Second, mental health problems were evaluated by self-reported psychometric instruments rather than through a psychiatric interview. Third, lack of data on previous psychiatric illness history or the type of psychiatric support received by HCWs is another limitation of the study.

## Conclusions

In conclusion, our findings indicate high prevalence of mental health issues including anxiety and depression as well as poor sleep quality and emotional burnout among ICU HCWs, particularly those with heavy workload. Our findings emphasize the critical role of screening and monitoring for mental health status among ICU HCWs and to provide timely adequate support to enhance resilience and to prevent long-term adverse impacts of current pandemic in mental well-being of the ICU HCW population who are particularly vulnerable to pandemic stress and thus to sustain a properly functioning ICU staff with ability to deliver high-quality patient care under pandemic conditions.

## Declaration of Conflicting Interests

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## Ethical Approval

Written informed consent was obtained from each subject following a detailed explanation of the objectives and protocol of the study which was conducted in accordance with the ethical principles stated in the "Declaration of Helsinki" and approved by the Recep Tayyip Erdogan University Faculty of Medicine Non-interventional Clinical Research Ethics Committee (Date of approval: 17/08/2021, Reference number / Protocol no:E-40465587-050.01.04-169).

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## References

1. Leira-Sanmartín M, Madoz-Gúrpide A, Ochoa-Mangado E, Ibáñez Á. Psychological impact of COVID-19 pandemic and related variables: a cross-sectional study in a sample of workers in a Spanish tertiary hospital. *Int J Environ Res Public Health*. 2021;18(7):3608.
2. Chew NWS, Lee GKH, Tan BYQ, et al. A multinational, multi-centre study on the psychological outcomes and associated physical symptoms amongst healthcare workers during COVID-19 outbreak. *Brain Behav Immun*. 2020;88:559-565.
3. Lai J, Ma S, Wang Y, et al. Factors associated with mental health outcomes among health care workers exposed to coronavirus disease 2019. *JAMA Network Open*. 2020;3(3):e203976.
4. Greenberg N, Weston D, Hall C, Caulfield T, Williamson V, Fong K. Mental health of staff working in intensive care during COVID-19. *Occup Med (Lond)*. 2021;71(2):62-67.
5. Yasmin S, Alam MK, Ali FB, et al. Psychological impact of COVID-19 among people from the banking sector in Bangladesh: a cross-sectional study. *Int J Ment Health Addict*. 2021:1-15. doi:10.1007/s11469-020-00456-0
6. Şahin MK, Aker S, Şahin G, Karabekiroğlu A. Prevalence of depression, anxiety, distress and insomnia and related factors in healthcare workers during COVID-19 pandemic in Turkey. *J Community Health*. 2020;45(6):1168-1177.
7. Akgün KM, Collett D, Feder SL, Shamas T, Schulman-Green D. Sustaining frontline ICU healthcare workers during the COVID-19 pandemic and beyond. *Heart Lung*. 2020;49(4):346-347.
8. 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;88:901-907.
9. Alshekaili M, Hassan W, Al Said N, et al. Factors associated with mental health outcomes across healthcare settings in Oman during COVID-19: frontline versus non-frontline healthcare workers. *BMJ Open*. 2020;10(10):e042030.
10. Salmon G, Morehead A. Posttraumatic stress syndrome and implications for practice in critical care nurses. *Crit Care Nurs Clin North Am*. 2019;31(4):517-526.
11. Zigmond AS, Snaith RP. The hospital anxiety and depression scale. *Acta Psychiatr Scand*. 1983;67(6):361-370.
12. Aydemir O. Validity and reliability of Turkish version of hospital anxiety and depression scale. *Turk J Psychiatry*. 1997;8(4):280-287.
13. Levine S, Ancill RJ, Roberts AP. Assessment of suicide risk by computer-delivered self-rating questionnaire: preliminary findings. *Acta Psychiatr Scand*. 1989;80(3):216-220.
14. Dilbaz N, Holat H, Bayam G, et al. Validity and reliability of suicide ideation scale. In: *Scientific Studies Book of 31st Turkish National Congress of Psychiatry* TPD Press; 1995: 40-41.
15. Maslach C, Jackson SE. The measurement of experienced burnout. *J Organ Behav*. 1981;2(2):99-113.
16. Ergin C. Adaptation of Maslach Burnout Inventory in physicians and nurses. In: Bayraktar R, Dağ I eds. *National Psychology Congress Scientific Studies*. Vol VII. Ankara: Meteksan Publishing; 1993:143-160. [Turkish].
17. Garner DM, Garfinkel PE. The eating attitudes test: an index of the symptoms of anorexia nervosa. *Psychol Med*. 1979;9(2):273-279.
18. Savasir I, Erol N. Anorexia nervosa symptom index. *Psikoloji Dergisi*. 1989;7:19-25. [Turkish].
19. Buysse DJ, Reynolds CF3rd, Monk TH, Berman SR, Kupfer DJ. The pittsburgh sleep quality index: a new instrument for psychiatric practice and research. *Psychiatry Res*. 1989;28:193-213.
20. Agargun MY, Kara H, Anlar O. Reliability and validity of Turkish version of pittsburgh sleep quality index. *Turk Psikiyatri Derg*. 1996;7:107-115.
21. Wu T, Jia X, Shi H, et al. Prevalence of mental health problems during the COVID-19 pandemic: a systematic review and meta-analysis. *J Affect Disord*. 2021;281:91-98.
22. Lu W, Wang H, Lin Y, Li L. Psychological status of medical workforce during the COVID-19 pandemic: a cross-sectional study. *Psychiatry Res*. 2020;288:112936.
23. Giorgi G, Lecca LI, Alessio F, et al. COVID-19-related mental health effects in the workplace: a narrative review. *Int J Environ Res Public Health*. 2020;17:7857.
24. Horsch A, Lalor J, Downe S. Moral and mental health challenges faced by maternity staff during the COVID-19 pandemic. *Psychol Trauma*. 2020;12(S1):S141-S142.
25. Tian T, Meng F, Pan W, et al. Mental health burden of frontline health professionals treating imported patients with COVID-19 in China during the pandemic. *Psychol Med*. 2020:1-2. doi:10.1017/S0033291720002093
26. 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 Network Open*. 2020;3(5):e2010185.
27. Lin YY, Pan YA, Hsieh YL, et al. COVID-19 pandemic is associated with an adverse impact on burnout and mood disorder in healthcare professionals. *Int J Environ Res Public Health*. 2021;18(7):3654.
28. Albert PR. Why is depression more prevalent in women? *J Psychiatry Neurosci*. 2015;40(4):219-221.
29. Liu CY, Yang YZ, Zhang XM, et al. The prevalence and influencing factors in anxiety in medical workers fighting COVID-19 in China: a cross-sectional survey. *Epidemiol Infect*. 2020; 148:e98.
30. Zhang C, Yang L, Liu S, et al. Survey of insomnia and related social psychological factors among medical staff involved in the 2019 novel coronavirus disease outbreak. *Front Psychiatry*. 2020;11:306.



31. Barrett ES, Horton DB, Roy J, et al. Jr. Prevalence of SARS-CoV-2 infection in previously undiagnosed health care workers in New Jersey, at the onset of the U.S. COVID-19 pandemic. *BMC Infect Dis.* 2020;20(1):853.
32. Gómez-Ochoa SA, Franco OH, Rojas LZ, et al. COVID-19 in health-care workers: a living systematic review and meta-analysis of prevalence, risk factors, clinical characteristics, and outcomes. *Am J Epidemiol.* 2021;190(1):161-175.
33. Shen X, Zou X, Zhong X, Yan J, Li L. Psychological stress of ICU nurses in the time of COVID-19. *Crit Care.* 2020;24(1):200.
34. Chen J, Liu X, Wang D, et al. Risk factors for depression and anxiety in healthcare workers deployed during the COVID-19 outbreak in China. *Soc Psychiatry Psychiatr Epidemiol.* 2021;56(1):47-55.
35. Richardson DP, Lovegrove JA. Nutritional status of micronutrients as a possible and modifiable risk factor for COVID-19: a UK perspective. *Br J Nutr.* 2021;125(6):678-684.
36. Damayanthi HDWT, Prabani KIP. Nutritional determinants and COVID-19 outcomes of older patients with COVID-19: a systematic review. *Arch Gerontol Geriatr.* 2021;95:104411.
37. Tan CW, Ho LP, Kalimuddin S, et al. Cohort study to evaluate the effect of vitamin D, magnesium, and vitamin B12 in combination on progression to severe outcomes in older patients with coronavirus (COVID-19). *Nutrition.* 2020;79-80:111017.
38. Galmés S, Serra F, Palou A. Current state of evidence: influence of nutritional and nutrigenetic factors on immunity in the COVID-19 pandemic framework. *Nutrients.* 2020;12(9):2738.
39. Kim SY, Jeon SW, Lim WJ, et al. Vitamin D deficiency and suicidal ideation: a cross-sectional study of 157,211 healthy adults. *J Psychosom Res.* 2020;134:110125.
40. Bao Y, Sun Y, Meng S, Shi J, Lu L. 2019-nCoV Epidemic: address mental health care to empower society. *Lancet* 2020;395(10224):e37-e38.