




BMJ Open Examining the mental health adversity among healthcare providers during the two waves of the COVID-19 pandemic: results from a cross-sectional, survey-based study

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To cite: Dezsó F, Birkás B, Vizin G, *et al.* Examining the mental health adversity among healthcare providers during the two waves of the COVID-19 pandemic: results from a cross-sectional, survey-based study. *BMJ Open* 2022;**12**:e059493. doi:10.1136/bmjopen-2021-059493

► Prepublication history and additional supplemental material for this paper are available online. To view these files, please visit the journal online (<http://dx.doi.org/10.1136/bmjopen-2021-059493>).

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Received 27 November 2021
Accepted 03 August 2022



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ABSTRACT

Objectives The current global health crisis of the COVID-19 pandemic has drastically affected the whole population, but healthcare workers are particularly exposed to high levels of physical and mental stress. This enormous burden requires both the continuous monitoring of their health conditions and research into various protective factors.

Design Cross-sectional surveys.

Setting and participants Self-administered questionnaires were constructed assessing COVID-19-related worries of health workers in Hungary. The surveys were conducted during two consecutive waves of the COVID-19 pandemic (N-first wave=376, N-second wave=406), between 17 July 2020 and 31 December 2020.

Primary and secondary outcome measures COVID-19-related worry, well-being and distress levels of healthcare workers. We also tested whether psychological resilience mediates the association of worry with well-being and distress. Multiple linear regression analyses were performed.

Results The results indicated that healthcare workers had high levels of worry and distress in both pandemic waves. When comparing the two waves, enhanced levels of worry (Wald's $\chi^2=4.36$, $p=0.04$) and distress (Wald's $\chi^2=25.18$, $p<0.001$), as well as compromised well-being (Wald's $\chi^2=58.64$, $p<0.001$), were found in the second wave. However, not all types of worries worsened to the same extent across the waves drawing attention to some specific COVID-19-sensitive concerns. Finally, the protective role of psychological resilience was shown by a mediator analysis suggesting the importance of increasing resilience as a key factor in maintaining the mental health of healthcare workers in the burden of the COVID-19 pandemic.

Conclusions Our results render the need for regular psychological surveillance in healthcare workers.

Registration Hungarian Scientific and Research Ethics Committee of the Medical Research Council (IV/5079-2/2020/EKU).

STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ In this study, we used a survey consisting of only 10 items being able to sufficiently monitor healthcare workers' COVID-19-related worries.
- ⇒ We examined important mental state indicators during two epidemic waves. Comparing the two waves allowed us to investigate how mental health changed when the epidemic situation worsened but patient care experienced improvement from the first to the second wave.
- ⇒ It can be noted that although healthcare workers' workload (eg, hours of care delivered to patients) may influence their perceived stress and worries, the workload experienced by the participants was not assessed.
- ⇒ This study did not investigate any personality trait and personal competence potentially affecting the participants' stress coping strategies.

INTRODUCTION

The recent health crises caused by the COVID-19 pandemic have impacted and still cause various health problems in millions of people worldwide.^{1 2} Similar to other large-scale infectious disease outbreaks, such as the severe acute respiratory syndrome in 2003,³ this current pandemic has also a significant psychological impact on all groups of the society, but especially on healthcare workers.⁴⁻⁸ Compared with previous work periods, the higher rates of fatalities and lack of instantly available and effective treatment protocols and methods regarding COVID-19 generated more difficult and stressful circumstances for healthcare professionals.^{9 10} In such conditions, adverse psychological outcomes (eg, anxiety, depression, post-traumatic stress disorder, burnout) proliferate and require individual, organisational and institutional

resilience strategies to avoid exacerbation of mental health problems among healthcare workers.^{10–12}

When facing psychological stressors, mental health outcomes depend mainly on coping strategies involving efforts to change or eliminate the source of stress and regulate the negative emotional consequences of the stressors.¹³ In the COVID-19 pandemic, coping mechanisms are primarily effective, if they support emotional stability, because personal efforts to reduce the source of stress (ie, COVID-19) are rather insufficient.^{14 15} In a recent study, the exposure to COVID-19 in the general population was a significant predictor only for mild stress-related symptoms but not for higher levels of distress.¹⁶ Of the many mental processes linked to coping, worries are considered especially relevant. Worries are associated with lower sense of control along with negative affectivity and are considered as prominent symptoms of anxiety disorders and depression.^{17 18} Correspondingly, worries may be good estimates of the level of stress experienced by the person and may indicate the level of anxiety and depression. Furthermore, more pronounced worries related to COVID-19 were found to be positively associated with higher levels of traumatic stress,¹⁹ anxiety and depression.²⁰ These findings suggest that COVID-19-related worries are significant predictors of the level of distress and severity of stress symptoms triggered by the pandemic.

Emotionally oriented coping strategies are suggested to be beneficial not only for reducing harms caused by acute distress, but also to effectively adapt if adversity is permanent, such as the COVID-19 pandemic.¹⁰ Factors that contribute to the adjustment and promote healthy coping are termed resilience.²¹ Resilient individuals tend to report less worries, and engage in protective and preventive behaviours, which prevent or diminish detrimental psychological outcomes and promote mental health.²² COVID-19-related studies found negative associations between worries and psychological resilience showing that more resilient individuals express less worries about the potential harmful outcomes of the pandemic.^{20 23 24} In addition, it has been found that resilience mediates both the associations between stress and anxiety, and the relation between stress and depression.^{20 25} Accordingly, resilience appears to be a key factor in managing COVID-19-related distress of healthcare workers.¹⁰ However, this pandemic as a temporally extended stressor might make healthcare workers exceed their coping capacity and reduce their resilience.^{5 26}

Therefore, in this self-report-based study, we examined the effects of COVID-19-related worries and individual resilience as indicators of distress (eg, level of anxiety and depression) in the first and second waves of the pandemic. The aims of the study were to investigate, whether (1) during the second wave of the pandemic, healthcare workers were more worried and had lower well-being as compared with the first wave of COVID-19; (2) both higher scores on worries related to COVID-19 and lower scores on resilience are associated with higher

levels of distress; (3) worries significantly predict the level of distress in both waves; (4) resilience mediates the associations between worries and distress, or not.

METHODS

In our study, we followed the recommendations of the STrengthening the Reporting of OBservational studies in Epidemiology statement²⁷ (see online supplemental table 1) and adhered to the Declaration of Helsinki²⁸ concerning ethical principles for medical researches involving human subjects.

Participants and procedure

Participants were recruited through an online survey which was delivered to different healthcare institutions including units for patients with COVID-19 in Hungary. We collected data over the first (from 17 July 2020 to 30 September 2020) and second waves (from 1 October 2020 to 31 December 2020) of the COVID-19 epidemic period in Hungary. In total, 782 participants completed the survey (N-first wave=376, N-second wave=406; see demographic characteristics in table 1). All participants agreed to a consent form with information about the study before completing the questionnaires (online supplemental appendix 1). Participants were asked to complete the survey consisting of demographical questions (ie, age, gender, occupation, fields, position, care for COVID-19-positive patients) and four self-report questionnaires (see below and online supplemental table 2).

Due to technical failure, during wave 1, responses from 92 participants for one of the items of the Depression, Anxiety and Stress Scale (DASS)²⁹ were not recorded. Depression scores of these participants were not calculated and analysed (N depression-first wave=284).

Patient and public involvement

No patient involved.

Measures

Worries of Epidemic in Healthcare Scale

The Worries of Epidemic in Healthcare Scale (WEHS) we developed was aimed to assess the epidemic-related worries among healthcare workers. As a first step, unstructured interviews were taken with healthcare workers. As a result, 15 areas of worry were identified and linked to the epidemic situations. These worries were then formulated as 15 different questionnaire items and used in a pilot survey study involving 65 healthcare workers. Participants were instructed as 'Please rate how worried/concerned you are about the following problems during the epidemic?'. Based on the pilot results, five items seemed to be confusing and/or poorly understandable and were therefore excluded from the final set. The final set of the 10 items used in this study were as follows: (1) I become infected and become seriously ill/die; (2) I infect a family member; (3) I did not receive sufficient professional training; (4) Little or poor-quality protective equipment;

Table 1 Sample characteristics in the two waves of the COVID-19 pandemic

Variables	First wave	Second wave	P value
N	376	406	
Age, mean (SD)	44.46 (11.82)	44.33 (11.14)	0.92
Experience (years), mean (SD)	18.26 (12.60)	19.62 (12.16)	0.09
Female/male, n (%)	251/125 (33.2/66.8)	288/118 (29.1/70.9)	0.22
Physicians*, n (%)	258 (68.6)	236 (58.1)	0.003
Internists	94 (36.4)	89 (37.7)	0.78
Intensive care professionals	40 (15.5)	65 (27.5)	0.001
Anaesthesiologists	41 (15.9)	62 (26.3)	0.005
Emergency medicine	28 (10.9)	23 (9.7)	0.77
Surgical profession	35 (13.6)	23 (9.7)	0.21
Nurses, n (%)	70 (18.6)	129 (31.8)	<0.001
Working at units for patients with COVID-19, n (%)	105 (27.9)	128 (31.5)	0.27
Contact with patients with COVID-19, n (%)	115 (30.6)	310 (76.4)	<0.001

Mann-Whitney U test was performed for the continuous variables (ie, age, experiences), and Fisher's exact test for categorical variables. P values indicating significant differences are printed in bold.

*The total number of physicians does not add up to the sum of job specialties, as while several physicians indicated more than one specialty, some did not indicate specialty at all.

(5) Patients should be discharged due to lack of capacity; (6) My financial difficulties arise/worsen; (7) I have to go to quarantine; (8) Patients without COVID-19 receive less optimal care than before; (9) The epidemic restarts; (10) Missing cases cause/will cause a significant surplus of work. Each item is rated on a 5-point Likert scale (1=not at all; 5=to a very large extent). The internal consistency of the items was acceptable (Cronbach's $\alpha=0.77$).

Depression, Anxiety and Stress Scale

To estimate the level of distress, the DASS with 21 items (DASS-21) was used.²⁹ DASS-21 includes three subscales (seven items each): depression, anxiety and stress. Each item was scored on a 5-point Likert scale (0=never; 4=always). In addition to the depression, anxiety and stress scores, a total score of the three subscales was also calculated and interpreted as an indicator of distress as suggested by Lee.³⁰ All scales demonstrated good or excellent internal consistency (depression: Cronbach's $\alpha=0.92$; anxiety: Cronbach's $\alpha=0.84$; stress: Cronbach's $\alpha=0.89$; total: Cronbach's $\alpha=0.95$).

Brief Resilience Scale

The Brief Resilience Scale (BRS) was used to assess the ability to recover and recuperate from difficulties and stress.³¹ BRS includes six items, and each item is rated on a 5-point Likert scale (1=strongly disagree; 5=strongly agree) (Cronbach's $\alpha=0.87$).

WHO-5 Well-Being Scale

The five-item WHO Well-Being Scale (WHO-5) is a short rating scale measuring the general subjective well-being.³² WHO-5 items are positive statements, and the respondent is asked to decide how true these statements for him or

her considering the last 2 weeks. Each item was scored on a 6-point Likert scale (5=all of the time; 0=at no time) (Cronbach's $\alpha=0.90$).

Analysis

To compare the sample characteristics in the two waves of the COVID-19 pandemic, the Mann-Whitney U test was performed for continuous variables, and Fisher's exact test was used for categorical variables. To examine the difference between the two pandemic waves in worries, distress and well-being, we assessed General Linear Models with robust SE estimates. As predictors, each model included pandemic wave, occupational status (ie, physician or nurse) and contact with patients with COVID-19 (ie, a variable showing whether the healthcare worker had contact with patients with COVID-19 or not). The latter two variables were included in the model as control variables because they showed a difference between the two waves (see table 1).

Multiple linear regression was performed to examine the association of COVID-19-related worry with well-being and distress. In addition, the role of resilience as a mediator in the association of worry with well-being and distress was estimated with Hayes's PROCESS macro for SPSS (V.3.5.3, model 4, 5000 bootstrap samples). Continuous variables were mean-centred. Two separate analyses were performed for well-being and distress as outcome variables. In both models (ie, well-being and distress model), COVID-19-related worries were the independent variable, and psychological resilience was handled as mediator while controlling for pandemic waves, gender, age and contact with patients with COVID-19.

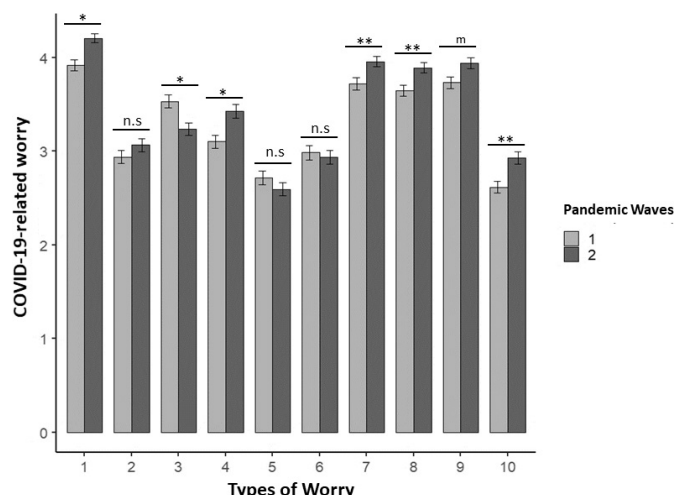


Figure 1 The different COVID-19-related worries during the two waves. Data are presented as mean and the SE of means. Types of worry—1: I become infected and become seriously ill/die, 2: I infect a family member, 3: I did not receive sufficient professional training, 4: Little or poor-quality protective equipment, 5: Patients should be discharged due to lack of capacity, 6: My financial difficulties arise/worsen, 7: I have to go to quarantine, 8: Patients without COVID-19 receive less optimal care than before, 9: The epidemic restarts, 10: Missing cases cause/will cause a significant surplus of work. * $P < 0.05$, ** $p < 0.01$. m: $p = 0.057$. The statistical comparison of the two waves was controlled for occupational status and the contact with patients with COVID-19. n.s., non-significant.

Data were analysed with SPSS V.25 (International Business Machines Corporation), and figures were made using R V.4.1 (<http://www.r-project.org>). A p value lower than 0.05 was considered statistically significant in each analysis.

RESULTS

Sample characteristics

In total, 782 participants completed the survey (N-first wave=376, N-second wave=406). Demographic and job characteristics of the healthcare workers participating in the study are summarised in [table 1](#).

The analysis showed no differences in age, work experience and gender; however, occupational status comparing the participants in the two waves was different. In addition, we found no significant difference between the two waves in the number of healthcare workers who worked on units for patients with COVID-19. However, there was a significant difference in the number of healthcare workers contacted with patients with COVID-19 between the two waves.

COVID-19-related worry increased from the first to second wave

The level of worry related to COVID-19 was significantly higher in the second than in the first wave ($\beta = -0.17$, Wald's $\chi^2 = 4.36$, $p = 0.04$). The overall level of worry in both waves can be considered high with approximate

mean scores of 3 (ie, wave 1: mean=3.29, SD=0.77; wave 2: mean=3.42, SD=0.71), measured on a 5-point scale.

When analysing each item of the WEHS separately, a significant increase was found from the first to the second wave for most types of worries (see also [figure 1](#)). Specifically, the COVID-19-related worry reported by the healthcare workers was enhanced by the second wave regarding the worry about self-infection ($\beta = -0.17$, Wald's $\chi^2 = 4.36$, $p = 0.04$), the poor quality of the protective equipment ($\beta = -0.24$, Wald's $\chi^2 = 9.50$, $p < 0.01$), quarantining ($\beta = -0.22$, Wald's $\chi^2 = 7.49$, $p < 0.01$), the risk of less optimal care of patients without COVID-19 ($\beta = -0.23$, Wald's $\chi^2 = 9.12$, $p < 0.01$), the significant surplus of work because of the many postponed patient care ($\beta = -0.25$, Wald's $\chi^2 = 10.28$, $p = 0.001$), and finally, with marginal significance, the restart of the epidemic ($\beta = -0.15$, Wald's $\chi^2 = 3.63$, $p = 0.057$).

There was one type of worry where we found a decrement in the second wave compared with the first: participants reported significantly less worry about their non-sufficient professional training in second wave than in the first ($\beta = 0.19$, Wald's $\chi^2 = 5.56$, $p = 0.02$).

No significant changes were also obtained in relation to the possibility of infecting a family member ($\beta = -0.14$, Wald's $\chi^2 = 3.06$, $p = 0.08$), about that patient should be discharged due to lack of healthcare capacity ($\beta = 0.10$, Wald's $\chi^2 = 1.59$, $p = 0.21$) and regarding the potential financial difficulties that arise due to the epidemic ($\beta = 0.09$, Wald's $\chi^2 = 1.17$, $p = 0.28$).

Lower well-being and higher distress in the second than in the first wave

Results indicated lower well-being in the second wave than in the first ($\beta = 0.61$, Wald's $\chi^2 = 58.64$, $p < 0.001$; see [figure 2A](#)). In addition, again in the second wave, healthcare workers had significantly higher distress both overall ($\beta = -0.43$, Wald's $\chi^2 = 25.18$, $p < 0.001$) and in the three distress subscales separately (depression: $\beta = -0.35$, Wald's $\chi^2 = 16.21$, $p < 0.001$; anxiety: $\beta = -0.40$, Wald's $\chi^2 = 24.89$, $p < 0.001$; stress: $\beta = -0.39$, Wald's $\chi^2 = 23.88$, $p < 0.001$; see [figure 2B](#)).

Regarding the severity levels (see [figure 3](#)), from the first wave to the second, a significant decrease in the number of individuals reporting normal level relative to those who were above the normal was observed for each distress scale (logistic regression; depression: $\beta = 0.56$, Wald's $\chi^2 = 10.22$, $p < 0.01$, OR=1.75; anxiety: $\beta = 0.73$, Wald's $\chi^2 = 19.24$, $p < 0.001$, OR=2.08, $p = 0.001$; stress: $\beta = 0.59$, Wald's $\chi^2 = 11.47$, $p < 0.001$, OR=1.75).

COVID-19-RELATED WORRY PREDICTS WELL-BEING AND DISTRESS, AND RESILIENCE ACTS AS A MEDIATOR

Results of multiple linear regression analyses are shown in [table 2](#).

The analyses controlling for gender, age, contact with patients with COVID-19, and pandemic waves showed that a higher level of COVID-19-related worry was significantly

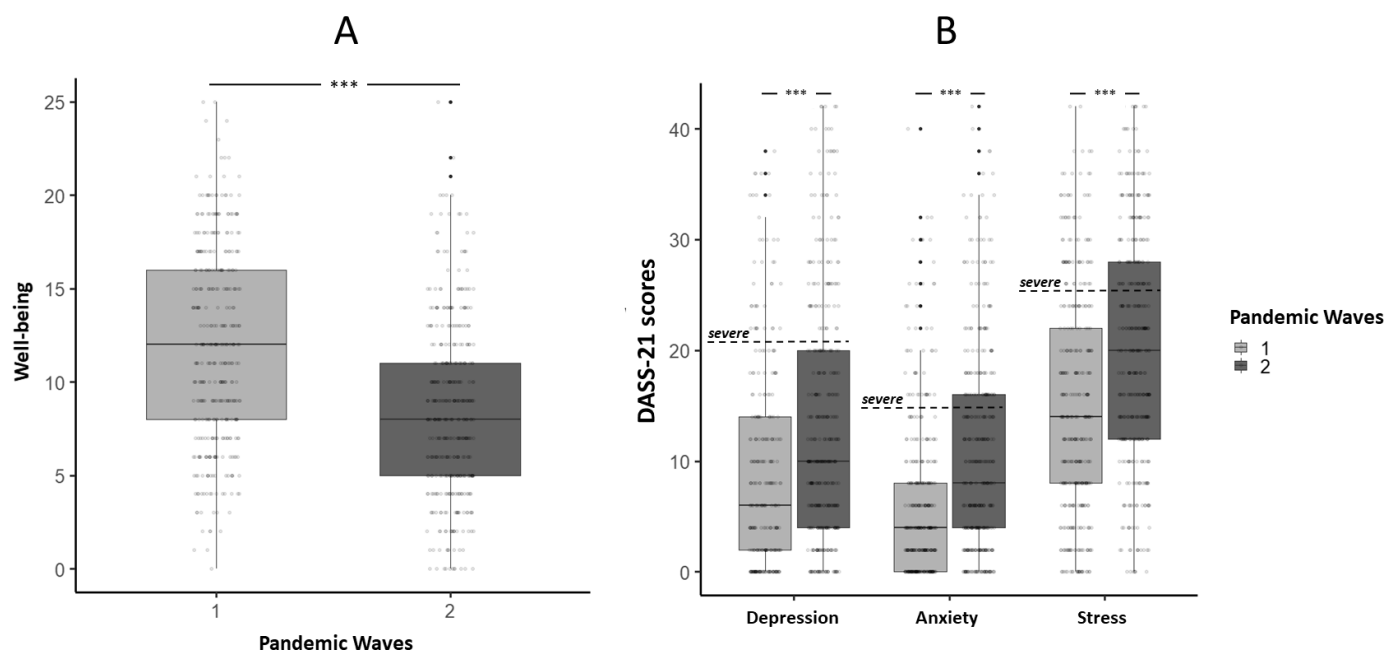


Figure 2 Well-being in the first and the second waves of the pandemic (A) and depression, anxiety, and stress in the first and the second waves of the pandemic (B). Data are presented as boxplot: median (black line), IQR (box) and minimum and maximum scores without outliers. Cut-off scores of the severe level are indicated by the horizontal dashed lines. ***P<0.001. The statistical comparison of the two waves was controlled for occupational status and the contact with patients with COVID-19. DASS-21, Depression, Anxiety and Stress Scale with 21 items.

associated with higher distress and lower well-being among the healthcare workers.

The results of the mediation analyses are presented in figure 4 and summarised here. The analysis revealed significant direct effect of COVID-19-related worry both on well-being and distress: greater level of worry predicted significantly lower well-being (total effect: $t=-7.26$, $p<0.001$, $\beta=-0.24$, 95% CI: -1.24 to -0.24 ; direct effect: $t=-3.91$, $p<0.001$, $\beta=-0.12$, 95% CI: -1.32 to -0.44) but higher distress (total effect: $t=12.56$, $p<0.001$, $\beta=0.42$,

95% CI: 6.34 to 8.69; direct effect: $t=8.82$, $p<0.001$, $\beta=0.27$, 95% CI: 3.85 to 6.06).

In addition, in both mediator models, indirect effects were also significant showing the mediator role of resilience (well-being model: $\beta=-0.12$, 95% CI: -0.15 to -0.09 , proportion of mediation: 50%; distress model: $\beta=0.14$, 95% CI: 0.11 to -0.18 , proportion of mediation: 33%). The indirect path constituted a negative association between worry and resilience indicating that individuals scoring lower on COVID-19-related worries had higher psychological resilience. In turn, higher resilience predicted better well-being and lower distress. Thus, the results of the mediation analyses suggest that resilience may act as a protective factor in the manifestation of COVID-19-related worries as reduced well-being and high distress.

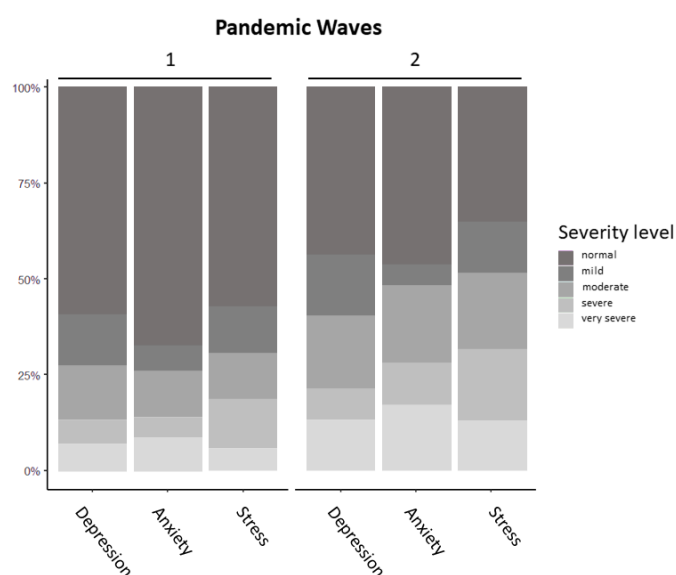


Figure 3 Proportion of the severity levels in depression, anxiety, and stress in the first and the second waves of the pandemic.

DISCUSSION

The recurrent waves of the COVID-19 epidemic are placing an increasing mental and physical burden on healthcare workers.³³ The maintenance of their physical and psychosocial stability belongs to one of the most important tasks that needs to be handled by healthcare management. However, maintaining physical and mental stability is made considerably more difficult by the fact that the pandemic has affected the personal lives and working conditions of healthcare professionals in many ways: it is a threat to both the individual and the family, and can impair the quality of care for both patients with COVID-19 and those without COVID-19. It is therefore essential to understand the concerns (ie, worries)

Table 2 Multiple linear regression results of COVID-19-related worry and control variables predicting well-being and distress

Predictors	Well-being				Distress			
	b	t	CI _{LB}	CI _{HB}	b	t	CI _{LB}	CI _{HB}
Worry	-0.24	-7.26***	-2.16	-1.24	0.42	12.56***	-22.59	-9.84
Wave	-0.29	-7.70***	-3.74	-2.22	0.18	4.82***	6.34	8.69
Age	0.07	2.09*	0.00	0.06	-0.08	-2.48*	2.86	6.80
Gender	-0.09	-2.65**	-1.74	-0.26	0.12	3.45***	-0.17	-0.02
Contact	-0.02	-0.39	-0.93	0.62	0.06	1.67	1.44	5.23
df	5, 776				5, 684			
R ²	0.14				0.27			
F	33.95***				51.87***			

Worry: COVID-19-related worry; wave: pandemic waves; contact: contact with patients with COVID-19. b: regression estimates.

*P<0.05; **p<0.01; ***p<0.001.

HB, higher bound; LB, lower bound.

that health workers face and the extent to which these concerns translate into different levels of psychosocial problems. The aim of the present study was therefore to understand the main COVID-19-related worries of health workers and the extent to which these worries have had an impact on distress and well-being during two consecutive waves of the COVID-19 epidemic. We also examined the role of resilience in protecting the individuals against the manifestation of aversive psychological outcomes of the enhanced level of the COVID-19-related worries.

Our results showed that COVID-19-related worries increased overall from the first to second wave of the COVID-19 outbreak. During the second, 'autumn', wave that produced a marked increase in the morbidity and mortality of patients with COVID-19, healthcare providers reported higher levels of COVID-19-related worries overall. However, not all types of worries showed significant difference between the two waves. For example, worries about professional unpreparedness (ie, insufficient professional training) to care for patients with

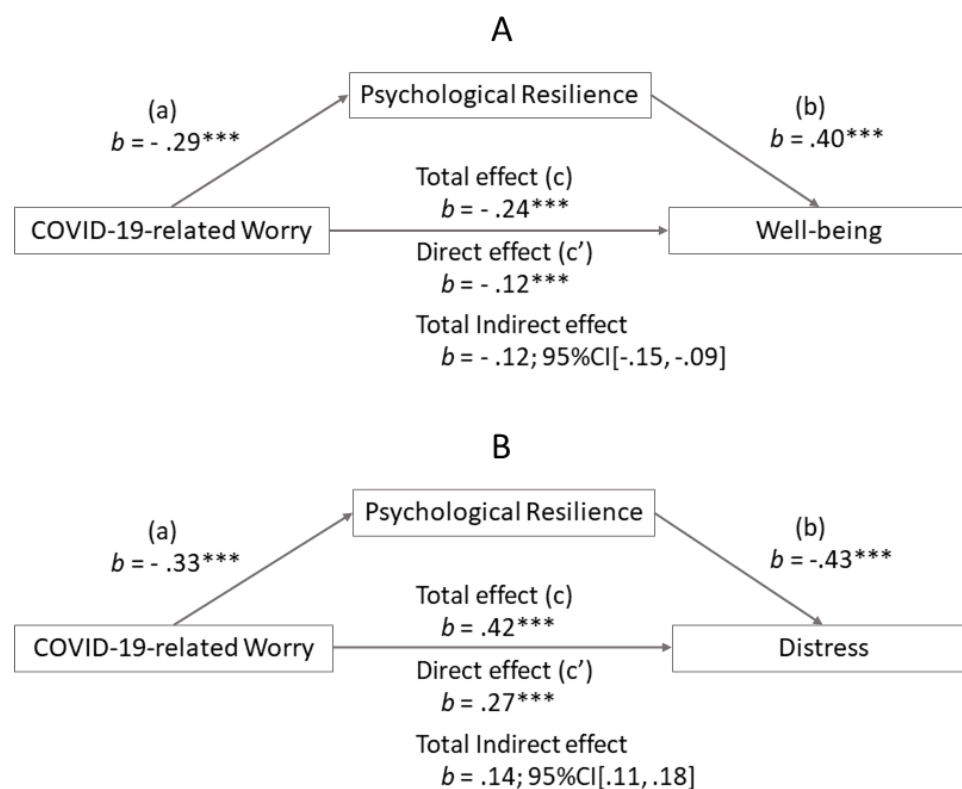


Figure 4 Results of the mediation analyses for the effects of COVID-19-related worry on well-being (A) and distress (B) mediated by psychological resilience. The values along the arrows are regression estimates (standardised). The 95% CIs are shown for the indirect effects. Both indirect effects are significant. The analyses were controlled for pandemic waves, gender, age and the contact with patients with COVID-19.

COVID-19 decreased in the second wave suggesting that participants had probably gained considerable treatment experience in the first wave of the outbreak. Despite the enhanced experience in patient care, worries about the working environment—the low-quality protective equipment, for example—were higher in the second wave than in the first. This finding is in line with a previous study showing that healthcare workers have good knowledge and positive attitude regarding protective equipment used in clinical settings.³⁴ In addition, worries have increased significantly about the risk of infection to self and that care for patients without COVID-19 may be jeopardised. The latter concern seems also to be common among healthcare workers: previously it has been observed that healthcare professionals working in non-COVID-19 areas also experience a great problem in patient management.³⁵ Their concerns referred mainly to the lack of concrete protocols for patient management, the delay in discharging duties toward the patients and the increased workload.³⁵

Regarding our second aim, results indicate that participants who completed the questionnaire in the second wave reported lower well-being and higher level of distress. All three components of distress—depression, anxiety and stress—were high already in the first wave and reached an even higher level in the second wave. This difference observed between the two waves was so great that, while more than 50% of respondents in the first wave had symptoms below the predefined normal severity threshold, in the second wave more than 60% of the healthcare providers were identified with distress above the normal level. This increase was particularly high at the ‘severe’ and ‘very severe’ symptoms where the number of individuals almost doubled in the second as compared with the first wave. Although to varying degrees, previous studies with healthcare providers also confirmed that distress among healthcare workers may be exceptionally high during the COVID-19 crisis. In a small sample (n=112) from Pakistan, over 70% of the healthcare workers who responded indicated moderate-to-severe levels of distress symptoms.³⁶ Elbay *et al*’s study³⁷ (n=442) found similarly high rates. In another study with much larger sample size (n=3770), the percentage of people with more severe symptoms was somewhat lower, but still reached highly remarkable levels: about 21%–28% of the individuals reported moderate-to-severe symptoms.³⁸ Importantly, our study has also shown that despite increasing experience in patient management, the level of distress stress can continue to rise during the successive waves of the COVID-19 epidemic. It can even reach extremely high levels that render the need for urgent interventions if we want to avoid personal tragedies and a drastic reduction in the stability of the healthcare system. These findings are similar to that of reported by Gündoğmuş *et al*.³⁹

The possible ways of intervention and prevention include identifying and reducing the major concerns (ie, worries), and enhancing those psychological defence mechanisms that may reduce the severe psychological

manifestation of the concerns. The relevance of these interventions is supported by our results showing that worry predicts the degree of distress and well-being. The short worry questionnaire used in the present study may be able to fulfil a dual role: it differentiates between types of worries the healthcare workers face with and it also predicts their distress level.

Finally, our results also revealed that psychological resilience acts as a protective factor in turning worries into severe psychological problems. We found that resilience clearly mediates the relationship between COVID-19-related worry and distress. This finding is in line with previous studies^{20 40 41} and confirms that the use of any therapy and action improving resilience may have considerable potential to reduce distress levels in healthcare workers. However, resilience is highly complex, thus its many COVID-19-specific components need to be explored in future studies in order to provide stronger psychological immunity for both the general population and healthcare workers.⁴² Potentially important factors relating to resilience during the COVID-19-related lockdowns were identified by Killgore *et al*⁴⁰: greater resilience was observed among those who undertook frequent outdoor activities, had better sleep quality, exerted more frequent religious activities, exercised more, and perceived social support from family and friends. However, more studies are still to be done to find the most effective resilience-related factors, and those which can be particularly important in improving the resilience of health workers.

Strengths and limitations

As a limitation of our study, it can be noted that although healthcare workers’ workload (eg, hours of care delivered to patients) may influence their perceived stress and worries, the workload experienced by the participants was not assessed. In addition, we did not investigate any personality trait and personal competence potentially affecting the participants’ stress coping strategies. Future studies may consider the examination of more factors including personality traits that may influence healthcare workers’ mental and physical health in such critical periods as the current pandemic. There are also points considered as strengths of our study. First, using only a 10-item measure, we sufficiently monitored healthcare workers’ COVID-19-related worries. Another strength of our study was that we examined important mental state indicators during two epidemic waves. Comparing the two waves allowed us to investigate how mental health changed when the epidemic situation worsened but patient care experiences improved from the first to the second wave. The results showed that even with increasing patient care experience, there was a deterioration in the psychological indicators we examined by the second wave of the epidemic.

Summary

To summarise, the present study examined the changes in and relationship between worry, distress and well-being variables in two consecutive waves of the COVID-19

pandemic in Hungary. The role of psychological resilience as a potential mediator in the association of worry with distress and well-being was also investigated. Healthcare workers reported high levels of worry and distress in both pandemic waves. When comparing the two waves, an enhanced level of worry and distress as well as compromised well-being were found in the second wave: more than 50% of the respondents reported higher than the normal symptom severity in anxiety, depression and stress. However, not all types of worries worsened to the same extent across the waves drawing attention to some specific COVID-19-sensitive concerns. Finally, the protective role of psychological resilience was highlighted by the mediator analysis suggesting the importance of resilience as a key factor in maintaining the mental health of healthcare workers in the burden of a pandemic. Our results render the need for regular psychological surveillance and most likely not just during pandemics but also in ordinary times when the high workload and occupational stress are known to adversely affect the mental health of healthcare providers.

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Acknowledgements The authors thank Dr András Matuz (Department of Behavioral Sciences, Medical School, University of Pécs) for the valuable statistical advice.

Contributors Conceptualisation—FD, PH, GV and ZM. Methodology—AC, BB and SV. Software—NG, GV and AC. Validation—HS, DL and AE. Formal analysis—NG. Investigation—FD. Resources—PH. Data curation—HS, DL and AE. Writing (original draft) preparation—GV, HS, BB and AC. Writing (review and editing)—FD, GV, SV, HS, DL, AE, ZM, PH and NG. Visualisation—AC. Supervision—PH. Project administration—SV. Funding acquisition—PH. Guarantor—AC. All authors have read and agreed to the published version of the manuscript.

Funding Funding was provided by an Economic Development and Innovation Operative Programme Grant (GINOP-2.3.4-15-2020-00010) and by a Human Resources Development Operational Programme Grant (EFOP-3.6.2-16-2017-00006, EFOP-3.6.1.-16-2016-00004), both co-financed by the European Union (European Regional Development Fund) within the framework of the Széchenyi 2020 Program, and the Hungarian National Research, Development and Innovation Office Grant (K 138816).

Disclaimer Sponsors had no role in the design, data collection, analysis, interpretation and manuscript preparation.

Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not required.

Ethics approval This study involves human participants and was approved by the Scientific and Research Ethics Committee of the Hungarian Medical Research Council (IV/5079-2/2020/EKU, online supplemental appendix 2). All the participants

provided written informed consent to participate in this study. The ethics committee has carefully checked and approved the consent procedure.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement All data relevant to the study are included in the article or uploaded as supplemental information. The original contributions generated for the study are included in the article/supplemental material; further inquiries can be directed to the corresponding author.

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SUPPLEMENTARY MATERIAL

TITLE

Examining the Mental Health Adversities Among Healthcare Providers During the Two Waves of the COVID-19 Pandemic: Results from a Cross-sectional, Survey-based Study

AUTHORS

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Table S1. STROBE Statement—Checklist of items that should be included in cross sectional studies

	Item No	Recommendation	Page number
Title and abstract	1	(a) Indicate the study’s design with a commonly used term in the title or the abstract	1
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4
Objectives	3	State specific objectives, including any prespecified hypotheses	4-5
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	5-6
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	5
Bias	9	Describe any efforts to address potential sources of bias	6
Study size	10	Explain how the study size was arrived at	5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	6
		(b) Describe any methods used to examine subgroups and interactions	-
		(c) Explain how missing data were addressed	-
		(d) If applicable, describe analytical methods taking account of sampling strategy	-
		(e) Describe any sensitivity analyses	-
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	6-7
		(b) Give reasons for non-participation at each stage	6-7
		(c) Consider use of a flow diagram	Table 1
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Page 6, Table 1
		(b) Indicate number of participants with missing data for each variable of interest	Page 6, Table 1
Outcome data	15*	Report numbers of outcome events or summary measures	7

Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	7
		(b) Report category boundaries when continuous variables were categorized	7
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	7
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	7
Discussion			
Key results	18	Summarise key results with reference to study objectives	8-10
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	9
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	8-10
Generalisability	21	Discuss the generalisability (external validity) of the study results	9-10
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	11

Table S2. Questionnaire

	Question	Options	Data type	Mandatory?
1	Please enter your age	<ul style="list-style-type: none"> Number of years between 18 and 100 	Number	Yes
2	Please enter your sex	<ul style="list-style-type: none"> Female Male 	Single choice	Yes
3	In which country do you work? (If you have a job in more than one country, please indicate where you worked / are working during the epidemic.)	<ul style="list-style-type: none"> List of the European countries 	Dropdown menu	Yes
4	What type of settlement do you work in? (If you work in more than one place, indicate where you spent / are spending the most time during the epidemic.)	<ul style="list-style-type: none"> Capital city County seat Other town Smaller than a town 	Single choice	Yes
5	What field (s) do you usually work in? (Multiple answers possible)	<ul style="list-style-type: none"> Intensive care Anaesthetics Emergency medicine Internal medicine profession Surgical profession Family doctor/General Practice Ambulance service Other 	Multiple choice	Yes
6	What position do you work in?	<ul style="list-style-type: none"> Doctor Nurse, assistant Other professional staff 	Single choice	Yes
7	How many years of clinical experience do you have?	<ul style="list-style-type: none"> Number of years from 0 (less than one year) to 80 	Single choice	Yes
Questions will pop-up randomly				
8	Have you been ordered to work in a different work area during the epidemic?	<ul style="list-style-type: none"> No Yes 	Single choice	Yes
9	To what extent do / did you feel it was your inner duty to be involved in caring for patients in an epidemiological situation?	<ul style="list-style-type: none"> Not at all Rather not Rather yes Completely 	Single choice	Yes

10	On average, how many personal contacts do / have you had with COVID positive or suspected patients at work?	<ul style="list-style-type: none"> • None • Less than 5 hours a week • More than 5 hours a week • More than 10 hours a week 	Single choice	Yes
11	Did you actually have to care for a COVID positive patient?	<ul style="list-style-type: none"> • No • Yes 	Single choice	Yes
12	Have you been diagnosed with coronavirus?	<ul style="list-style-type: none"> • No • Yes, but I did not need hospital care • Yes, and I have been in hospital care 	Single choice	Yes
13	Did / did you have a relative or close acquaintance who was diagnosed with coronavirus? (If more than one, state the person whose infection affected you the most.)	<ul style="list-style-type: none"> • No • Yes, but there was no need for hospital care • Yes, s/he was in hospital care and recovered • Yes, and s/he died of it 	Single choice	Yes
14	Please rate how worried / concerned you are about the following problems during the epidemic? (Use a scale from 1 to 5 to score.)	<ul style="list-style-type: none"> a. I become infected and become seriously ill / die b. I infect a family member c. I did not receive sufficient professional training d. Little or poor quality protective equipment e. Patients should be discharged due to lack of capacity f. My financial difficulties arise / worsen g. I have to go to quarantine h. Non-COVID patients receive less optimal care than before i. The epidemic restarts j. Missing cases cause / will cause a significant surplus of work 	<ul style="list-style-type: none"> 1. Not at all 2. (without marking) 3. (without marking) 4. (without marking) 5. To a very large extent 	Yes
15	To what extent is/was your work stressful mentally during the epidemic?	<ul style="list-style-type: none"> • It was not stressful at all • It was a little stressful • It was moderately stressful • It was very stressful 	Single choice	Yes
16	To what extent is / was your work demanding physically?	<ul style="list-style-type: none"> • It was not demanding at all • It was a little demanding • It was moderately demanding • It was very demanding 	Single choice	Yes

17	In your opinion, to what extent has the frequency of tension / conflicts increased between colleagues during the epidemic situation?	<ul style="list-style-type: none"> • It has not increased at all • It has increased a little • It has definitely increased • It has severely increased 	Single choice	Yes
18	Please read each statement and circle a number 0, 1, 2 or 3 which indicates how much the statement applied to you over the past week. There are no right or wrong answers. Do not spend too much time on any statement.	<ol style="list-style-type: none"> 1. I found it hard to wind down 2. I was aware of dryness of my mouth 3. I couldn't seem to experience any positive feeling at all 4. I experienced breathing difficulty (eg, excessively rapid breathing, breathlessness in the absence of physical exertion) 5. I found it difficult to work up the initiative to do things 6. I tended to over-react to situations 7. I experienced trembling (eg, in the hands) 8. I felt that I was using a lot of nervous energy 9. I was worried about situations in which I might panic and make a fool of myself 10. I felt that I had nothing to look forward to 11. I found myself getting agitated 12. I found it difficult to relax 13. I felt down-hearted and blue 14. I was intolerant of anything that kept me from getting on with what I was doing 15. I felt I was close to panic 16. I was unable to become enthusiastic about anything 17. I felt I wasn't worth much as a person 18. I felt that I was rather touchy 19. I was aware of the action of my heart in the absence of physical exertion (eg, sense of heart rate increase, heart missing a beat) 20. I felt scared without any good reason 21. I felt that life was meaningless 	<ol style="list-style-type: none"> 0. Did not apply to me at all 1. Applied to me to some degree, or some of the time 2. Applied to me to a considerable degree, or a good part of time 3. Applied to me very much, or most of the time 	Yes
19	Please respond to each item by marking one box per row	<ul style="list-style-type: none"> • I tend to bounce back quickly after hard times • I have a hard time making it through stressful events. • It does not take me long to recover from a stressful event. • It is hard for me to snap back when something bad happens. • I usually come through difficult times with little trouble. • I tend to take a long time to get over set-backs in my life. 	<ol style="list-style-type: none"> 1. Strongly Disagree 2. Disagree 3. Neither agree nor disagree 4. Agree 5. Strongly agree 	Yes
20	How did your sleep change during the epidemic?	<ul style="list-style-type: none"> • It got a lot worse • It got a bit worse 	Single choice	Yes

	(Considering the duration and quality of sleep.)	<ul style="list-style-type: none"> There was no change in it It got a bit better It got a lot better 		
Please answer question 21 only if the answer to question 20 was the worsening of sleep.				
21	If your sleep has deteriorated, what do you think the reason was? (Multiple answers possible)	<ul style="list-style-type: none"> Increased stress level Increased working hours Change in work schedule Other 	Multiple choice	Yes
22	Please rate each statement how they apply to you in the past two weeks. Notice that higher numbers mean better well-being. Example: If you have felt cheerful and in good spirits more than half of the time during the last two weeks, put a tick in the box with the number 3 in the upper right corner.	<ul style="list-style-type: none"> I have felt cheerful and in good spirits I have felt calm and relaxed I have felt active and vigorous I woke up feeling fresh and rested My daily life has been filled with things that interest me 	5. All of the time 4. Most of the time 3. More than half of the time 2. Less than half of the time 1. Some of the time 0. At no time	Yes
23	With whom could / can you share problems and concerns during the epidemic? (Multiple answer possible. If with no one, please check only the last option.	<ul style="list-style-type: none"> My partner Family A friend A colleague Work manager Religious leader With a specialist (psychologist, psychotherapist, psychiatrist) With an alternative spiritual helper (lifestyle counsellor, astrologer, kinesiologist, etc.) Other Nobody 	Multiple choice	Yes
24	Do you consider it necessary for your workplace to provide the opportunity for spiritual support from a professional?	<ul style="list-style-type: none"> No, I don't find it necessary Yes, but I would not use it Yes, and I would make / make use of it 	Single choice	Yes
25	How did the following habits change during the epidemic? (If	<ul style="list-style-type: none"> Alcohol consumption Smoking Coffee consumption 	1. Significantly decreased 2. Slightly reduced 3. Not changed	Yes

	one does not apply to you, check "I don't have this habit.")	<ul style="list-style-type: none">• Carbohydrate intake (e.g. chocolate, chips, cola)• Energy drink consumption• Sports, physical activities• Gambling• Computer game• Watching TV• use of social media• Use of sedatives, sleeping pills• Drug use• Watching porn	4. Slightly increased 5. Significantly increased 6. I have no such habit	
26	Did / did you have any other concerns or problems you would like to share?		Short text	No

Appendix S1. Information for study participants

Dear Participant Healthcare Worker,

Thank you for participating in our research ‘Investigating the Problems and Wellbeing of Healthcare Workers in an Epidemic Situation’. The research is organized by the Intensive Care Unit of the Military Hospital – Hungarian Defense Forces, Budapest, the Institute of Translational Medicine of the University of Pécs, the Institute of Behavioral Sciences of the University of Pécs and the Department of Clinical Psychology and Addiction of Eötvös Loránd University, Budapest. The leader of the research is Dr. Flóra Dezső (Military Hospital).

The aim of the present study is to assess many aspects of the mental burden caused by the COVID-19 epidemic among health care workers. We would like to map out all the personal or institutional opportunities and resources that can contribute to the mental wellbeing of healthcare staff.

Participation in the research is completely voluntary. However, it is very important for the success of the research that we get to know the opinions of as many employees as possible, including yours.

You can complete the questionnaires online during the survey. It will take about 8-10 minutes to complete the questionnaire.

The results of the research will be published later and presented at scientific conferences. Only aggregated data from the research is published, data that can be traced back to individuals are not published.

In the research, we collect the data anonymously and do not record any other personal information.

We treat all information we collect in the course of our research in the strictest confidence, in accordance with data protection rules related. The data obtained during the research are stored on a secure computer with a code. We perform statistical analyses on the data obtained during the research, from which the identity of any participant cannot be established.

If you wish to get any feedback regarding the study, finishing your answers you can send a 6 digit code to the email address below. You will get the response to the email address provided by you.

The study was approved by the Scientific and Research Ethics Committee of the Health Science Council, Hungary.

If you have additional questions or would like to speak to one of the researchers about the research, please contact us:

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Appendix S1. Information for study participants - continuedQuestionnaire introduction

Dear Participant Healthcare Worker,

In the research organized by the University of Pécs, Eötvös Loránd University, Budapest and the Hungarian Military Hospital, Budapest , we ask you to fill in the following questionnaire. The study seeks to map the physical and mental burden on medical staff and the extent and ways of coping with this burden. The data collected through the questionnaire can help us to design and develop a truly effective support system for healthcare workers in critical situations such as the COVID-19 epidemic.

There is no obligation to answer the questions. You don't have to answer the questions, but any one of them is a great help in our work.

By participating in the research, we are unable to identify you personally, and the data obtained from the completed questionnaires will be treated completely anonymously, encrypted and blocked.

It takes about 10 minutes to complete the questionnaire, there are no right or wrong answers. The questionnaires do not provide a diagnosis and the data will be used solely for the purpose of our scientific research.

More information about the research can be found here (You can reach it by clicking on the detailed information we provided in TUKÉB)

Contribution to scientific research

☐ By completing the questionnaire, I consent to the use of the data for scientific research.

Questionnaire closing remarks

Thank you for contributing to our work and helping to prepare medical staff more effectively by completing the questionnaire!

Research leaders: Dr. Péter Hegyi, Dr. Flóra Dezső

Appendix S2. Ethical approval

**Medical Research Council
Scientific and Research Ethics Committee**
Mailing Address: 7-8 Széchenyi István Square, Budapest H-1051
Seat: 25 Alkotmány Street, Budapest 1054

Reg. no.: IV/5079-2/2020/EKU
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Subject: Authorization Decree

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Chief Investigator: Dr Flóra Dezső and Dr Péter Hegyi

DECREE

The non-intrusive clinical research project titled as “**The Investigation of the Pandemic-related Problems and Well-being of Health Workers (FEAR)**” has been submitted for ethical review to the Scientific and Research Ethics Committee of the Medical Research Council by Dr Flóra Dezső (44 Róbert Károly Blvd. Budapest 1134) representing the Military Hospital – State Health Centre, Central Department of Anaesthesiology and Intensive Care, and by Dr Péter Hegyi (12 Szigeti Street Pécs 7624) representing the University of Pécs Medical School Institute for Translational Medicine (hereinafter referred to as “Applicants”).

I am pleased to inform you that the Scientific and Research Ethics Committee of the Medical Research Council has granted ethical approval for this research project.

Budapest, 17 June 2020.

This is the official translational of the Hungarian ethical approval granted by the Hungarian Scientific and Research Ethics Committee of the Medical Research Council, translated by the University of Pécs Institute for Translational Medicine.


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