



Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.



Stress, anxiety, depression and burnout in frontline healthcare workers during two peaks of COVID-19 pandemic in Russia

Ekaterina Mosolova^a, Dmitry Sosin^b, Sergey Mosolov^{b,c,*}

^a Faculty of Basic Medicine, Lomonosov Moscow State University, Moscow, Russian Federation

^b Department of Psychiatry, Russian Medical Academy of Continuous Professional Education, Ministry of Public Health of Russian Federation, Moscow, Russian Federation

^c Moscow Research Institute of Psychiatry, Moscow, Russian Federation

ARTICLE INFO

Keywords:

Stress
Anxiety
Depression
Suicide
Burnout
Healthcare workers
COVID-19

ABSTRACT

Purpose: In this study we aimed to assess the range of psychopathological symptoms (anxiety, stress, depression, burnout) and risk factors in frontline HCWs during spring and autumn outbreaks of the new coronavirus infection in Russian Federation.

Methods: We conducted two independent, cross-sectional hospital-based online surveys. Data of 2195 HCWs were collected between May 19th and May 26th 2020 and between October 10th and October 17th 2020. Stress, anxiety, depression, burnout and perceived stress were assessed using the Russian versions of SAVE-9 and GAD-7, PHQ-9, MBI and PSS-10 scales. Logistic regression analysis was performed to determine the influence of different variables.

Results: The study revealed the rates of anxiety, stress, depression, emotional exhaustion and depersonalization and perceived stress as 32.3%, 31.1%, 45.5%, 74.2%, 37.7%, 67.8%, respectively. Moreover, 2.4% of HCWs reported suicidal thoughts. The rate of anxiety was higher in October 2020 compared with May 2020. Revealed risk factors included: female gender, younger age, being a physician, working for over a week, living outside of Moscow or Saint Petersburg, being vaccinated against COVID-19.

Conclusion: These results demonstrate the need for urgent supportive programs for HCWs fighting COVID-19 that fall into higher risk factors groups and its increasing importance over time.

1. Introduction

A large group of HCWs was involved in the treatment of patients with the novel SARS-COV-2 virus worldwide. Recent World Psychiatric Association report states that HCWs, working long hours in life-threatening conditions, often without appropriate protective equipment, may develop anxiety, depression, posttraumatic stress disorder (PTSD), insomnia, and excessive irritability and anger. The paper also states that these HCWs feel it is important to engage psychiatrists to provide self-help techniques, offer group or individual support or treatments for distressed colleagues and their families (Stewart and Appelbaum, 2020).

The levels of depression, stress, anxiety and burnout are at disturbing levels in many parts of the world. Some studies report the level of moderate and severe depression and anxiety according to Patient Health Questionnaire-9 (PHQ-9) and General Anxiety Disorder-7 (GAD-7) scales as 44.80% (Naser et al., 2020) and 33.14%, respectively.

Moreover, many studies assessed and reported high levels of stress (Gilleen et al., 2020; Lai et al., 2020; Luceño-Moreno et al., 2020; Wang et al., 2020c; Wanigasooriya et al., 2021; Zhang et al., 2020a; Zhu et al., 2020) and burnout (Barello et al., 2020; Duarte et al., 2020; Luceño-Moreno et al., 2020) among HCWs worldwide.

Despite cultural and organizational differences, many risk factors are similar worldwide. Risk groups that previously displayed higher level of stress and affective symptoms include: frontline HCWs (Alshekaili et al., 2020; An et al., 2020; Dai et al., 2020; Duarte et al., 2020; Gilleen et al., 2020; Haravuori et al., 2020; Johnson et al., 2020; Lai et al., 2020; Lu et al., 2020; Que et al., 2020; Rossi et al., 2020; Wang et al., 2020c; Wanigasooriya et al., 2021; Zhan et al., 2020), women (Alonso et al., 2020; Azoulay et al., 2020; Barello et al., 2020; Duarte et al., 2020; Gilleen et al., 2020; Lai et al., 2020; Luceño-Moreno et al., 2020; Naser et al., 2020; Wang et al., 2020c; Wanigasooriya et al., 2021; Zhang et al., 2020b; Zhu et al., 2020), nurses (Alenazi et al., 2020; Alonso et al., 2020;

* Corresponding author at: Sergey Mosolov, Moscow Research Institute of Psychiatry, 3 Poteshnaya ul., 107076 Moscow, Russia.

E-mail address: profmosolov@mail.ru (S. Mosolov).

<https://doi.org/10.1016/j.psychres.2021.114226>

Received 24 April 2021; Received in revised form 20 September 2021; Accepted 25 September 2021

Available online 29 September 2021

0165-1781/© 2021 Elsevier B.V. All rights reserved.

Azoulay et al., 2020; Barello et al., 2020; Gilleen et al., 2020; Han et al., 2019; Lai et al., 2020; Song et al., 2020; Zhan et al., 2020), younger age participants (Alonso et al., 2020; Han et al., 2020; Liu et al., 2021; Luceño-Moreno et al., 2020; Naser et al., 2020; Wanigasooriya et al., 2021), HCWs with chronic illness (Alenazi et al., 2020; Duarte et al., 2020; Wanigasooriya et al., 2021; Zhang et al., 2020b; Zhu et al., 2020) or mental disorders (Alonso et al., 2020; Gilleen et al., 2020; Wanigasooriya et al., 2021), respiratory therapists (Alenazi et al., 2020; Lu et al., 2020; Naser et al., 2020; Que et al., 2020), intensive care unit (Lu et al., 2020; Wanigasooriya et al., 2021) and emergency department workers, those with kids (Alonso et al., 2020; Duarte et al., 2020; Han et al., 2020), or elderly relatives (Alenazi et al., 2020; Han et al., 2020; Luceño-Moreno et al., 2020), or relatives with chronic illness (Dai et al., 2020; Gilleen et al., 2020; Luceño-Moreno et al., 2020; Zhu et al., 2020), those working outside of big cities (Gilleen et al., 2020; Zhang et al., 2020b).

Potentially controllable risk factors included: smoking (Alenazi et al., 2020; An et al., 2020; Wanigasooriya et al., 2021), alcohol abuse (Que et al., 2020), lack of physical activity (Luceño-Moreno et al., 2020), significant working demands (Gilleen et al., 2020; Mohd Fauzi et al., 2020; Song et al., 2020), lack of personal protective equipment (Gilleen et al., 2020; Wang et al., 2020c), insufficient training for protection (Luceño-Moreno et al., 2020; Wang et al., 2020c), low income (Duarte et al., 2020; Luceño-Moreno et al., 2020; Naser et al., 2020), lack of social and psychological support (Liu et al., 2020; Song et al., 2020; Wanigasooriya et al., 2021), isolation from families (Alonso et al., 2020; Dai et al., 2020; Liu et al., 2020; Luceño-Moreno et al., 2020; Mohd Fauzi et al., 2020), low experience (Mohd Fauzi et al., 2020; Song et al., 2020; Wang et al., 2020a).

However, due to the differences in assessment tools, cut-off scores, and percentage of frontline HCWs in different studies, it is difficult to compare results across countries, especially as it relates to stress and burnout. We did not find studies that reported rates of suicidal thoughts and/or behavior among HCWs. Moreover, today, there are only a few studies that compare HCW's mental health between the first and second waves of COVID-19 (Liu et al., 2020; Sasaki et al., 2020; Spiller et al., 2020), and its results were contradictory. However some studies reported that longer duration of frontline work correlates with higher levels of stress (Wang et al., 2020b).

Moreover, only a few studies assessed the state of mental health in HCWs in Russia (Bachilo et al., 2020; Petrikov et al., 2020) where the HCWs mortality is among the highest in the world (Lifshits and Neklyudova, 2020).

Most existing studies use such common tools as Patient Health Questionnaire-9 (PHQ-9), Generalized Anxiety Disorder Assessment-7 (GAD-7) and Perceived Stress Scale-10 (PSS-10) to assess depression, anxiety and perceived stress symptoms during the COVID-19 pandemic. However, stress and anxiety during the pandemic may present with quiet specific features, for example, with fear of getting infected and stress due to major life changes such as separation from families. Thus, it is necessary to use more precise and sensitive questionnaires such as Stress and Anxiety to Viral Epidemics Scale-9 (SAVE-9) that has shown its good diagnostic accuracy for the evaluation of stress and anxiety among HCWs during COVID-19 pandemic not only in Russia (Mosolova et al., 2021) but also in several other countries (Chung et al., 2020; Lee et al., 2021; Okajima et al., 2021).

Therefore, we undertook a study to assess the range of psychopathological symptoms (anxiety, stress, depression, burnout) and risk factors in frontline HCWs during spring and autumn outbreaks of the new coronavirus infection in Russian Federation.

2. Methods

2.1. Study population and survey design

We conducted two independent, cross-sectional hospital-based

online surveys. Data were collected between May 19th and May 26th 2020 – sample 1, (S1) and between October 10th and October 17th 2020 - sample (S2). Participants answered online questionnaire spread through social networks. The surveys were anonymous, and confidentiality of information was assured. The study and the form of the survey were approved by the Local Ethical Committee of Moscow Research Institute of Psychiatry, waiving a written participation consent. Most participants worked in the hospitals treating patients with COVID-19 in Moscow.

2.2. Psychopathological symptoms assessment

Both questionnaires investigated stress and anxiety symptoms. These were assessed using the validated Russian version of Stress and Anxiety to Viral Epidemic Scale (SAVE-9) (Chung et al., 2020) and the Russian version of General Anxiety Disorder-7 scale (GAD-7) (Spitzer et al., 2006). We also collected information on age, gender, occupation and the duration of work with patients diagnosed with COVID-19. The total score of anxiety using GAD-7 was interpreted as: normal (0–4), mild (5–9), moderate (10–14), and severe (15–21) anxiety (Spitzer et al., 2006). The cut-off score for the Russian version of SAVE-9 was taken as 18 (Mosolova et al., 2021).

The second survey collected additional information about the place of residence, duration of work with COVID-19, health history of COVID-19, participation in the vaccine study for COVID-19. We also measured symptoms of depression using Patient Health Questionnaire (PHQ-9) (Kroenke et al., 2001). The total score of depression was interpreted as: minimal (0–4), mild (5–9), moderate (10–14), moderately severe (15–19), severe (20–27) (Kroenke et al., 2001). We used single items measures of emotional exhaustion (MBI-EE) and depersonalization (MBI-D) derived from Maslach Burnout Inventory (MBI) scale to assess burnout (West et al., 2009). We also used Perceived Stress Scale-10 (PSS-10) to access perceived stress (Cohen et al., 1983). The total score was interpreted as: low stress (0–13), moderate stress (14–26) and high stress (27–40).

2.3. Statistical analysis

Data analysis was performed using SPSS statistical software version 21.0 (IBM Corp., Armonk, NY). Given that all data were not normally distributed according to Kolmogorov-Smirnov test ($p < 0.05$), they were presented as medians with interquartile ranges (IQRs). Sample characteristics and median levels of symptoms were compared using χ^2 test for categorical and Mann-Whitney U test for dependent variables. A multivariable logistic regression model was used in order to explore the association between the level of depression (≥ 10 by PHQ-9), anxiety (≥ 10 by GAD-7), stress (≥ 18 by SAVE-9), perceived stress (≥ 14 by PSS-10), depersonalization (≥ 3 by MBI-D), emotional exhaustion (≥ 3 by MBI-EE) and between age, gender, occupation, the duration of work with COVID -19, place of residence, vaccination and positive test for COVID in the second survey. Spearman rank correlation was used to measure the degree of association scales total score. The chosen significance level for all tests was set as $\alpha = 0.05$.

3. Results

3.1. Demographics

S1 and S2 included 1090 and 1105 participants, respectively. Demographic characteristics and differences in stress and anxiety symptoms between S1 and S2 are outlined in Table 1. S1 and S2 samples did not differ by gender. However, S2 included significantly more physicians ($p < 0.001$) and HCWs in older age group ($p = 0.009$). During the first wave mean duration of work was 35.01 ± 11.22 days. The level of anxiety among the participants of the second study was higher relative to levels of participants in the first study according to GAD-7 score

Table 1
Comparison of demographics characteristics between S1 and S2 groups.

Parameter	Total (n = 2 195)	S1 (n = 1 090)	S2 (n = 1 105)	p
Physicians	1316 [60.0%]	548 [50.3%]	941[85.1%]	<0.001*
Nurses	474 [21.6%]	542[49.7%]	164[14.9%]	
Female	1482 [67.5%]	740 [67.9%]	742 [67.1%]	0.711
Male	713 [32.5%]	350 [32.1%]	363 [32.9%]	
Age	Median (IQR)	Median (IQR)	Median (IQR)	P
	34 (18)	33 (19)	34 (17)	0.009*
Symptom assessment				
GAD-7	Median (IQR)	Median (IQR)	Median (IQR)	P
	6 (9)	5 (9)	7 (9)	<0.001*
Normal	864 [39.4%]	503 [46.1%]	361 [32.7%]	
Mild	648 [29.5%]	309 [28.4%]	339 [30.7%]	
Moderate	364 [16.6%]	144 [13.2%]	220 [19.9%]	
Severe	319 [14.5%]	134[12.3%]	185 [16.7%]	
SAVE-9	Median (IQR)	Median (IQR)	Median (IQR)	P
	15 (9)	14 (9)	15 (10)	0.051

GAD-7: general anxiety disorder-7 scale, IQR: interquartile range, SAVE-9: Stress and Anxiety to Viral Epidemic scale, S1: Sample 1, S2: sample 2, *- $P < 0.05$.

($p < 0.001$), but both samples had equal severity of stress and anxiety symptoms according to SAVE-9 score. The SAVE-9 total score significantly correlated with GAD-7 total score ($\rho = 0.565$, $p < 0.001$).

Additional characteristics assessed in the second survey are presented in [table 2](#). Most participants (455 [41.2%]) worked with patients diagnosed with coronavirus disease for over 6 months. 316 [28.6%] have tested positive for COVID-19. Only 23 [2.1%] HCWs participated in the vaccine study for COVID-19. SAVE-9, GAD-7, PHQ-9 and PSS-10 scores did not differ significantly for HCWs who were involved in the

Table 2
Demographic characteristics of the participants from S2.

Parameter	S2 total
The duration of work with COVID-19	
< 1 week	31 [2.8%]
1 week – 1 month	90 [8.1%]
1 – 3 months	183 [16.6%]
4 – 6 months	346 [31.3%]
>6 months	455 [41.2%]
Have you been tested positive for COVID-19?	
Yes	316 [28.6%]
No	789 [71.4%]
Have you been vaccinated against COVID-19?	
Yes	23 [2.1%]
No	1082 [97.9%]
MBI	
	Median (IQR)
	7 (4)
Depersonalization	
	3 (3)
Low (0–1)	315 [28.5%]
Moderate (2–3)	374 [33.8%]
High (4–6)	416 [37.7%]
Emotional exhaustion	
	5 (3)
Low (0–1)	60 [5.4%]
Moderate (2–3)	218 [19.7%]
High (4–6)	827 [74.9%]
PHQ-9	
	Median (IQR)
	9 (10)
Minimal (0–4)	278 [25.2%]
Mild (5–9)	323 [29.2%]
Moderate (10–14)	250 [22.6%]
Moderate Severe (15–19)	159 [14.4%]
Severe (20–27)	95 [8.6%]
PSS-10	
	Median (IQR)
	17 (11)
Low stress (0–13)	355 [32.2%]
Moderate stress (14–26)	628 [56.8%]
High stress (27–40)	122 [11.0%]

IQR: interquartile range, MBI: The Maslach Burnout Inventory, PHQ-9: Patient Health Questionnaire, PSS-10: perceived stress scale-10, S2: sample 2, *- $P < 0.05$.

1st and 2nd wave (worked for over 6 months) and for those who worked less than 6 months as well for those who have been tested positively for COVID-19 and for those who have not.

According to the MBI, 416 [37.7%] HCWs have become more callous toward people since they took this job (depersonalization), 827 [74.9%] feel burned out from their work (emotional exhaustion). We compared demographic characteristics between groups with high (4–6) and low (<4) emotional exhaustion. Those with high emotional exhaustion differed by gender, residence location, and duration of work with COVID-19: were women ($p < 0.001$), lived outside of Moscow or Saint Petersburg ($p < 0.001$), worked for less than 6 months ($p < 0.001$). HCWs with high emotional exhaustion also had significantly higher scores across all scales.

Moderate or severe depression symptoms were registered in 504 [45.5%] HCWs, according to PHQ-9. The PHQ-9 score significantly correlated with SAVE-9 score ($\rho = 0.476$, $p < 0.001$). Moderate or high perceived stress was reported by 750 [67.8%] HCWs according to PPS-10 scale. PSS-10 score significantly correlated with SAVE-9 score ($\rho = 0.506$, $p < 0.001$).

Vaccinated participants had significantly lower anxiety level ($p = 0.031$).

3.2. The frequency of symptoms

The frequency of participants' answers from S1 and S2 on each SAVE-9 scale question are presented in [Table 3](#). During the second wave HCWs worried more that the virus outbreak would continue indefinitely, felt more skeptical about their job after going through this experience, more frequently thought that they would avoid treating patients with viral illnesses, and more frequently thought that their colleagues would have more work to do due to their absence from a possible quarantine and might blame them. However, S2 participants worried less that others might avoid them even after the infection risk has been minimized. 62.3% of HCWs have been often or always worrying that family or friends may become infected because of them, 34.7% have been more sensitive towards minor physical symptoms, 32.8% have been thinking that their colleagues might blame them, 29.6% have been worried about getting infection.

The frequency of participants' answers on each GAD-7 scale question are presented in [Table 4](#). The frequency of all symptoms assessed with GAD-7 were significantly higher during the second wave. The most common symptoms included: have been feeling nervous, anxious, or on edge (40.8% more than half the days or nearly every day), have had trouble relaxing (36.5%) have been easily annoyed or irritable (31.4%).

According to MBI scale 32.5% of participants every day felt burned out from their work (emotional burnout) and 9.7% became more callous toward people (depersonalization) [Table 5](#).

According to PHQ-9 scale most participants felt tired or had little energy (31.0%), had little interest or pleasure in doing things (22.0%), had trouble falling or staying asleep, or sleeping too much (21.4%). 2.4% of participants had suicidal thoughts that they would be better off dead, or of hurting themselves ([Table 6](#)).

The most common symptoms according to PSS-10 scale included: fairly or very often felt nervous and "stressed" (50.9%), fairly or very often have been angered because of things that were outside of their control (29.9%), fairly or very often have been upset because of something that happened unexpectedly (25.9%) ([Table 7](#)).

All the symptoms assessed with GAD-7, PHQ-9, PSS-10 and MBI scales were higher in HCWs with high stress according to SAVE-9 cut-off score.

3.3. Logistic regression analysis

All multivariate logistic regression models were reliable ((-2Log likelihood ratio from 559.98 to 1109, 92, $p < 0.001$). Groups with low stress, anxiety, depression and perceived stress symptoms were used as

Table 3

The frequency of S1 and S2 participants' answers on each SAVE-9 scale question.

SAVE-9	Never	Rarely	Sometimes	Often	Always	p
Are you afraid the virus outbreak will continue indefinitely?						
S1. No. (%)	444 (40.7)	232 (21.3)	301(27.6)	79(7.2)	34(3.1)	<0.001*
S2. No. (%)	315 (28.5)	186 (16.8)	378 (34.2)	141(12.8)	85(7.7)	
Total. No. (%)	759(34.6)	418(19.0)	679(30.9)	220(10.0)	119(5.4)	
Are you afraid your health will worsen because of the virus?						
S1. No. (%)	180 (16.5)	263 (24.1)	412 (37.8)	154(14.1)	81(7.4)	0.435
S2. No. (%)	192 (17.4)	239 (21.6)	405 (36.7)	177(16.0)	92 (8.3)	
Total. No. (%)	372(16.9)	502(22.9)	817(37.2)	331(15.1)	173(7.9)	
Are you worried that you might get infected?						
S1. No. (%)	133(12.2)	264(24.2)	357(32.8)	217(19.9)	119(10.9)	0.062
S2. No. (%)	174 (15.7)	276 (25.0)	341 (30.9)	185 (16.7)	129 (11.7)	
Total. No. (%)	307(14.0)	540 (24.6)	698(31.8)	402(18.3)	248(11.3)	
Are you more sensitive towards minor physical symptoms than usual?						
S1. No. (%)	139(12.8)	249(22.8)	315(28.9)	250(22.9)	137(12.6)	0.332
S2. No. (%)	159 (14.4)	281 (25.4)	292 (26.4)	234(21.2)	139(12.6)	
Total. No. (%)	298(13.6)	530(24.1)	607(27.7)	484(22.1)	276(12.6)	
Are you worried that others might avoid you even after the infection risk has been minimized?						
S1. No. (%)	414(38.0)	198(18.2)	243(22.3)	158(14.5)	77(7.1)	<0.001*
S2. No. (%)	479 (43.3)	235 (21.3)	231 (20.9)	102(9.2)	58(5.2)	
Total. No. (%)	893(40.7)	433(19.7)	474(21.6)	260(11.8)	135(6.2)	
Do you feel skeptical about your job after going through this experience?						
S1. No. (%)	471(43.2)	172(15.8)	235(21.6)	140(12.8)	72(6.6)	<0.001*
S2. No. (%)	365 (33.0)	168(15.2)	284(25.7)	184(16.7)	104(9.4)	
Total. No. (%)	836(38.1)	340(15.5)	519(23.6)	324(14.8)	176(8.0)	
After this experience. do you think you will avoid treating patients with viral illnesses?						
S1. No. (%)	741(68.0)	159(14.6)	107(9.8)	54(5.0)	29(2.7)	0.009*
S2. No. (%)	669(60.5)	195(17.6)	140(12.7)	67(6.1)	34(3.1)	
Total. No. (%)	1410(64.2)	354(16.1)	247(11.3)	121(5.5)	63(2.9)	
Do you worry your family or friends may become infected because of you?						
S1. No. (%)	57(5.2)	95(8.7)	231(21.2)	320(29.4)	387(35.5)	0.162
S2. No. (%)	69(6.2)	114 (10.3)	261(23.6)	288(26.1)	373(33.8)	
Total. No. (%)	126(5.7)	209(9.5)	492(22.4)	608(27.7)	760(34.6)	
Do you think that your colleagues would have more work to do due to your absence from a possible quarantine and might blame you?						
S1. No. (%)	337(30.9)	185(17.0)	249(22.8)	174(16.0)	145(13.3)	<0.001*
S2. No. (%)	334(31.1)	124(11.2)	236(21.4)	228(20.6)	172(15.7)	
Total. No. (%)	681(31.0)	309(14.1)	485 (22.1)	402(18.3)	318(14.5)	

SAVE-9- Stress and Anxiety to Viral Epidemic scale, S1 – Sample 1, S2 – sample 2, *- $P < 0.05$.

the reference categories in all models.

According to results in May 2020 ($N = 1090$) female gender ($p < 0.001$), younger age ($p < 0.001$), being a physician (compared with nurses) ($p < 0.001$) was associated with higher anxiety, and only female gender with higher SAVE-9 score ($p = 0.001$) (Table 8).

According to results of both surveys ($N = 2195$) women were associated with higher anxiety level ($p < 0.001$) according to GAD-7 scale. Younger age was associated with higher level of stress ($p = 0.026$) and anxiety ($p < 0.001$) (Table 9).

The results of regression analysis for S2 ($N = 1105$) are presented in appendix 1. HAS group was associated with female gender ($p = 0.008$), living outside of Moscow ($p = 0.001$) or Saint Petersburg ($p = 0.003$) compared with other cities.

Moderate or severe anxiety was associated with female gender ($p < 0.001$), younger age ($p = 0.001$), living outside of Moscow ($p = 0.003$) or Saint Petersburg ($p = 0.036$), working for over 1 week ($p = 0.002$), the absence of vaccination against COVID-19 ($p = 0.022$).

The level of depression symptoms was higher in women ($p < 0.001$), those living outside of Moscow ($p = 0.001$) or Saint Petersburg ($p = 0.022$), working for over 1 week ($p = 0.032$), those without vaccination against COVID-19 ($p = 0.044$).

Depersonalization was associated with younger age ($p < 0.001$) and living outside of Moscow ($p < 0.001$). HCWs who have been working with

patients with COVID-19 for 1–3 ($p = 0.002$) and 4–6 months ($p = 0.047$) showed lower depersonalization.

Emotional exhaustion was associated with female gender ($p = 0.001$) and living outside of Moscow ($p < 0.001$). Working for less than 1 week ($p < 0.001$), 1–3 ($p < 0.001$) and 4–6 months ($p = 0.013$) - with lower emotional exhaustion.

High level of perceived stress according to PSS-10 scale was associated with female gender ($p < 0.001$), being a physician ($p = 0.042$), living outside of Saint-Petersburg ($p = 0.004$) and the absence of vaccination ($p = 0.010$).

4. Discussion

This study revealed that a substantial proportion of HCWs working during the COVID-19 pandemic in Russia have mental health problems that have exacerbated since the first wave in the spring. High level of stress by SAVE-9 and moderate or severe anxiety by GAD-7 were registered in 32.3% and 31.1% HCWs, respectively. The level of anxiety in Russia was higher when compared with other countries (Lai et al., 2020; Lu et al., 2020; Wanigasooriya et al., 2021; Zhu et al., 2020). This at least partially can be explained by higher contamination and mortality rates among HCWs in Russia (Lifshits and Neklyudova, 2020). Another possible reason is that all participants were directly involved in

Table 4
The frequency of S1 and S2 participants' answers on each GAD-7 scale question.

GAD-7					
How often have you been bothered by feeling nervous, anxious, or on edge over the past 2 weeks?					
	Not at all	Several days	More than half the days	Nearly every day	p
S1. No. (%)	335 (30.7)	408(37.4)	131(12.1)	216(19.8)	<0.001*
S2. No. (%)	176 (15.9)	381 (34.5)	216 (19.5)	332 (30.0)	
Total. No. (%)	511 (23.3)	789(35.9)	347(15.8)	548(25.0)	
How often have you been bothered by not being able to stop or control worrying over the past 2 weeks?					
S1. No. (%)	608 (55.8)	312(28.6)	83(7.6)	87(8)	<0.001*
S2. No. (%)	448 (40.5)	412(37.3)	124(11.2)	121(11.0)	
Total. No. (%)	1056 (48.1)	724 (33.0)	207(9.4)	208 (9.5)	
How often have you been bothered by worrying too much about different things over the past 2 weeks?					
S1. No. (%)	407 (37.3)	422(38.7)	130(11.9)	131(12.1)	<0.001*
S2. No. (%)	289 (26.2)	465(42.1)	165(14.9)	186(16.8)	
Total. No. (%)	696 (31.7)	887 (40.4)	295(13.4)	317(14.4)	
How often have you been bothered by trouble relaxing over the past 2 weeks?					
S1. No. (%)	405 (37.2)	341(31.3)	154(14.1)	190(17.4)	<0.001*
S2. No. (%)	271 (24.5)	375(33.9)	185(16.7)	274(24.8)	
Total. No. (%)	676 (30.8)	716 (32.6)	339(15.4)	464 (21.1)	
How often have you been bothered by being so restless that it's hard to sit still over the past 2 weeks?					
S1. No. (%)	657 (60.3)	288(26.4)	82(7.5)	63(5.8)	<0.001*
S2. No. (%)	556 (50.3)	329(29.8)	126(11.4)	94(8.5)	
Total. No. (%)	1213 (55.3)	617 (28.1)	208 (9.5)	157 (7.2)	
How often have you been bothered by becoming easily annoyed or irritable over the past 2 weeks?					
S1. No. (%)	398 (36.5)	418(38.4)	128(11.7)	146(13.4)	<0.001*
S2. No. (%)	249 (22.5)	441(39.9)	209(18.9)	206(18.6)	
Total. No. (%)	647 (29.5)	859(39.1)	337(15.4)	352(16.0)	
How often have you been bothered by feeling afraid as if something awful might happen over the past 2 weeks?					
S1. No. (%)	579 (53.1)	351(32.2)	66(6.1)	94(8.6)	<0.001*
S2. No. (%)	526 (47.6)	357(32.3)	121(11.0)	101(9.1)	
Total. No. (%)	1105 (50.3)	708(32.3)	187(8.5)	195(8.9)	

GAD-7: general anxiety disorder-7 scale, S1: Sample 1, S2: sample 2, * - $P < 0.05$.

treating patients with COVID-19 and worked as frontline personnel. However, mean total score of SAVE-9 in our sample was lower than in some other studies (Chung et al., 2020; Tavormina et al., 2020).

All studies consistently reported the main symptom of the fear that family or a friend may become infected because of the HCWs (Tavormina et al., 2020). Therefore, providing HCWs with appropriate PPE and training them how to use it to stay safe is essential. Another potential solution could be providing an opportunity for HCWs to live separately from family and friends to protect them from infecting others. It is important to note, however, that previous studies reported that living alone was associated with higher levels of stress and anxiety (Liu et al., 2020).

The level of anxiety among the participants of the second study was higher when compared to the level of anxiety of participants from the first study according to GAD-7 mean score. Some studies confirm that duration of work with COVID-19 was associated with higher stress levels (Wang et al., 2020c). Similarly, American Nurses Foundation performed surveys in spring and October 2020 and revealed that feelings of exhaustion, being overwhelmed, anxious, and irritable all intensified since the spring (Cipriano et al., 2020). Other studies reported lower levels of anxiety in May compared to those in April in Switzerland (Spiller et al., 2020) as well as in China in March compared to January (Liu et al., 2012). The results of our study may be different given that our survey dates correspond to the peak of two outbreaks of COVID-19 in Russia, while dates of other mentioned studies correspond to the first outbreak and the subsequent decline in incidence of COVID-19 cases and deaths after the initial peak. Some previous studies reported higher levels of anxiety and stress in those who have less working experience (Wang et al., 2020c). Therefore, the effect of the duration of work with COVID-19 on mental health of HCWs needs further investigation.

During the second wave HCWs worried more that the virus outbreak would continue indefinitely, felt more skeptical about their job after going through this experience, more frequently thought that they would avoid treating patients with viral illnesses, and more frequently thought that their colleagues would have more work to do due to their absence from a possible quarantine and might blame them. Indirectly these data could be the evidence of depressive ideas of guilt. However, during the second wave participants worried less that others might avoid them even after the contamination risk has been minimized that can be associated with lower stigmatization of HCWs.

There were significant differences in all items of GAD-7 between S1 and S2, but not in SAVE-9 scale, that may be explained by the focus of SAVE-9 scale on the specific aspects related to the pandemic, when commonly used scales such as GAD-7 assess general symptoms of anxiety. These findings may also be addressed during the development of supportive measures by focusing on the attitude of HCWs to their job and patients and on strengthening and building trusting relationships between employees of the hospital.

The main finding of the second survey was that 74.2% of participants felt burned out from their work. Almost half of the respondents (45.5%) had moderate or severe depression symptoms according to PHQ-9. Most participants had asthenic complaints (feeling tired or having little energy), anhedonia (little interest or pleasure in doing things), and insomnia (trouble falling or staying asleep). The level of moderate or severe depression symptoms in our sample was higher relative to other studies (Azoulay et al., 2020; Lai et al., 2020; Naser et al., 2020; Zhan et al., 2020; Zhu et al., 2020). Moreover 2.4% of participants had thoughts that they would be better off dead, or of hurting themselves, which reflects a higher potential risk of suicide. Our study shows the importance of assessing the risk of suicide in HCWs perhaps with using more specific and valid scales like C-SSRS (Posner, 2007) or SAD PERSONS (Juhnke and Hovestadt, 1995). Two thirds of participants (67.8%) had moderate or high perceived stress according to PPS-10 scale that was also higher relative to other studies. (Liu et al., 2021). The most common symptoms included: feeling nervous and "stressed", have been angered because of things outside of their control, have been upset

Table 5
The frequency of S2 participants' answers on each MBI single-item.

MBI	Frequency						
	Never	A few times a year	Once a month or less	A few times a month	Once a week	A few times a week	Every day
I feel burned out from my work							
Total. No. (%)	12(1.1)	48(4.3)	58(5.2)	160 (14.5)	242 (21.9)	226 (20.5)	359(32.5)
I have become more callous toward people since I took this job							
Total. No. (%)	185(16.7)	130(11.8)	141(12.8)	233(21.1)	189(17.1)	120(10.9)	107(9.7)

Footnote. MBI: The Maslach Burnout Inventory, *- P<0.05.

Table 6
The frequency of S2 participants' answers on each item of PHQ-9 scale.

PHQ-9	Frequency			
	Never	Rarely	Sometimes	Often
Little interest or pleasure in doing things				
Total. No. (%)	251 (22.7)	387 (35.0)	224 (20.3)	243 (22.0)
Feeling down, depressed, or hopeless				
Total. No. (%)	278 (25.2)	448 (40.5)	223 (20.2)	156 (14.1)
Trouble falling or staying asleep, or sleeping too much				
Total. No. (%)	287 (26.0)	350 (31.7)	231 (20.9)	237 (21.4)
Feeling tired or having little energy				
Total. No. (%)	83 (7.5)	405 (36.7)	275 (24.9)	342(31.0)
Poor appetite or overeating				
Total. No. (%)	402(36.4)	322 (29.1)	181 (16.4)	200(18.1)
Feeling bad about yourself or that you are a failure or have let yourself or your family down				
Total. No. (%)	617 (55.8)	259 (23.4)	119 (10.8)	110(10.0)
Trouble concentrating on things, such as reading the newspaper or watching television				
Total. No. (%)	471 (42.6)	322(29.1)	143(12.9)	169(15.3)
Moving or speaking so slowly that other people could have noticed, or the opposite being so fidgety or restless that you have been moving around a lot more than usual				
Total. No. (%)	650(58.8)	279(25.2)	105(9.5)	70(6.3)
Thoughts that you would be better off dead, or of hurting yourself				
Total. No. (%)	946(85.6)	102(9.2)	30(2.7)	27(2.4)

PHQ-9: Patient Health Questionnaire-9, S1: Sample 1, S2: sample 2, *- P<0.05.

because of something that happened unexpectedly.

The most significant risk factors in our study were female gender, being a physician, younger age, working outside of Moscow or Saint Petersburg, working for over 6 months, the absence of vaccination against COVID-19.

In discussing possible risk factors of psychological problems in frontline HCWs we should note that women had higher levels of stress and anxiety according to both surveys. This result corresponds to other studies (Alonso et al., 2020; Azoulay et al., 2020; Barello et al., 2020; Duarte et al., 2020; Gilleen et al., 2020; Lai et al., 2020; Luceño-Moreno et al., 2020; Naser et al., 2020; Wang et al., 2020c; Wanigasooriya et al., 2021; Zhang et al., 2020b; Zhu et al., 2020) and female gender seems to be the main risk factor. It is also known that depression, anxiety disorders, PTSD and burnout are more common in women (Albert, 2015; Zender and Olshansky, 2009).

Similarly, most studies from other countries report that younger age was associated with higher levels of psychopathological symptoms (Alonso et al., 2020; Han et al., 2020; Liu et al., 2021; Luceño-Moreno et al., 2020; Naser et al., 2020; Wanigasooriya et al., 2021). These results can be explained by lower experience of younger age HCWs, especially in such stressful situations.

In our study physicians reported higher level of anxiety and perceived stress. Interestingly, most other studies reported that nurses were more vulnerable to stress, anxiety and depression compared to

Table 7
The frequency of S2 participants' answers on each PSS-10 scale.

PSS-10	Frequency				
	Never	Almost never	Sometimes	Fairly often	Very often
In the last month, how often have you been upset because of something that happened unexpectedly?					
Total. No. (%)	177 (16.0)	241 (21.8)	400 (36.2)	208 (18.8)	79(7.1)
In the last month, how often have you felt that you were unable to control the important things in your life?					
Total. No. (%)	260 (23.5)	268 (24.3)	325 (29.4)	173 (15.7)	79(7.1)
In the last month, how often have you felt nervous and "stressed"?					
Total. No. (%)	74 (6.7)	129 (11.7)	342 (31.0)	327 (29.6)	233 (21.1)
In the last month, how often have you felt confident about your ability to handle your personal problems?					
Total. No. (%)	45(4.1)	82 (7.4)	343(31.0)	410 (37.1)	225 (20.4)
In the last month, how often have you felt that things were going your way?					
Total. No. (%)	71 (6.4)	198 (17.9)	407 (36.8)	313(28.3)	116 (10.5)
In the last month, how often have you found that you could not cope with all the things that you had to do?					
Total. No. (%)	152 (13.8)	265 (24.0)	416 (37.6)	193(17.5)	79(7.1)
In the last month, how often have you been able to control irritations in your life?					
Total. No. (%)	49 (4.4)	107(9.7)	355(32.1)	394(35.7)	200 (18.1)
In the last month, how often have you felt that you were on top of things?					
Total. No. (%)	22(2.0)	84(7.6)	359(32.5)	453(41.0)	187 (16.9)
In the last month, how often have you been angered because of things that were outside of your control?					
Total. No. (%)	114 (10.3)	226(20.5)	435(39.4)	246(22.3)	84(7.6)
In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?					
Total. No. (%)	278 (25.2)	264 (23.9)	320 (29.0)	159 (14.4)	84 (7.6)

PSS-10: Perceived Stress Scale-10, S1: Sample 1, S2: sample 2, *- P<0.05.

physicians (Alenazi et al., 2020; Alonso et al., 2020; Azoulay et al., 2020; Barello et al., 2020; Gilleen et al., 2020; Han et al., 2019; Lai et al., 2020;

Table 8

Influence of gender, age, position in participants lows stress and anxiety levels in May (S1).

Categories	SAVE-9			GAD-7		
	p	OR	95% CI	p	OR	95% CI
Male (vs. Female)	0.001*	0.710	0.581–0.866	<0.001*	0.481	0.390–0.594
Age	0.077	0.992	0.984–1.001	<0.001*	0.974	0.965–0.983
Physicians (vs. nurses)	0.727	1.035	0.852–1.259	<0.001*	1.526	1.244–1.872

CI: confidence interval, GAD-7: General Anxiety Disorder-7 scale, OR: odds ratio, SAVE-9: Stress and Anxiety to viral epidemics scale-9.

Table 9

Influence of gender, age, position in participants with low stress and anxiety level (total sample – S1+S2).

Categories	SAVE-9			GAD-7		
	p	OR	95% CI	p	OR	95% CI
Male (vs. Female)	0.134	0.800	0.597–1.071	<0.001*	0.477	0.344–0.662
Age	0.026*	0.987	0.975–0.998	<0.001*	0.967	0.,954–0.980
Physicians (vs. nurses)	0.481	0.909	0.696–1.186	0.262	1.177	0.886–1.563

CI: confidence interval, GAD-7: General Anxiety Disorder-7 scale, OR: odds ratio, SAVE-9: Stress and Anxiety to viral epidemics scale-9.

Song et al., 2020; Zhan et al., 2020), explained their direct contact with patients when performing medical manipulations. However, one study reported that physicians had higher level of depression (Wang et al., 2020a). Such results can be associated with higher responsibly that physicians take on when treating new and poorly investigated infectious disease.

Working in Moscow or Saint Petersburg (two major cities of Russian Federation) were associated with lower anxiety level as well as other symptoms among HCWs. This result can be explained by having better working conditions, including sufficient PPE, higher salaries and full personnel strength in big cities compared to others. Mortality rates of HCWs in Russia were higher in cities other than Moscow (Lifshits and Neklyudova, 2020). Some studies from other countries also confirmed that working outside of the capitals was associated with higher levels of stress and anxiety (Gilleen et al., 2020; Luceño-Moreno et al., 2020).

The analysis of risk factors associated with the frequency of psychopathological symptoms showed that working for over 1 week is associated with higher levels of anxiety, depression and emotional burnout in HCWs. This result is consistent with discussed above higher level of anxiety according to GAD-7 in October compared with May. Once again it highlights that there is no adaptation of HCWs over time to extreme working conditions. On the contrary psychopathological symptoms are intensifying and can have more severe consequences. Therefore, the importance of psychological help only increases over time.

Vaccinated participants in our study had significantly lower stress and anxiety levels, even though only 2.1% of participant were vaccinated in October. This finding once again indicates that the main factor contributing to the anxiety level is the fear of getting infected or infecting family and friends.

Therefore, risk groups of HCWs should be defined at early stages of work and provided with additional social and psychological support. Unfortunately, nowadays, many barriers limit the immediate formation of such support programs due to the quarantine policy; however, self-help interventions (Yang et al., 2020), spread of online materials on stress and anxiety reduction, access to psychological assistance hotlines, and involvement in leisure activities among HCWs may be helpful (Chen et al., 2020). Some organizations have already developed strategies to manage healthcare workers' mental health burden (Greenberg et al., 2020; Tomlin et al., 2020). However, the implementation of effective and evidence-based models is needed worldwide.

This study has several limitations. First, the bias related to anonymous online survey could not be excluded; we had to follow this design due to the pandemic, although face-to-face interviews and follow-up of the participants from survey 1 would have been more accurate in assessing the rates of psychopathological symptoms of depression,

anxiety, stress and burnout. Second, the levels of depression and burnout haven't been specifically assessed during the first wave; therefore, it was not possible to compare their rates. Third, the population of S1 and S2 was different - S2 included significantly more physicians and HCWs in older age group.

In conclusion, our study has shown high rates of stress, anxiety, depression and burnout symptoms especially among frontline HCWs in Russia compared with other countries. Female gender, younger age, being a physician, working for over a week, living outside of Moscow or Saint Petersburg and not being vaccinated for COVID-19 were factors associated with higher level of stress, anxiety, depression and burnout in HCWs. It is known that high level of depression may lead to increased suicide rate. Therefore, these results demonstrate the urgent need for supportive programs to the frontline HCWs at risk fighting COVID-19.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial or not-for-profit sectors.

CRediT authorship contribution statement

Ekaterina Mosolova: Software, Data curation, Visualization, Investigation. **Dmitry Sosin:** Software, Data curation, Writing – review & editing. **Sergey Mosolov:** Conceptualization, Methodology, Data curation, Supervision, Writing – review & editing.

Declaration of Competing Interest

We declare no competing interests.

Acknowledgements

This study was not financially supported. We are thankful to all the HCWs in Russian COVID-19 medical centers who voluntarily participated in our online survey.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at [doi:10.1016/j.psychres.2021.114226](https://doi.org/10.1016/j.psychres.2021.114226).

Appendix 1

Categories	MBI-D P	OR	95% CI	MBI-EE P	OR	95% CI	PSS-10 P	OR	95% CI	SAVE-9 P	OR	95% CI	GAD-7 P	OR	95% CI	PHQ-9 P	OR	95% CI
Male (vs. female)				0,001	0,615	0,459–0,824	<0,001	0,498	0,379–0,654	0,008	0,686	0,512–0,908	<0,001	0,519	0,391–0,688	<0,001	0,543	0,415–0,709
Age	<0,001	0,974	0,961–0,986				<0,001	0,972	0,960–0,985				0,001	0,978	0,965–0,991	<0,001	0,971	0,959–0,983
Physicians (vs. nurses)	<0,001	0,580	0,432–0,779	<0,001	0,574	0,422–0,781				0,001	0,544	0,402–0,736	0,003	0,636	0,473–0,856	0,001	0,630	0,475–0,837
City (vs. other): Moscow Saint Petersburg				<0,001	0,159	0,074–0,343	0,004	0,445	0,257–0,771	0,003	0,357	0,181–0,704	0,036	0,521	0,284–0,957	0,022	0,517	0,294–0,911
Duration of work (vs. >6 months):																		
<1 week	0,002	0,552	0,379–0,803	<0,001	0,450	0,302–0,671												
1 – 3 months	0,047	0,742	0,553–0,995	0,013	0,647	0,459–0,913												
4 - 6 months																		
Vaccinated (vs. not vaccinated)							0,010	0,320	0,134–0,765				0,022	0,180	0,041–0,784	0,044	0,350	0,126–0,970

CI: confidence interval, GAD-7: General Anxiety Disorder-7 scale, MBI-D: Maslach Burnout Inventory – Depersonalization, MBI-EE: Maslach Burnout Inventory – Emotional Exhaustion, OR: odds ratio, PHQ-9: Patient Health Questionnaire-9, PSS-10: Perceived Stress Scale-10, SAVE-9: Stress and Anxiety to viral epidemics scale-9.

References

Albert, P., 2015. Why is depression more prevalent in women? *J. Psychiatry Neurosci.* 40, 219–221. <https://doi.org/10.1503/jpn.150205>.

Alenazi, T.H., BinDhim, N.F., Alenazi, M.H., Tamim, H., Almagrabi, R.S., Aljohani, S.M., H Basyouni, M., Almubark, R.A., Althumiri, N.A., Alqahtani, S.A., 2020. Prevalence and predictors of anxiety among healthcare workers in Saudi Arabia during the COVID-19 pandemic. *J. Infect. Public Health* 13, 1645–1651. <https://doi.org/10.1016/j.jiph.2020.09.001>.

Alonso, J., Vilagut, G., Mortier, P., Ferrer, M., Alayo, I., Aragón-Peña, A., Aragonès, E., Campos, M., Cura-González, I.D., Emparanza, J.I., Espuga, M., Forjaz, M.J., González-Pinto, A., Haro, J.M., López-Fresneña, N., Salazar, A.D.M. de, Molina, J.D., Ortí-Lucas, R.M., Parellada, M., Pelayo-Terán, J.M., Pérez-Zapata, A., Pijoan, J.I., Plana, N., Puig, M.T., Rius, C., Rodríguez-Blázquez, C., Sanz, F., Serra, C., Kessler, R. C., Bruffaerts, R., Vieta, E., Pérez-Solà, V., 2020. Mental health impact of the first wave of COVID-19 pandemic on Spanish healthcare workers: a large cross-sectional survey. *Rev. Psiquiatr. Salud Ment.* <https://doi.org/10.1016/j.rpsm.2020.12.001>.

Alshekaili, M., Hassan, W., Al Said, N., Al Sulaimani, F., Jayapal, S.K., Al-Mawali, A., Chan, M.F., Mahadevan, S., Al-Adawi, S., 2020. Factors associated with mental health outcomes across healthcare settings in Oman during COVID-19: frontline versus non-frontline healthcare workers. *BMJ Open* 10, e042030. <https://doi.org/10.1136/bmjopen-2020-042030>.

An, Y., Yang, Y., Wang, A., Li, Y., Zhang, Q., Cheung, T., Ungvari, G.S., Qin, M.-Z., An, F.-R., Xiang, Y.-T., 2020. Prevalence of depression and its impact on quality of life among frontline nurses in emergency departments during the COVID-19 outbreak. *J. Affect. Disord.* 276, 312–315. <https://doi.org/10.1016/j.jad.2020.06.047>.

Azoulay, E., Cariou, A., Bruneel, F., Demoule, A., Kouatchet, A., Reuter, D., Souppart, V., Combes, A., Klouche, K., Argaud, L., Barbier, F., Jourdain, M., Reigner, J., Papazian, L., Guidet, B., Géri, G., Resche-Rigon, M., Guisset, O., Labbé, V., Mégarbane, B., Van Der Meersch, G., Guitton, C., Friedman, P., Pochard, F., Darmon, M., Kentish-Barnes, N., 2020. Symptoms of Anxiety, Depression, and Peritraumatic Dissociation in Critical Care Clinicians Managing Patients with COVID-19. A Cross-Sectional Study. *Am. J. Respir. Crit. Care Med.* 202, 1388–1398. <https://doi.org/10.1164/rccm.202006-25680C>.

Bachilo, E.V., Baryluk, J.B., Shuldyakov, A.A., Efremov, A.A., Novikov, D.E., 2020. Mental health of medical workers during the COVID-19 pandemic in Russia: results of a cross-sectional study. *medRxiv.* <https://doi.org/10.1101/2020.07.27.20162610>.

Barello, S., Palamenghi, L., Graffigna, G., 2020. Burnout and somatic symptoms among frontline healthcare professionals at the peak of the Italian COVID-19 pandemic. *Psychiatry Res* 290, 113129. <https://doi.org/10.1016/j.psychres.2020.113129>.

Chen, Q., Liang, M., Li, Y., Guo, J., Fei, D., Wang, L., He, L., Sheng, C., Cai, Y., Li, X., Wang, J., Zhang, Z., 2020. Mental health care for medical staff in China during the COVID-19 outbreak. *The Lancet Psychiatry* 7, e15–e16. [https://doi.org/10.1016/S2215-0366\(20\)30078-X](https://doi.org/10.1016/S2215-0366(20)30078-X).

Chung, S., Kim, H.J., Ahn, M.H., Yeo, S., Lee, J., Kim, K., Kang, S., Suh, S., 2020. Development of the Stress and Anxiety to Viral Epidemics-9 (SAVE-9) scale for assessing work-related stress and anxiety in healthcare workers in response to COVID-19. *medRxiv Prepr.* Shin, Y.W., 9, 1–18. <https://doi.org/10.31234/osf.io/a52b4>.

Cipriano, P.F., Boston-Leary, K., Mcmillan, K., Peterson, C., 2020. The US COVID-19 crises: facts, science and solidarity. *Int. Nurs. Rev.* 67, 437–444. <https://doi.org/10.1111/inr.12646>.

Cohen, S., Kamarck, T., Mermelstein, R., 1983. A global measure of perceived stress. *J. Health Soc. Behav.* 24, 385–396.

Dai, Y., Hu, G., Xiong, H., Qiu, H., Yuan, X., Yuan, X., Hospital, T., Avenue, J.F., Qiu, H., Hospital, T., 2020. Psychological impact of the coronavirus disease 2019 (COVID-19) outbreak on healthcare workers in China Yuhong. *medRxiv Prepr.* <https://doi.org/10.1101/2020.03.03.20030874>.

Duarte, I., Teixeira, A., Castro, L., Marina, S., Ribeiro, C., Jácome, C., Martins, V., Ribeiro-Vaz, I., Pinheiro, H.C., Silva, A.R., Ricou, M., Sousa, B., Alves, C., Oliveira, A., Silva, P., Nunes, R., Serrão, C., 2020. Burnout among Portuguese healthcare workers during the COVID-19 pandemic. *BMC Public Health* 20, 1885. <https://doi.org/10.1186/s12889-020-09980-z>.

Gilleen, J., Santaolalla, A., Valdearenas, L., Fusté, M., 2020. The Impact of the COVID-19 Pandemic on the Mental Health and Wellbeing of UK Healthcare Workers. *SSRN Electron. J.* 1–24. <https://doi.org/10.2139/ssrn.3638287>.

Greenberg, N., Docherty, M., Gnanapragasam, S., Wessely, S., 2020. Managing mental health challenges faced by healthcare workers during covid-19 pandemic. *BMJ* 368, m1211. <https://doi.org/10.1136/bmj.m1211>.

Han, L., Wong, F.K.Y., She, D.L.M., Li, S.Y., Yang, Y.F., Jiang, M.Y., Ruan, Y., Su, Q., Ma, Y., Chung, L.Y.F., 2020. Anxiety and Depression of Nurses in a North West Province in China During the Period of Novel Coronavirus Pneumonia Outbreak. *J. Nurs. Scholarsh.* 52, 564–573. <https://doi.org/10.1111/jnu.12590>.

Han, S., Shanafelt, T.D., Sinsky, C.A., Awad, K.M., Dyrbye, L.N., Fiscus, L.C., Trockel, M., Goh, J., 2019. Estimating the Attributable Cost of Physician Burnout in the United States. *Ann. Intern. Med.* 170, 784. <https://doi.org/10.7326/M18-1422>.

Haravuori, H., Junntila, K., Haapa, T., Tuisku, K., Kujala, A., Rosenström, T., Suvisaari, J., Pukkala, E., Laukkala, T., Jylhä, P., 2020. Personnel Well-Being in the Helsinki University Hospital during the COVID-19 Pandemic—A Prospective Cohort Study. *Int. J. Environ. Res. Public Health* 17, 7905. <https://doi.org/10.3390/ijerph17217905>.

Johnson, S.U., Ebrahimi, O.V., Hoffart, A., 2020. PTSD symptoms among health workers and public service providers during the COVID-19 outbreak. *PLoS ONE* 15, e0241032. <https://doi.org/10.1371/journal.pone.0241032>.

- Juhnke, G.A., Hovestadt, A.J., 1995. Using the SAD PERSONS Scale to Promote Supervisee Suicide Assessment Knowledge. *Clin. Superv.* 13, 31–40. https://doi.org/10.1300/J001v13n02_03.
- Kronke, K., Spitzer, R.L., Williams, J.B.W., 2001. The PHQ-9: validity of a brief depression severity measure. *J. Gen. Intern. Med.* 16, 606–613. <https://doi.org/10.1046/j.1525-1497.2001.016009606.x>.
- Lai, J., Ma, S., Wang, Y., Cai, Z., Hu, J., Wei, N., Wu, J., Du, H., Chen, T., Li, R., Tan, H., Kang, L., Yao, L., Huang, M., Wang, H., Wang, G., Liu, Z., Hu, S., 2020. Factors Associated With Mental Health Outcomes Among Health Care Workers Exposed to Coronavirus Disease, 2019. *JAMA Netw. Open* 3, e203976. <https://doi.org/10.1001/jamanetworkopen.2020.3976>.
- Lee, J., Lee, H.J., Hong, Y., Shin, Y., Chung, S., Park, J., 2021. Risk Perception, Unhealthy Behavior, and Anxiety Due to Viral Epidemic Among Healthcare Workers: The Relationships With Depressive and Insomnia Symptoms During COVID-19. *Front Psychiatry* 12, 615387. <https://doi.org/10.3389/fpsy.2021.615387>.
- Lifshits, M.L., Neklyudova, N.P., 2020. COVID-19 mortality rate in Russian regions: forecasts and reality. *R-Economy* 6, 171–182. <https://doi.org/10.15826/recon.2020.6.3.015>.
- Liu, X., Kakade, M., Fuller, C.J., Fan, B., Fang, Y., Kong, J., Guan, Z., Wu, P., 2012. Depression after exposure to stressful events: lessons learned from the severe acute respiratory syndrome epidemic. *Compr. Psychiatry* 53, 15–23. <https://doi.org/10.1016/j.comppsy.2011.02.003>.
- Liu, Y., Chen, H., Zhang, N., Wang, X., Fan, Q., Zhang, Y., Huang, L., Hu, B., Li, M., 2021. Anxiety and depression symptoms of medical staff under COVID-19 epidemic in China. *J. Affect. Disord.* 278, 144–148. <https://doi.org/10.1016/j.jad.2020.09.004>.
- Liu, Z., Wu, J., Shi, X., Ma, Y., Ma, Xiao, Teng, Z., You, X., Zhang, Y., Zhang, W., Feng, Z., Long, Q., Ma, Xiaoyun, Wang, L., Zeng, Y., 2020. Mental health status of healthcare workers in China for COVID-19 epidemic. *Ann. Glob. Heal.* 86, 1–8. <https://doi.org/10.5334/aogh.3005>.
- Lu, W., Wang, H., Lin, Y., Li, L., 2020. Psychological status of medical workforce during the COVID-19 pandemic: a cross-sectional study. *Psychiatry Res* 288, 112936. <https://doi.org/10.1016/j.psychres.2020.112936>.
- Luceño-Moreno, L., Talavera-Velasco, B., García-Albuérne, Y., Martín-García, J., 2020. Symptoms of Posttraumatic Stress, Anxiety, Depression, Levels of Resilience and Burnout in Spanish Health Personnel during the COVID-19 Pandemic. *Int. J. Environ. Res. Public Health* 17, 5514. <https://doi.org/10.3390/ijerph17155514>.
- Mohd Fauzi, M.F., Mohd Yusoff, H., Muhamad Robat, R., Mat Saruan, N.A., Ismail, K.I., Mohd Haris, A.F., 2020. Doctors' Mental Health in the Midst of COVID-19 Pandemic: the Roles of Work Demands and Recovery Experiences. *Int. J. Environ. Res. Public Health* 17, 7340. <https://doi.org/10.3390/ijerph17197340>.
- Mosolova, E., Chung, S., Sosin, D., Mosolov, S., 2021. Stress and anxiety among healthcare workers associated with COVID-19 pandemic in Russia. *Psychiatr. Danub.* 32, 549–556. <https://doi.org/10.24869/PSYD.2020.549>.
- Naser, A.Y., Dahmash, E.Z., Al-Rousan, R., Alwafi, H., Alrawashdeh, H.M., Ghoul, I., Abidine, A., Bokhary, M.A., AL-Hadiithi, H.T., Ali, D., Abuthawabeh, R., Abdelwahab, G.M., Alhartani, Y.J., Al Muhaisen, H., Dagash, A., Alyami, H.S., 2020. Mental health status of the general population, healthcare professionals, and university students during 2019 coronavirus disease outbreak in Jordan: a cross-sectional study. *Brain Behav* 10, e00146. <https://doi.org/10.1002/brb3.1730>.
- Okajima, I., Chung, S., Suh, S., 2021. Validation of the Japanese version of Stress and Anxiety to Viral Epidemics-9 (SAVE-9) and relationship among stress, insomnia, anxiety, and depression in healthcare workers exposed to coronavirus disease 2019. *Sleep Med* 84, 397–402. <https://doi.org/10.1016/j.sleep.2021.06.035>.
- Petrikov, S.S., Kholmogorova, A.B., Surogina, A.Yu., Mikita, O.Yu., Roy, A.P., R.A., A., 2020. Professional burnout in specialists and anxiety in the general population during the pandemic. *Couns. Psychology Psychotherapy* 28, 8–45.
- Posner, K., 2007. Columbia Classification Algorithm of Suicide Assessment (C-CASA): classification of Suicidal Events in the FDA's Pediatric Suicidal Risk Analysis of Antidepressants. *Am. J. Psychiatry* 164, 1035. <https://doi.org/10.1176/appi.ajp.164.7.1035>.
- Que, J., Shi, L., Deng, J., Liu, J., Zhang, L., Wu, S., Gong, Y., Huang, W., Yuan, K., Yan, W., Sun, Y., Ran, M., Bao, Y., Lu, L., 2020. Psychological impact of the COVID-19 pandemic on healthcare workers: a cross-sectional study in China. *Gen. Psychiatry* 33, e100259. <https://doi.org/10.1136/gpsych-2020-100259>.
- Rossi, R., Soccì, V., Pacitti, F., Di Lorenzo, G., Di Marco, A., Siracusano, A., Rossi, A., 2020. Mental Health Outcomes Among Frontline and Second-Line Health Care Workers During the Coronavirus Disease 2019 (COVID-19) Pandemic in Italy. *JAMA Netw. open* 3, e2010185. <https://doi.org/10.1001/jamanetworkopen.2020.10185>.
- Sasaki, N., Kuroda, R., Tsuno, K., Kawakami, N., 2020. The deterioration of mental health among healthcare workers during the covid-19 outbreak: a population-based cohort study of workers in japan. *Scand. J. Work. Environ. Heal.* 46, 639–644. <https://doi.org/10.5271/sjweh.3922>.
- Song, X., Fu, W., Liu, X., Luo, Z., Wang, R., Zhou, N., Yan, S., Lv, C., 2020. Mental health status of medical staff in emergency departments during the Coronavirus disease 2019 epidemic in China. *Brain. Behav. Immun.* 88, 60–65. <https://doi.org/10.1016/j.bbi.2020.06.002>.
- Spiller, T.R., Méan, M., Ernst, J., Sazpinar, O., Gehrke, S., Paolercio, F., Petry, H., Pfaltz, M.C., Morina, N., Aebischer, O., Gachoud, D., Von Känel, R., Weilenmann, S., 2020. Development of Health Care Workers' Mental Health during the SARS-CoV-2 Pandemic in Switzerland: two Cross-Sectional Studies. *Psychol. Med* 1–4. <https://doi.org/10.1017/S0033291720003128>.
- Spitzer, R.L., Kroenke, K., Williams, J.B.W., Löwe, B., 2006. A Brief Measure for Assessing Generalized Anxiety Disorder. *Arch. Intern. Med.* 166, 1092. <https://doi.org/10.1001/archinte.166.10.1092>.
- Stewart, D.E., Appelbaum, P.S., 2020. COVID-19 and psychiatrists' responsibilities: a WPA position paper. *World Psychiatry* 19, 406–407. <https://doi.org/10.1002/wps.20803>.
- Tavormina, G., Tavormina, M.G.M., Franza, F., Aldi, G., Amici, P., Amorosi, M., Anzallo, C., Cervone, A., Costa, D., D'Errico, I., De Berardis, D., Di Napoli, W., Elisei, S., Felisio, B., Ferella, G., Harnic, D., Juli, M.R., Lisa, G., Litta, A., Marcasciano, S., Mazza, A., Meloni, E., Mendolicchio, L., Min, M.V., Moretti, P., Perito, M., Russiello, M., Sanna, J.T., Sidari, A., Sinisi, I., Solomita, B., Spurio, M.G., Stranieri, G., Tavormina, R., Vacca, A., Vellante, F., Vitarisi, S., Shin, Y.-W., Chung, S., 2020. A New Rating Scale (SAVE-9) to Demonstrate the Stress and Anxiety in the Healthcare Workers During the COVID-19 Viral Epidemic. *Psychiatr. Danub.* 32, 5–9.
- Tomlin, J., Dalgleish-Warburton, B., Lamph, G., 2020. Psychosocial Support for Healthcare Workers During the COVID-19 Pandemic. *Front. Psychol.* 11, 1–7. <https://doi.org/10.3389/fpsyg.2020.01960>.
- Wang, HuaJun, Huang, D., Huang, H., Zhang, J., Guo, L., Liu, Y., Ma, H., Geng, Q., 2020a. The psychological impact of COVID-19 pandemic on medical staff in Guangdong, China: a cross-sectional study. *Psychol. Med.* 36, 1–9. <https://doi.org/10.1017/S0033291720002561>.
- Wang, Hui, Liu, Y., Hu, K., Zhang, M., Du, M., Huang, H., Yue, X., 2020b. Healthcare workers' stress when caring for COVID-19 patients: an altruistic perspective. *Nurs. Ethics* 27, 1490–1500. <https://doi.org/10.1177/0969733020934146>.
- Wang, Y., Ma, S., Yang, C., Cai, Z., Hu, S., Zhang, B., Tang, S., Bai, H., Guo, X., Wu, J., Du, H., Kang, L., Tan, H., Li, R., Yao, L., Wang, G., Liu, Z., 2020c. Acute psychological effects of Coronavirus Disease 2019 outbreak among healthcare workers in China: a cross-sectional study. *Transl. Psychiatry* 10, 348. <https://doi.org/10.1038/s41398-020-01031-w>.
- Wanigasooriya, K., Palimar, P., Naumann, D.N., Ismail, K., Fellows, J.L., Logan, P., Thompson, C.V., Birmingham, H., Beggs, A.D., Ismail, T., 2021. Mental health symptoms in a cohort of hospital healthcare workers following the first peak of the COVID-19 pandemic in the UK. *BJPsych Open* 7, e24. <https://doi.org/10.1192/bjo.2020.150>.
- West, C.P., Dyrbye, L.N., Sloan, J.A., Shanafelt, T.D., 2009. Single Item Measures of Emotional Exhaustion and Depersonalization Are Useful for Assessing Burnout in Medical Professionals. *J. Gen. Intern. Med.* 24, 1318–1321. <https://doi.org/10.1007/s11606-009-1129-z>.
- Yang, L., Yin, J., Wang, D., Rahman, A., Li, X., 2020. Urgent need to develop evidence-based self-help interventions for mental health of healthcare workers in COVID-19 pandemic. *Psychol. Med.* 7, 1–2. <https://doi.org/10.1017/S0033291720001385>.
- Zender, R., Olshansky, E., 2009. Women's Mental Health: depression and Anxiety. *Nurs. Clin. North Am.* 44, 355–364. <https://doi.org/10.1016/j.cnur.2009.06.002>.
- Zhan, Y., Zhao, S., Yuan, J., Liu, H., Liu, Y., Gui, L., Zheng, H., Zhou, Y., Qiu, L., Chen, J., Yu, J., Li, S., 2020. Prevalence and Influencing Factors on Fatigue of First-line Nurses Combating with COVID-19 in China: a Descriptive Cross-Sectional Study. *Curr. Med. Sci.* 40, 625–635. <https://doi.org/10.1007/s11596-020-2226-9>.
- Zhang, C., Yang, L., Liu, S., Ma, S., Wang, Y., Cai, Z., Du, H., Li, R., Kang, L., Su, M., Zhang, J., Liu, Z., Zhang, B., 2020a. Survey of Insomnia and Related Social Psychological Factors Among Medical Staff Involved in the 2019. Novel Coronavirus Disease Outbreak. *Front. Psychiatry* 11, 1–9. <https://doi.org/10.3389/fpsy.2020.00306>.
- Zhang, W.R., Wang, K., Yin, L., Zhao, W.F., Xue, Q., Peng, M., Min, B.Q., Tian, Q., Leng, H.X., Du, J.L., Chang, H., Yang, Y., Li, W., Shangguan, F.F., Yan, T.Y., Dong, H. Q., Han, Y., Wang, Y.P., Cosci, F., Wang, H.X., 2020b. Mental Health and Psychosocial Problems of Medical Health Workers during the COVID-19 Epidemic in China. *Psychother. Psychosom.* 89, 242–250. <https://doi.org/10.1159/000507639>.
- Zhu, Z., Xu, S., Wang, H., Liu, Z., Wu, J., Li, G., Miao, J., Zhang, C., Yang, Y., Sun, W., Zhu, S., Fan, Y., Chen, Y., Hu, J., Liu, J., Wang, W., 2020. COVID-19 in Wuhan: sociodemographic characteristics and hospital support measures associated with the immediate psychological impact on healthcare workers. *EclinicalMedicine* 24, 100443. <https://doi.org/10.1016/j.eclinm.2020.100443>.