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

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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; Luceno-Moreno et al., 2020; Wang et al., 2020a; Wanigasooriya et al., 2021; Zhang et al., 2020a; Zhu et al., 2020) and burnout (Barello et al., 2020; Duarte et al., 2020; Luceno-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., 2020a; 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; Luceno-Moreno et al., 2020; Naser et al., 2020; Wang et al., 2020a; Wanigasooriya et al., 2021; Zhang et al., 2020b; Zhu et al., 2020), nurses (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; Song et al., 2020; Zhan et al., 2020), younger age participants (Alonso et al., 2020; Han et al., 2020; Liu et al., 2021; Luceno-Moreno et al., 2020; Naser et al., 2020; Wanigasooriya et al., 2021), HCWs with chronic illness (Alenza 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 (Alenza 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 (Alenza et al., 2020; Han et al., 2020; Luceno-Moreno et al., 2020), or relatives with chronic illness (Dai et al., 2020; Gilleen et al., 2020; Luceno-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 (Alenza et al., 2020; An et al., 2020; Wanigasooriya et al., 2021), alcohol abuse (Que et al., 2020), lack of physical activity (Luceno-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 (Luceno-Moreno et al., 2020; Wang et al., 2020c), low income (Duarte et al., 2020; Luceno-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 (Alenza et al., 2020; Dai et al., 2020; Liu et al., 2020; Luceno-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 (10–27) (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 χ² test for categorial 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-E) 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 α = 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 (14)           | 33 (19)        | 24 (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 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 (r = 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 (r = 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%), fairy or very often have been angered because of things that were outside of their control (29.9%), fairy 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
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                    | Not at all | Several days | More than half the days | Nearly every day | P      |
|--------------------------|------------|--------------|-------------------------|------------------|--------|
| How often have you been bothered by feeling nervous, anxious, or on edge over the past 2 weeks? | S1. No. 608 (55.8%) | 312 (28.6%) | 83 (7.6%) | 8 (0.7%) | <0.001* |
|                         | S2. No. 448 (40.5%) | 412 (37.3%) | 124 (11.2%) | 11 (1.0%) |        |
|                         | Total. No. 1056 (70.1%) | 724 (64.1%) | 267 (24.0%) | 20 (1.8%) |        |
| How often have you been bothered by not being able to stop or control worrying over the past 2 weeks? | S1. No. 586 (50.3%) | 422 (38.7%) | 130 (11.9%) | 12 (1.0%) | <0.001* |
|                         | S2. No. 289 (26.2%) | 465 (42.1%) | 165 (14.9%) | 18 (1.6%) |        |
|                         | Total. No. 875 (48.1%) | 607 (53.2%) | 295 (26.4%) | 30 (2.6%) |        |
| How often have you been bothered by being too restless that it’s hard to sit still over the past 2 weeks? | S1. No. 405 (37.2%) | 341 (31.3%) | 154 (14.1%) | 19 (1.7%) | <0.001* |
|                         | S2. No. 271 (24.5%) | 375 (33.9%) | 185 (16.7%) | 27 (2.4%) |        |
|                         | Total. No. 676 (35.7%) | 616 (55.3%) | 339 (30.1%) | 46 (4.2%) |        |
| How often have you been bothered by being too stressed that it’s hard to fall asleep over the past 2 weeks? | S1. No. 657 (60.3%) | 288 (26.4%) | 82 (7.5%) | 5 (0.5%) | <0.001* |
|                         | S2. No. 556 (50.3%) | 329 (29.8%) | 126 (11.4%) | 9 (0.9%) |        |
|                         | Total. No. 1213 (65.6%) | 407 (36.5%) | 208 (18.9%) | 15 (1.3%) |        |
| How often have you been bothered by feeling afraid as if something awful might happen over the past 2 weeks? | S1. No. 593 (53.1%) | 418 (38.4%) | 128 (11.7%) | 14 (1.3%) | <0.001* |
|                         | S2. No. 249 (22.5%) | 441 (39.0%) | 209 (18.9%) | 10 (0.9%) |        |
|                         | Total. No. 842 (45.6%) | 488 (43.2%) | 337 (30.1%) | 15 (1.3%) |        |

GAD-7: general anxiety disorder-7 scale, S1: Sample 1, S2: sample 2, *P<0.05.
In our study physicians reported higher levels of anxiety and perceived stress. Interestingly, most other studies reported that nurses were more vulnerable to stress, anxiety and depression compared to physicians (Alenazi et al., 2020; Alonso et al., 2020; Azoulay et al., 2020; Barello et al., 2020; Duarte et al., 2020; Gilleen et al., 2020; Lai et al., 2020; Luce et al., 2020; Naser et al., 2020; Wang et al., 2020c; Wanigasooriya et al., 2021). These results can be explained by lower experience of younger age HCWs, especially in such stressful situations.

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., 2020; Luce-Noreno 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.

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

| MBI | I feel burned out from my work | A few times a year | Once a month or less | Every day |
|-----|-------------------------------|-------------------|----------------------|-----------|
| Total No. (%) | Never | 12(1.1) | 48(4.3) | 58(5.2) |
| Petersburg, working for over 6 months, the absence of vaccination being a physician, younger age, working outside of Moscow or Saint Petersburg were more vulnerable to stress, anxiety and depression compared to

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

| PHQ-9 | Never | Rarely | Sometimes | Often |
|-------|-------|--------|-----------|-------|
| Feeling down, depressed, or hopeless | 251(22.7) | 387(35.0) | 224(20.3) | 243(22.0) |
| Total No. (%) | Never | 617(55.8) | 259(23.4) | 119(10.8) | 110(10.0) |
| Trouble falling or staying asleep, or sleeping too much | 278(25.2) | 446(40.5) | 223(20.2) | 156(14.1) |
| 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 | 287(26.0) | 350(31.7) | 231(20.9) | 237(21.4) |
| Poor appetite or overeating | 83(7.5) | 405(36.7) | 279(24.9) | 340(31.0) |
| Total No. (%) | Never | 946(85.6) | 102(9.2) | 30(2.7) | 27(2.4) |

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

| PSS-10 | Never | Almost never | Sometimes | Fairly often | Very often |
|--------|-------|--------------|-----------|-------------|-----------|
| In the last month, how often have you been upset because of something that happened unexpectedly? | 177(16.0) | 241(21.8) | 400(36.2) | 208(18.8) |
| Total No. (%) | Never | 26(23.5) | 268(24.3) | 325(29.4) | 173(15.7) |
| In the last month, how often have you felt nervous and ‘stressed’? | 74(6.7) | 129(11.7) | 342(31.0) | 327(29.6) |
| Total No. (%) | Never | 71(6.4) | 198(17.9) | 407(36.8) | 313(28.3) |
| In the last month, how often have you found that you could not cope with all the things that you had to do? | 152(13.8) | 265(24.0) | 416(37.6) | 193(17.5) |
| Total No. (%) | Never | 49(4.4) | 107(9.7) | 355(32.1) | 200(18.1) |
| In the last month, how often have you felt difficulties were piling up so high that you could not overcome them? | 114(10.5) | 226(20.5) | 435(39.4) | 246(22.3) |
| Total No. (%) | Never | 27(2.5) | 264(23.9) | 320(29.0) | 159(14.4) |

Footnote. MBI: The Maslach Burnout Inventory, *-P<0.05.
Effective and evidence-based models is needed worldwide. However, the implementation of e-health could not be excluded; we had to follow this design. Some organizations have already developed strategies to manage healthcare workers (Chen et al., 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).

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.

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### 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.

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### Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.psychres.2021.114226.
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