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Stress, Anxiety, Depression and Burnout in Frontline Healthcare Workers during COVID-19 Pandemic in Russia

Ekaterina Mosolova, Dmitry Sosin and Sergey Mosolov

Abstract

During the COVID-19 pandemic, healthcare workers (HCWs) have been subject to increased workload while also exposed to many psychosocial stressors. Most studies reported high levels of depression and anxiety among HCWs worldwide. Our study is based on two online surveys of 2195 HCWs from different regions of Russia during spring and autumn epidemic outbreaks 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. Revealed risk factors included: female gender, younger age, working for over 6 months, living outside of Moscow or Saint Petersburg, the fear of getting infected or infecting family and friends. These results demonstrate the need for urgent supportive programs for HCWs fighting COVID-19 that fall into higher risk factors groups.

Keywords: stress, anxiety, depression, suicide, burnout, healthcare workers, COVID-19

1. Introduction

A large group pf HCWs was involved in the treatment of patients with the novel SARS-COV-2 virus worldwide. Recently World Psychiatric Association states that HCWs, working long hours in life-threatening conditions, often without appropriate protective equipment, may develop anxiety, depression, post-traumatic 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 [1].

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 44.71% [2], 32.8% [3], respectively. Moreover, many studies assessed and reported high levels of stress and burnout among HCWs worldwide [4–7].

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 workers [8], women [9] nurses [6, 10], younger age [11] and HCWs with chronic illness [7], or mental disorders [12], respiratory therapists [13] intensive care unit workers [13]. Potentially controllable risk factors include: significant working demands [4], lack of personal protective equipment [15], insufficient training for protection [14], low income [2], lack of support [14], isolation from families [3], the fear of relatives getting infected [15].

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 [16, 17], however there is evidence that longer duration of frontline work correlates with higher levels of stress [18]. Moreover, only a few studies assessed the state of mental health in HCWs in Russia [19, 20], where the HCWs mortality is among the highest in the world [21].

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. Materials and methods

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.

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) [22] and the Russian version of GAD-7 [23]. 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 [23]. The cut-off score for the Russian version of SAVE-9 was taken as 18 [24]. HCWs with SAVE-9 score < 18 was considered low stress and anxiety group (LSA), and with ≥18 – high stress and anxiety group (HSA).

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) [25]. The total score of depression was interpreted as: minimal (0–4), mild (5–9), moderate (10–14), moderately severe (15–19), severe (10–27) [25]. We used single items measures of emotional burnout and depersonalization derived from Maslach Burnout Inventory (MBI) scale to assess burnout [26]. We also used Perceived Stress Scale-10 (PSS-10) to access perceived stress [27]. The total score was interpreted as: low stress (0–13), moderate stress (14–26) and high stress (27–40).

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 stress according to SAVE-9 score and age, gender and occupation for both pandemic waves and between the level of stress and age, gender, occupation, the duration of work with COVI D-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. Associations between multiple variables were investigated using network analytic methods [28, 29]. These analyses were conducted in the R statistical environment. 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. LSA group included 1486 HCWs (67.7%), and HAS – 709 (32.2%). Demographic characteristics and differences in stress and anxiety symptoms between S1 and S2 as well as between LSA and HSA groups 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). 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 (<0.001), but both samples had equal severity of stress and anxiety symptoms according to SAVE-9 score. LSA group included significantly more men relative to HSA (p < 0.001). LSA group had significantly lower anxiety level according to GAD-7 scale (p < 0.001). 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 was 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). HCWs from LSA group also had significantly lower MBI total and both items scores, as well as PHQ-9 and PSS-10 scores (p < 0.001).

Parameter	S1 (n = 1 090)	S2 (n = 1 105)	p	LSA (n = 1486)	HSA (n = 709)	p	Total (n = 2 195)
Physicians	548 [50.3%]	941[85.1%]	<0.001*	1012[68.1%]	477[67.3%]	0.699	1316 [60.0%]
Nurses	542[49.7%]	164 [14.9%]		474[31.9%]	232[32.7%]		474 [21.6%]
Female	740 [67.9%]	742 [67.1%]	0.711	516[34.7%]	197[27.8%]	<0.001*	1482 [67.5%]
Male	350 [32.1%]	363 [32.9%]		970[65.3%]	512[72.2%]		713 [32.5%]
Age	Median (IQR)	Median (IQR)	p	Median (IQR)	Median (IQR)	p	Median (IQR)
	33 (19)	34 (17)	0.009*	34(18)	33(17)	0.177	34 (18)
Symptom assesement							
GAD-7	Median (IQR)	Median (IQR)	p	Median (IQR)	Median (IQR)	p	Median (IQR)
	5 (9)	7 (9)	<0.001*	4(7)	10(9)	<0.001*	6 (9)
normal	503 [46.1%]	361 [32.7%]		772[52.0%]	92[13.0%]		864 [39.4%]
mild	309 [28.4%]	339 [30.7%]		438[29.5%]	210 [29.6%]		648 [29.5%]
moderate	144 [13.2%]	220 [19.9%]		171[11.5%]	193[27.3%]		364 [16.6%]
severe	134[12.3%]	185 [16.7%]		105[7.1%]	214 [30.2%]		319 [14.5%]
SAVE-9	Median (IQR)	Median (IQR)	p	Median (IQR)	Median (IQR)	p	Median (IQR)
	14 (9)	15 (10)	0.051	11(7)	21(5)	<0.001*	15 (9)

*Footnote: GAD-7 – general anxiety disorder-7 scale, HSA – high stress and anxiety group, IQR – interquartile range, LSA – low stress and anxiety group, SAVE-9- Stress and Anxiety to Viral Epidemic scale, S1 – Sample 1, S2 – sample 2. *P<0.05.*

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

3.2 The frequency of symptoms

The frequency of participants' answers from S1 and S2 and from HSA and LSA groups 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 partici-pants worried less that others might avoid them even after the infection risk has been minimized. The frequency of all symptoms assessed with SAVE-9 were significantly higher in HSA group. 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 toward minor physical symptoms, 32.8% have been thinking that their colleagues might blame them, 29.6% have been worried about getting infection.

Parameter	LSA (n = 727)	HSA (n = 378)	p	S2 total
The duration of work with COVID-19				
< 1 week	22[3.0%]	9[2.4%]	0.787	31 [2.8%]
1 week – 1 month	59[8.1%]	31[8.2%]		90 [8.1%]
1 – 3 months	116[16.0%]	67[17.7%]		183 [16.6%]
4 - 6 months	235[32.3%]	111[29.4%]		346 [31.3%]
>6 months	295[40.6%]	160[42.3%]		455 [41.2%]
Have you been tested positive for COVID-19?				
Yes	215[29.6%]	101[32.0%]	0.319	316 [28.6%]
No	512[70.4%]	277[73.3%]		789 [71.4%]
Have you been vaccinated against COVID-19?				
Yes	20[2.8%]	3[0.8%]	0.031[*]	23 [2.1%]
No	707[97.2%]	375[99.2%]		1082 [97.9%]
MBI	Median (IQR)	Median (IQR)	p	Median (IQR)
	7(4)	9(3)	<0.001[*]	7 (4)
Depersonalization	3(3)	4(3)	<0.001[*]	3 (3)
Low (0-1)	245[33.7%]	70[18.6%]		315 [28.5%]
Moderate (2-3)	256[35.2%]	118[31.2%]		374 [33.8%]
High (4-6)	226[31.1%]	190[50.2%]		416 [37.7%]
Emotional exhaustion	4(2)	6(2)	<0.001[*]	5 (3)
Low (0-1)	58[8.0%]	2[0.5%]		60 [5.4%]
Moderate (2-3)	179[24.6%]	39[10.4%]		218 [19.7%]
High (4-6)	490[67.4]	337[89.2%]		827 [74.9%]
PHQ-9	Median (IQR)	Median (IQR)	p	Median (IQR)
	7(9)	12(9)	<0.001[*]	9 (10)
Minimal (0-4)	253[34.8%]	35[6.6%]		278 [25.2%]
Mild (5-9)	233[32.0%]	90[23.8%]		323 [29.2%]
Moderate (10-14)	132[18.2%]	118[31.2%]		250 [22.6%]
Moderate Severe (15-19)	76[10.5%]	83[22.0%]		159 [14.4%]
Severe (20-27)	33[4.5%]	62[16.4%]		95 [8.6%]
PSS-10	Median (IQR)	Median (IQR)	p	Median (IQR)
	15(10)	21(8)	<0.001[*]	17 (11)
Low stress (0-13)	312[42.9%]	43[11.4%]		355 [32.2%]
Moderate stress (14-26)	366[50.3%]	262[69.3%]		628 [56.8%]
High stress (27-40)	49[6.8%]	73[19.3%]		122 [11.0%]

HSA – high stress and anxiety group, IQR – interquartile range, LSA – low stress and anxiety group, MBI -The Maslach Burnout Inventory, PHQ-9 - Patient Health Questionnaire, PSS-10 – perceived stress scale-10, S2 – sample 2.
*P < 0.05.

Table 2.
Demographic characteristics of the participants from S2 with LSA and HSA.

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 and in HAS group. The most common

SAVE-9

Are you afraid the virus outbreak will continue indefinitely?

	Never	Rarely	Sometimes	Often	Always	p
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)	
LSA	703 (47.3)	322(21.7)	371(25.0)	68(4.6)	22(1.5)	<0.001[*]
HSA	56(7.9)	96(13.5)	308(43.4)	152(21.4)	97(13.5)	
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?

	Never	Rarely	Sometimes	Often	Always	p
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)	
LSA	365 (24.6)	454(30.6)	559(37.6)	91(6.1)	17(9.8)	<0.001[*]
HSA	7(1.0)	48(6.8)	258(36.4)	240(33.9)	156(22.0)	
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?

	Never	Rarely	Sometimes	Often	Always	p
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)	
LSA	300(20.2)	484(32.6)	531(35.7)	146(9.8)	25(1.7)	<0.001[*]
HSA	7(2.3)	56(7.9)	167(23.6)	256(36.1)	223(31.5)	
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?

	Never	Rarely	Sometimes	Often	Always	p
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)	
LSA	287(19.3)	476(32.0)	456(30.7)	201(13.5)	66(4.4)	<0.001[*]
HSA	11 (1.6)	54(7.6)	151(21.3)	283(39.9)	210(29.6)	
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?

	Never	Rarely	Sometimes	Often	Always	p
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)	
LSA	800(53.8)	313(21.1)	269(18.1)	89(6.0)	15(1.0)	<0.001[*]
HSA	93 (13.1)	120(16.9)	205(28.9)	171(24.1)	120(16.9)	
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?

	Never	Rarely	Sometimes	Often	Always	p
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)	
LSA	728(49.0)	254(17.1)	297(20.0)	142(4.4)	65(4.4)	<0.001[*]

SAVE-9						
Are you afraid the virus outbreak will continue indefinitely?						
	Never	**Rarely**	**Sometimes**	**Often**	**Always**	**p**
HSA	108(15.2)	86(12.1)	222(31.3)	182(25.7)	111(15.7)	
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?						
	Never	Rarely	Sometimes	Often	Always	p
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)	
LSA	1134(76.3)	202(13.6)	103(6.9)	30(2.0)	17(1.1)	<0.001*
HSA	276(38.9)	152(21.4)	144(20.3)	91(12.8)	46(6.5)	
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?						
	Never	Rarely	Sometimes	Often	Always	p
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)	
LSA	125 (8.4)	194(13.1)	437(29.4)	429(28.9)	301(20.3)	<0.001*
HSA	1(0.1)	15(2.1)	55(7.8)	179(25.2)	459(64.7)	
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?						
	Never	Rarely	Sometimes	Often	Always	p
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)	
LSA	599(40.3)	248(16.7)	329(22.1)	205(13.8)	105(7.1)	<0.001*
HSA	82(11.6)	61(8.6)	156(22.0)	197(27.8)	213(30.0)	
Total. No. (%)	681(31.0)	309(14.1)	485 (22.1)	402(18.3)	318(14.5)	

HSA – high stress and anxiety group, LSA – low stress and anxiety group, SAVE-9- Stress and Anxiety to Viral Epidemic scale, S1 – Sample 1, S2 – sample 2.
$*P < 0.05$.

Table 3.
The frequency of S1 and S2 participants' answers on each SAVE-9 scale question.

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%).

The level of emotional burnout and depersonalization according to two single-item MBI question scale differed significantly between LSA and HSA groups (**Table 5**). 32.5% every day felt burned out from their work, and 9.7% became more callous toward people.

All the symptoms assessed with PHQ-9 and PSS-10 differed significantly between groups with low and high stress according to SAVE-9 during the second COVID-19 wave (**Tables 6** and **7**). 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.

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)	
LSA	469(31.6)	586(39.4)	195(13.1)	236(15.9)	<0.001[*]
HSA	42(5.9)	203(789)	152(21.4)	312(56.9)	
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?

	Not at all	Several days	More than half the days	Nearly every day	
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)	
LSA	896(60.3)	436(29.3)	84(5.7)	70(4.7)	<0.001[*]
HSA	160(22.6)	288(39.8)	123(17.3)	138(19.5)	
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?

	Not at all	Several days	More than half the days	Nearly every day	
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)	
LSA	620(41.7)	608(40.9)	138(9.3)	120(8.1)	<0.001[*]
HSA	76(10.7)	279(39.4)	157(22.1)	709(32.3)	
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?

	Not at all	Several days	More than half the days	Nearly every day	
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)	
LSA	589(39.6)	503(33.8)	194(13.1)	200(13.5)	<0.001[*]
HSA	87(12.3)	213(30.0)	145(20.5)	264(37.2)	
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?

	Not at all	Several days	More than half the days	Nearly every day	
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)	
LSA	1006(67.7)	350(23.6)	87(5.9)	43(2.9)	<0.001[*]
HSA	207(29.2)	267(37.7)	121(17.1)	114(16.1)	
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?

	Not at all	Several days	More than half the days	Nearly every day	
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)	

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**
LSA	575(38.7)	595(40.0)	173(11.6)	143(9.6)	<0.001[*]
HSA	72(10.2)	264(37.2)	164(23.1)	209(29.5)	
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?					
	Not at all	Several days	More than half the days	Nearly every day	
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)	
LSA	959(64.5)	407(27.4)	66(4.4)	54(3.6)	<0.001[*]
HSA	146(20.6)	301(42.5)	121(17.1)	141(19.9)	
Total. No. (%)	1105(50.3)	708(32.3)	187(8.5)	195(8.9)	

GAD-7- general anxiety disorder-7 scale, HSA – high stress and anxiety group, LSA – low stress and anxiety group, S1 – Sample 1, S2 – sample 2.
*P < 0.05.

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

MBI							
I feel burned out from my work							
	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**	**p**
LSA	12(1.7)	46(6.3)	54(7.4)	125(17.2)	184(25.3)	140(19.3)	166 (22.8)	<0.001[*]
HSA	0(0.0)	2(0.5)	4(1.1)	35(9.3)	58(15.3)	86(22.8)	193(51.1)	
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							
	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	p
LSA	151(20.8)	94(12.9)	101(13.9)	155(21.3)	114(15.7)	64(8.8)	48(6.6)	<0.001[*]
HSA	34(9.0)	36(9.5)	40(10.6)	78(20.6)	75(19.8)	56(14.8)	59(15.6)	
Total. No. (%)	185(16.7)	130(11.8)	141(12.8)	233(21.1)	189(17.1)	120(10.9)	107(9.7)	

HSA – high stress and anxiety group, LSA – low stress and anxiety group, MBI -The Maslach Burnout Inventory.
*P < 0.05.

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

PHQ-9

Little interest or pleasure in doing things

	Never	Rarely	Sometimes	Often	p
LSA	220(30.3)	264(36.3)	118(16.2)	125(17.2)	<0.001*
HSA	31(8.2)	123(32.5)	106(28.0)	118(31.2)	
Total. No. (%)	251 (22.7)	387 (35.0)	224 (20.3)	243 (22.0)	

Feeling down. depressed. or hopeless

	Never	Rarely	Sometimes	Often	p
LSA	243(33.4)	307(42.2)	105(14.4)	72(9.9)	<0.001*
HSA	35(9.3)	141(37.3)	118(31.2)	84(22.2)	
Total. No. (%)	278 (25.2)	448 (40.5)	223 (20.2)	156 (14.1)	

Trouble falling or staying asleep. or sleeping too much

	Never	Rarely	Sometimes	Often	p
LSA	242(33.3)	240(33.0)	122(16.8)	123(16.9)	<0.001*
HSA	45(11.9)	110(29.1)	109(28.8)	114(30.2)	
Total. No. (%)	287 (26.0)	350 (31.7)	231 (20.9)	237 (21.4)	

Feeling tired or having little energy

	Never	Rarely	Sometimes	Often	p
LSA	74(10.2)	314(43.2)	155(21.3)	184(25.3)	<0.001*
HSA	9(2.4)	91(24.1)	120(31.7)	158(41.8)	
Total. No. (%)	83 (7.5)	405 (36.7)	275 (24.9)	342(31.0)	

Poor appetite or overeating

	Never	Rarely	Sometimes	Often	p
LSA	329(45.3)	212(29.2)	89(12.2)	97(13.3)	<0.001*
HSA	73(19.3)	110(29.1)	92(24.3)	103(27.2)	
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

	Never	Rarely	Sometimes	Often	p
LSA	482(66.3)	148(20.4)	47(6.5)	50(6.9)	<0.001*
HSA	135(35.7)	111(29.4)	72(19.0)	60(15.9)	
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

	Never	Rarely	Sometimes	Often	p
LSA	387(53.2)	188(25.9)	70(9.6)	82(11.3)	<0.001*
HSA	84(22.2)	134(35.4)	73(19.3)	87(23.0)	
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 figety or restless that you have been moving around a lot more than usual

	Never	Rarely	Sometimes	Often	p
LSA	490(67.5)	162(22.3)	43(5.9)	31(4.3)	<0.001*
HSA	160(42.3)	117(31.0)	62(16.4)	39 (3.4)	
Total. No. (%)	650 (58.8)	279 (25.2)	105(9.5)	70(6.3)	

PHQ-9					
Little interest or pleasure in doing things					
	Never	**Rarely**	**Sometimes**	**Often**	**p**
Thoughts that you would be better off dead. or of hurting yourself					
	Never	Rarely	Sometimes	Often	p
LSA	647(89.0)	54(7.4)	12(1.7)	14(1.9)	<0.001*
HSA	299(79.1)	48(12.7)	18(4.8)	13(3.4)	
Total. No. (%)	946(85.6)	102(9.2)	30(2.7)	27(2.4)	

HSA – high stress and anxiety group, LSA – low stress and anxiety group, PHQ-9-Patient Health Questionnaure-9, S1 – Sample 1, S2 – sample 2.
*P < 0.05.

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

PSS-10					
In the last month. how often have you been upset because of something that happened unexpectedly?					
	Never	**Almost never**	**Sometimes**	**Fairly often**	**Very often**	**p**
LSA	169(23.2)	191(26.3)	244(33.6)	92(12.7)	31(4.3)	<0.001*
HSA	8(2.1)	50(13.2)	156(41.3)	116(30.7)	48(12.7)	
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?						
	Never	Almost never	Sometimes	Fairly often	Very often	
LSA	237(32.6)	195(26.8)	180(24.8)	83(11.4)	32(4.4)	<0.001*
HSA	23(6.1)	73(19.3)	145(38.4)	90(23.8)	47(12.4)	
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"?						
	Never	Almost never	Sometimes	Fairly often	Very often	
LSA	71(9.8)	116(16.0)	250(34.4)	174(23.9)	116(49.8)	<0.001*
HSA	3(0.8)	13(3.4)	92(24.3)	153(40.5)	117(31.1)	
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?						
	Never	Almost never	Sometimes	Fairly often	Very often	
LSA	36(5.0)	45(6.2)	168(23.1)	294(40.4)	184(25.3)	<0.001*
HSA	9(2.4)	37(9.8)	175(46.3)	116(30.7)	41(10.8)	
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?						
	Never	Almost never	Sometimes	Fairly often	Very often	
LSA	42(5.8)	100(13.8)	254(34.9)	236(32.5)	95(13.1)	<0.001*
HSA	29(7.7)	98(25.9)	153(40.5)	77 (20.4)	21(5.6)	
Total. No. (%)	71 (6.4)	198 (17.9)	407 (36.8)	313(28.3)	116(10.5)	

PSS-10

In the last month. how often have you been upset because of something that happened unexpectedly?

	Never	Almost never	Sometimes	Fairly often	Very often	p

In the last month. how often have you found that you could not cope with all the things that you had to do?

	Never	Almost never	Sometimes	Fairly often	Very often	
LSA	141(19.4)	203(27.9)	248(34.1)	93(12.8)	42(5.8)	<0.001[*]
HSA	11(2.9)	62(16.4)	168(44.4)	100(26.5)	37(9.8)	
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?

	Never	Almost never	Sometimes	Fairly often	Very often	
LSA	39 (5.4)	67(9.2)	194(26.7)	273(37)	154(21.2)	<0.001[*]
HSA	10(2.6)	40(10.6)	161(42.6)	121(32.0)	46(12.2)	
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?

	Never	Almost never	Sometimes	Fairly often	Very often	
LSA	12(1.7)	34(4.7)	193(26.5)	333(45.8)	155(21.3)	<0.001[*]
HSA	10(2.6)	50(13.2)	166(43.9)	120(31.7)	32(8.5)	
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?

	Never	Almost never	Sometimes	Fairly often	Very often	
LSA	100(13.8)	185(25.4)	276(38.0)	128 (17.6)	38(5.2)	<0.001[*]
HSA	14(3.7)	41(10.8)	159(42.1)	118(31.2)	46(12.2)	
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?

	Never	Almost never	Sometimes	Fairly often	Very often	
LSA	247(34.0)	191(26.3)	184(25.3)	74(10.2)	31(4.3)	<0.001[*]
HSA	31(8.2)	73(19.3)	136(36.0)	85(22.5)	53(14.0)	
Total. No. (%)	278 (25.2)	264 (23.9)	320 (29.0)	159 (14.4)	84 (7.6)	

HSA – high stress and anxiety group, LSA – low stress and anxiety group, PSS-10 -Perceived Stress Scale-10, S1 – Sample 1, S2 – sample 2.
*P < 0.05.

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

The most common symptoms according to PSS-10 scale included: fairy 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%).

Categories	p	OR	Lower limit	Upper limit
Male	0.001*	0.710	0.581	0.866
Female	0	0	0	0
Age	0.077	0.992	0.984	1.001
Physicians	0.727	1.035	0.852	1.259
Nurses	0	0	0	0

Table 8.
Influence of gender, age, position in participants from HAS group (total sample – S1+S2).

3.3 Logistic regression and network analysis

The regression model for total sample (N = 2195) was reliable (−2Log likelihood ratio = 571.5; p = 0.05). The group with LSA (SAVE-9 score < 18) was used as the reference category. Male sex (Odds Ratio (OR) 0,710 [95%CI 0.581–0.866, p = 0.001]) was associated with lower anxiety level among the participants from HAS group (see **Table 8**).

The regression model for second wave sample (N = 1105) was reliable (−2Log likelihood ratio = 1067.1; p = 0.05). The LSA group (SAVE-9 score < 18) was used as the reference category. Male sex (OR 0.686 [95%CI 0.512–0.908, p = 0.008]) and working in Moscow (OR 0,544 [95%CI 0.402–0.736, p = 0.001]) or Saint Petersburg (OR 0,357 [95%CI 0.181–0.704, p = 0.003]) were associated with lower anxiety level among the participants from HAS group (see **Table 9**).

Categories	p	OR	Lower limit	Upper limit
Male	0.008*	0.686	0.512	0.908
Female	0	0	0	0
Age	0.904	0.999	0.987	1.012
Physicians	0.727	1.035	0.852	1.259
Nurses	0	0	0	0
Place of residence: Moscow	0.001*	0.544	0.402	0.736
Place of residence: St. Petersburg	0.003*	0.357	0.181	0.704
Place of residence: Other	0	0	0	0
Duration of work with COVID-19: < 1 week	0.465	0.739	0.328	1.664
Duration of work with COVID-19: 1 week – 1 month	0.607	0.880	0.541	1.431
Duration of work with COVID-19: 1 – 3 months	0.952	0.880	0.541	1.431
Duration of work with COVID-19: 4 - 6 months	0.174	0.810	0.598	1.097
Duration of work with COVID-19: >6 months	0	0	0	0
Have been tested positive for COVID-19	0.590	0.924	0.694	1.230
Haven't been tested positive for COVID-19	0	0	0	0
Have been vaccinated against COVID-19	0.057	0.301	0.87	1.034
Haven't been vaccinated against COVID-19	0	0	0	0

Table 9.
Influence of gender, age, position, place of residence, the duration of work with COVID-19, the history of COVID-19 and vaccination in participants from HAS group (S2 sample).
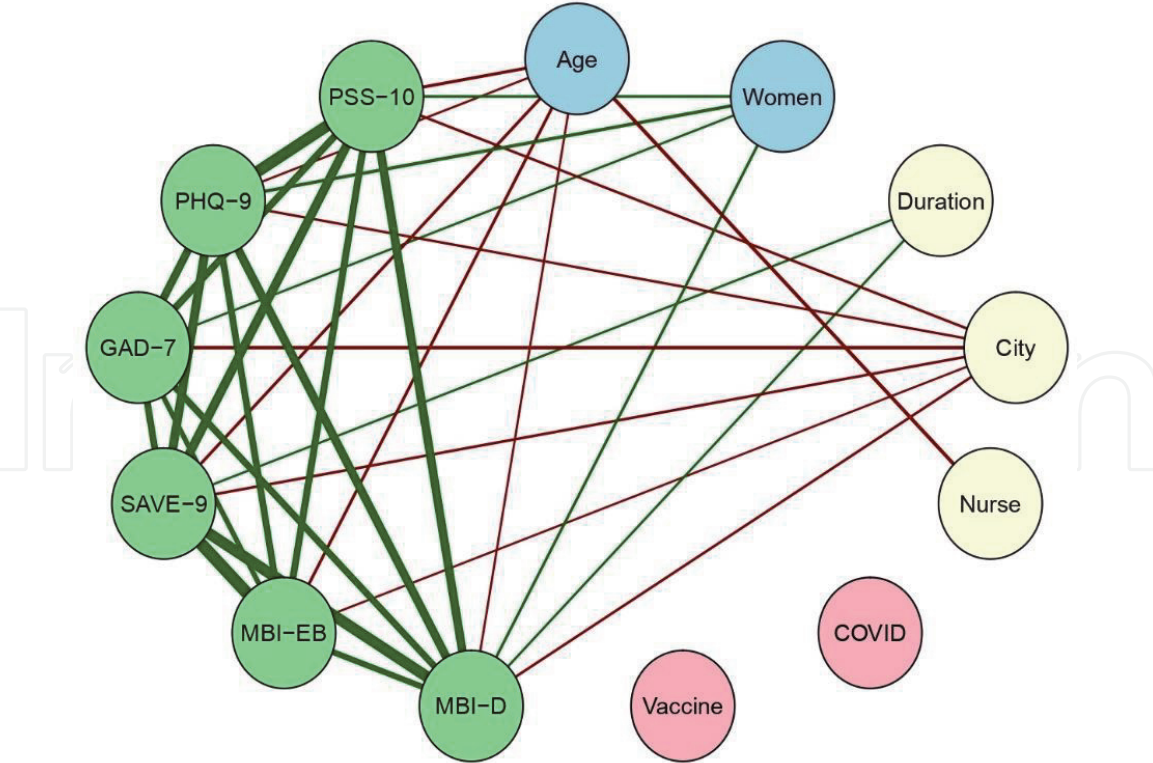
Figure 1.
Relationships between multiple variables for 2195 HCWs during first and second waves of COVID-19 in Russia (network analysis). Nodes represent variables. The coloring of the nodes indicates different groups of variables (green = mental health, blue = demographics, light yellow = work-related factors, pink = COVID-19-related factors); edges represent associations between the nodes (continuous /green = positive, dashed/red = negative, thickness = magnitude of the relationship); age = years of age, women = gender (levels: men = 1, women = 2); duration = the duration of work with patients with COVID-19 (levels: less than 6 months = 1, 6 months and over = 2); city = hospital location (levels: Moscow/ Saint Petersburg = 1,other location = 0); nurse = working position (levels: physician = 1, nurse = 2); COVID = the history of COVID-19 (positive test) (levels: No = 0, Yes = 1), Vaccine = the history of vaccination against COVID-19 (levels: No = 0, Yes = 1); MBI-D = depersonalization according to MBI, MBI-EB = emotional burnout according to MBI; SAVE-9 = total SAVE-9 score, GAD-7 = total GAD-7 score, PHQ-9 = total PHQ-9 score, PSS-10 = total PSS-10 score.

The results of the network analyses are presented in **Figure 1**.

Scores across all scales significantly correlated with each other. Age negatively correlated with perceived stress according to PSS-10, emotional exhaustion, total score of SAVE-9 and being a nurse. Being a woman positively correlated with perceived stress according to PSS-10, anxiety, depression, emotional exhaustion. Living in Moscow or Saint Petersburg negatively correlated with all symptoms. Working for over 6 months positively correlated with level of stress and anxiety according to SAVE-9 and emotional burnout.

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 [10, 12–14]. This at least partially can be explained by higher contamination and mortality rates among HCWs in Russia [21]. Another possible reason is that all participants were directly involved in 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 [30, 31].

All studies consistently reported the main symptom of the fear that family or a friend may become infected because of the HCWs [31]. 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 [11].

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 [18]. Other studies reported lower levels of anxiety in May compared to those in April in Switzerland [16] as well as in China in March compared to January [17]. 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.

Network analysis also revealed that working for over 6 months positively correlated with level of stress and anxiety according to SAVE-9 and emotional burnout. On the other hand, HCWs who worked for less than 6 months reported higher emotional exhaustion. Similarly, some previous studies reported higher levels of anxiety and stress in those who have less working experience [32]. 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. 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 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 in our sample was higher relative to other studies [2, 5, 9, 10, 12]. 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 [33] or SAD PERSONS [34]. 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 [11]. The most common symptoms included: feeling nervous and "stressed", have been angered because of things outside of their control, have been upset because of something that happened unexpectedly.

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 [6, 8, 11, 12], and female gender seems to be the main risk factor. According to the network analysis being a woman also positively correlated with perceived stress according to PSS-10, anxiety, depression, emotional exhaustion. Age was also associated with higher perceived stress and emotional exhaustion according to the network analysis similar to other

studies [11, 14]. 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 [21]. Vaccinated participants in our study had significantly lower stress and anxiety levels. 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 [35], spread of online materials on stress and anxiety reduction, access to psychological assistance hotlines, and involvement in leisure activities among HCWs may be helpful [36].

This study has several limitations. 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 would have been more accurate in assessing the levels of depression, anxiety, stress and burnout. The levels of depression and burnout have not been specifically assessed during the first wave; therefore, it was difficult to compare their rates.

5. Conclusions

Our study has shown high rates of stress, anxiety, depression and burnout especially among frontline HCWs in Russia. Female gender, living outside of Moscow or Saint Petersburg and not being vaccinated for COVID-19 were factors associated with higher level of stress and anxiety 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.

Acknowledgements

Conflict of interest

The authors declare no conflict of interest.

Nomenclature

GAD -7   General Anxiety Disorder-7 scale
HCWs   healthcare workers
IQR   interquartile range
MBI   Maslach Burnout Inventory scale
LSA   low stress and anxiety group
PHQ-9   Patient Health Questionnaire −9 scale

PSS-10	Perceived Stress Scale-10
PTSD	post-traumatic stress disorder
SAVE-9	Stress and Anxiety to Viral Epidemic scale-9
S1	sample 1 (May 19th and May 26th 2020)
S2	sample 2 (between October 10th and October 17th)

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