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TITLE

From Worry to Distress: Mental Health Adversities Among Healthcare Providers During the Two Waves of the COVID-19 Pandemic – a survey of healthcare workers

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ABSTRACT

Objectives

The current global health crisis of the coronavirus disease 2019 (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 mediate the association of worry with well-being and distress.

Results

The results indicated that healthcare workers had high level of worry and distress in both pandemic waves. When comparing the two waves, enhanced levels of worry and distress, as well as compromised well-being, 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).

Keywords

COVID-19, healthcare providers, COVID-19-related worry, well-being, distress, resilience, SARS-CoV-2

Article Summary

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 (e.g., 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.

1. INTRODUCTION

The most recent health crises caused by the coronavirus disease 2019 (COVID-19) pandemic has 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 (SARS) 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 to 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 (e.g., anxiety, depression, posttraumatic stress disorder, burnout) proliferate and require individual, organizational, 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 current pandemic, coping mechanisms are primarily effective, if they support emotional stability, because personal efforts to reduce the source of stress (i.e., 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 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 adversities are 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, engage in protective and preventive behaviors 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, healthcare workers might 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 (e.g., level of anxiety and depression) in the first and second wave 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 less resilient as compared to the first peak of COVID-19; (2) both, higher scores on worries related to COVID-19 and lower scores on resilience are associated with higher levels of anxiety and depression; (3)

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

2. METHODS

In our study we followed the recommendations of the STrengthening the Reporting of OBservational studies in Epidemiology (STROBE) Statement[27] (see Table S1) and adhered to the Declaration of Helsinki[28] concerning ethical principles for medical researches involving human subjects.

2.1. Participants and Procedure

Participants were recruited through an online survey which was delivered to different health care institutions including units for COVID-19 patients 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 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 (Appendix S1). The research was approved by Scientific and Research Ethics Committee of the Hungarian Medical Research Council (IV/5079-2/2020/EKU, Appendix S2). Participants were asked to complete the survey consisting of demographical questions (i.e., age, gender, occupation, fields, position, care for COVID-19 positive patients) and four self-report questionnaires (see below 2.2. and Table S2).

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

2.2. Patient and Public Involvement

No patient involved.

2.3. 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, 5 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. (5) Patients should be discharged due to lack of capacity. (6) My financial difficulties arise/ worsen. (7) I have to go to quarantine. (8) Non-COVID-19 patients 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 five-point Likert scale (1=not at all – 5=to a very large extent). The internal consistency of the items was acceptable (Cronbach-α = .77).

Depression, Anxiety and Stress Scale

Depression, Anxiety and Stress Scale - 21 Items (DASS-21) was used to assess depression, anxiety and stress [29]. DASS-21 includes three subscales (7 items each): depression, anxiety, and stress. Each item was scored on a five-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 et al. (2019) [30]. All scales demonstrated good or excellent internal consistency (Depression: Cronbach-α = .92; Anxiety: Cronbach-α = .84; Stress: Cronbach-α = .89; Total: Cronbach-α = .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 6 items, and each item is rated on a five-point Likert scale (1 = Strongly Disagree – 5 = Strongly Agree), (Cronbach-α = .87).

WHO-5 Well-Being Scale

The 5-item World Health Organization Well-Being Index (WHO-5) is a short rating scale measuring the general subjective well-being (Bech et al., 1996 [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 two weeks. Each item was scored on a six-point Likert scale (5 = all of the time – 0 = at no time). (Cronbach-α =.90).

2.4. Analysis

To compare the variables measured in the two waves, the Mann–Whitney U-test was performed for continuous variables, and Fisher's exact test was for categorical variables. A p-value lower than 0.05 was considered statistically significant. The role of resilience as a mediator in the association of Worry with Well-being and Distress was tested using linear regression models. The models were estimated with Hayes's (2018) PROCESS macro for SPSS (version 3.5.3, model 4, 5000 bootstrap samples). Continuous variables were mean-centered. Two separate analyses were performed for Well-being and Distress as outcome variables. In both models COVID-19 related worries were the independent variable, and psychological Resilience was handled as mediator while controlling for pandemic waves, gender, age, and the number of COVID-19 patients treated by the healthcare worker. Data were analysed with SPSS version 25 (International Business Machines Corporation, USA), and figures were made using R version 4.1 (http://www.r-project.org).

3. RESULTS

3.1. 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 summarized in Table 1. The analysis showed no differences in age, work experience, and gender; however, occupational status comparing the participants in the two waves were different. In addition, we found no significant difference between the two waves in the number of participants

who worked on COVID-19 patient units. There was significant difference in the number of contacts with COVID-19 patients between the two cohorts.

3.2. 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 ($Z = -2.33$, $p = .02$). The overall level of worry in both waves can be considered high with approximate mean scores of 3 (i.e., wave 1: mean = 3.29, SD = .77; wave 2: mean = 3.42, SD = .71), measured on a 5-point scale. When analysing each item of the WEHS separately, the analyses showed a significant increase 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 ($Z = -3.66$, $p < .001$), the poor quality of the protective equipment ($Z = -3.40$, $p = .001$), quarantining ($Z = -2.20$, $p = .03$), the risk of less optimal care of non-COVID-19 patients ($Z = -2.87$, $p = .004$), the restart of the epidemic ($Z = -2.08$, $p = .04$), and finally, the significant surplus of work because of the many postponed patient care ($Z = -3.35$, $p = .001$). There was one type of worry where we found a decrement in the second wave compared to the first: participants reported significantly less worry about their non-sufficient professional training in second wave than in the first ($Z = -3.22$, $p = .001$). No significant changes were also obtained in relation to the possibility of infecting a family member ($Z = -1.30$, $p = .19$), about that patient should be discharged due to lack of healthcare capacity ($Z = -1.25$, $p = .21$), and regarding the potential financial difficulties arisen due to the epidemic ($Z = -.47$, $p = .64$).

3.3. Lower Well-being and Higher Distress in the Second than in the First Wave

Results indicted lower well-being in the second wave than in the first ($Z = -8.68$, $p < .001$; see Figure 2A). In addition, again in the second wave, healthcare workers had significantly higher distress both overall ($Z = -6.86$, $p < .001$) and in the three distress subscales separately (Depression: $Z = -5.39$, $p < .001$, Anxiety: $Z = -7.28$, $p < .001$, Stress: $Z = -6.69$, $p < .001$; 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 (Depression: $\chi 2 = -16.40$, $p < .001$, Anxiety: $\chi 2 = 34.95$, $p = .001$, Stress: $\chi 2 = 31.87$, $p < .001$).

3.4. COVID-19-related Worry Predicts Distress and Well-being, and Resilience Acts as a Mediator

The results of the mediation analyses are presented in Figure 4. The analysis revealed significant direct effect of COVID-19-related worry both on Well-being and Distress: great-er level of Worry predicted significantly lower Well-being but higher Distress. In addition, indirect effects were also significant showing the mediator role of Resilience. 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.

4. 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 needs to be handled by healthcare managements. 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 COVID-19 and non-COVID-19 patients. It is therefore essential to understand the concerns (i.e. worries) 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 COVID-19 patients healthcare providers reported higher levels of COVID-19-related worries overall. However, not all type of worries showed significant difference between the two waves. For example, worries about professional unpreparedness (i.e., insufficient professional training) to care for COVID-19 patients decreased in the second wave suggesting that participants had probably gained considerable treatment experience in the first wave of the outbreak. Despite of 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 non-COVID-19 patients may be jeopardized. 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 than as compared to the first wave. Although to varying degrees, but previous studies with healthcare providers also confirmed that distress among healthcare workers may be exceptionally high during the COVID 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 study [37] (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 of 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 renders the need of urgent interventions if we want to avoid personal tragedies and a drastic reduction in the stability of the health care 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 (i.e., worries), and enhancing those psychological defense 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 a 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 frequency religious activities, exercised more, 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 (e.g., 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 summarize, 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 level of worry and distress in both pandemic waves. When comparing the two waves, enhanced level of worry and distress as well as compromised well-being were found in the second wave: more than 50% percent 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 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.

5. STATEMENTS

CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

FINANCIAL SUPPORT STATEMENT

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

CREDIT AUTHOR CONTRIBUTIONS

Conceptualization, F.D., P.H., G.V., and Z.M.; methodology, A.C., B.B, and S.V.; software, N.G., G.V., and A.C.; validation, H.S., D.L. and A.E.; formal analysis, N.G.; investigation, F.D.; resources, P.H.; data curation, H.S., D.L., and A.E.; writing—original draft preparation, G.V., H.S., B.B., and A.C.; writing—review and editing, F.D., G.V., S.V., H.S., D.L., A.E., Z.M., P.H., and N.G.; visualization, A.C.; supervision, P.H.; project administration, S.V.; funding acquisition, P.H. All authors have read and agreed to the published version of the manuscript.

INSTITUTIONAL REVIEW BOARD STATEMENT

The study was approved by the Scientific and Research Ethics Committee of the Medical Research Council (IV/5079-2/2020/EKU). All the participants provided written informed consent to participate in this study. The ethics committee have carefully checked and approved the consent procedure.

INFORMED CONSENT STATEMENT

Online informed consent was obtained from all subjects involved in the study.

PATIENT AND PUBLIC INVOLVEMENT STATEMENT

Did not involve.

DATA AVAILABILITY STATEMENT

The original contributions generated for the study are included in the article/Supplementary Material, further inquiries can be directed to the corresponding author.

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None

SUPPLEMENTARY MATERIALS

Table S1: STROBE checklist, Table S2: Questionnaire, Appendix S1: Information for study participants, Appendix S2: Ethical approval

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

Variables	1st wave	2nd wave	*p*-value
N	376	406	
Age, mean (SD)	44.46 (11.82)	44.33 (11.14)	.92
Experience (years), mean (SD)	18.26 (12.60)	19.62 (12.16)	.09
Female/male, n (%)	251/125 (33.2/66.8%)	288/118 (29.1/70.9%)	.22
Physicians, n (%)	258 (68.6%)	236 (58.1%)	***.003***
Internists	94 (36.4%)	89 (37.7%)	.78
Intensive care professionals	40 (15.5%)	65 (27.5%)	***.001***
Anesthesiologists	41 (15.9%)	62 (26.3%)	***.005***
Emergency medicine	28 (10.9%)	23 (9.7%)	.77
Surgical profession	35 (13.6%)	23 (9.7%)	.21
Nurses, n (%)	70 (18.6%)	129 (31.8%)	***<.001***
Working at COVID-19 patient unit, n (%)	105 (27.9%)	128 (31.5%)	.27
Contact with COVID-19 patients, n (%)	115 (30.6%)	310 (76.4%)	***<.001***

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

6. FIGURE LEGEND

Figure 1. The different COVID-19-related worries during the two waves. Data are presented as mean and the standard error 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: Non-COVID-19 patients receive less optimal care than before, 9: The epidemic restarts, 10: Missing cases cause / will cause a significant surplus of work; *p < .05, **p < .01, ***p < .001.

Figure 2. Well-being in the first and the second wave of the pandemic (A) and Depression, anxiety, and stress in the first and the second wave of the pandemic (B). Data are presented as boxplot: median (black line), interquartile range (box) and minimum and maximum scores without outliers. Cut-off scores of the severe level are indicated by the horizontal dashed lines. ***p < .001.

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

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 standardized beta values. The 95% confidence intervals (CIs) are shown for the indirect effects. Both indirect effects are significant.

7. REFERENCES

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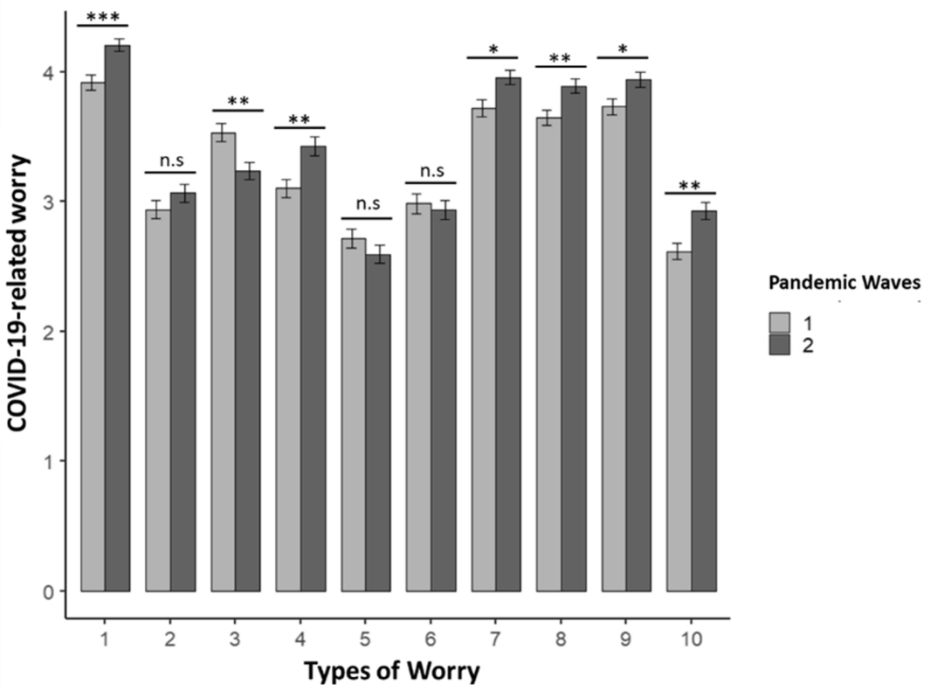

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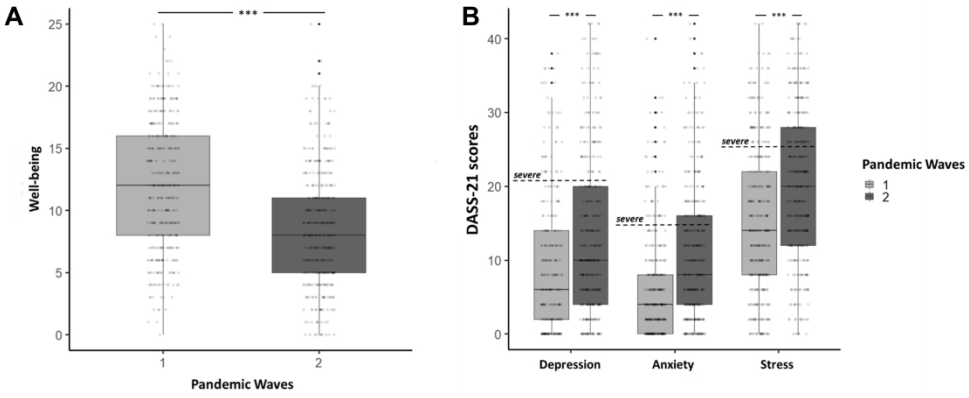

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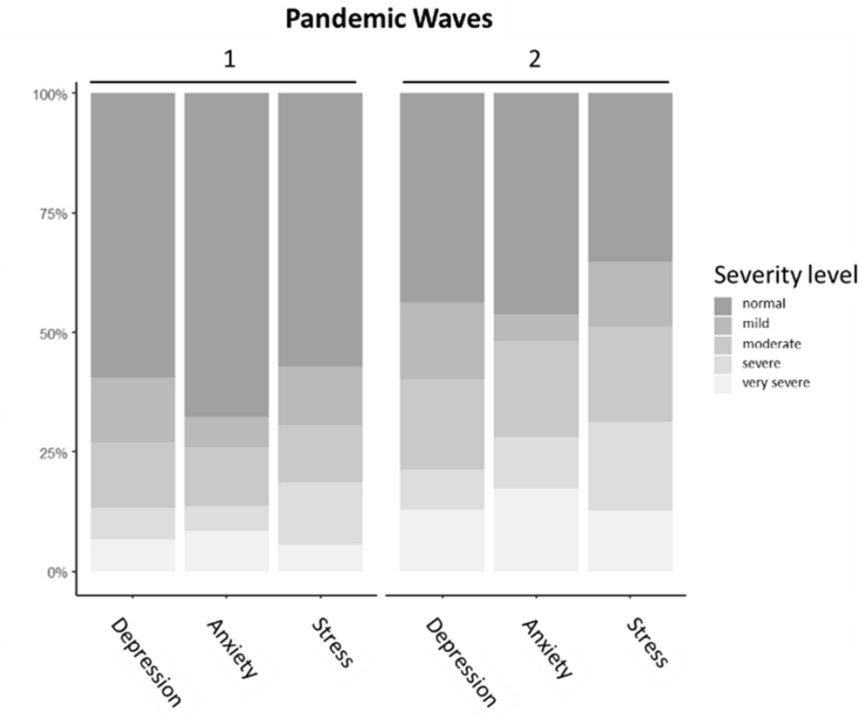

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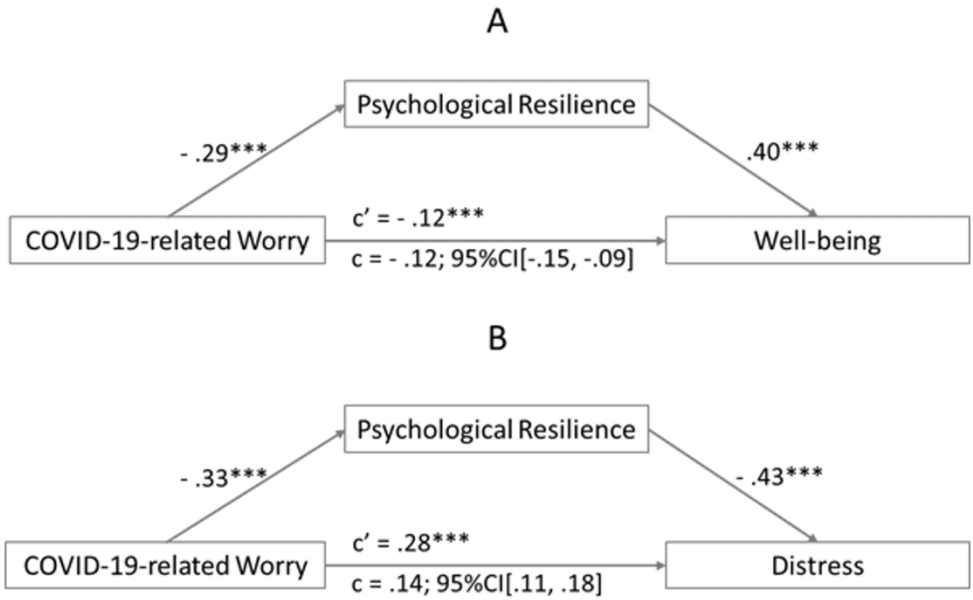

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SUPPLEMENTARY MATERIAL

TITLE

From Worry to Distress: Mental Health Adversities Among Healthcare Providers During the Two Waves of the COVID-19 Pandemic – a survey of healthcare workers

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	• Number of years between 18 and 100	Number	Yes
2	Please enter your sex	• 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.)	• 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.)	• 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)	• 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?	• Doctor • Nurse, assistant • Other professional staff	Single choice	Yes
7	How many years of clinical experience do you have?	• 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?	• 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?	• 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?	• 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?	• No • Yes	Single choice	Yes
12	Have you been diagnosed with coronavirus?	• 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.)	• 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.)	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	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?	• 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?	• 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?	• 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.	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	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	• 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.	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?	• It got a lot worse • It got a bit worse	Single choice	Yes

	(Considering the duration and quality of sleep.)	• 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)	• 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.	• 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.	• 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?	• 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	• 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.")	• 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:

Dr. Flóra Dezső

(anesthesiologist, psychotherapist)

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MH EK Military Hospital KAITO

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Appendix S1. Information for study participants - continued

Questionnaire 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 TUKEB)

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**
Administrator: **Dr Tamás Kardon Secretary**
E-mail: tukeb@emmi.gov.hu
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Subject: Authorization Decree

Research Center: Military Hospital – State Health Centre, Central Department of Anaesthesiology and Intensive Care (44 Róbert Károly Blvd. Budapest 1134) University of Pécs Medical School Institute for Translational Medicine (12 Szigeti Street Pécs 7624)

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.

Prof. Dr. Péter Hegyi
Head of Institute

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

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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

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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

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ABSTRACT

Objectives

The current global health crisis of the coronavirus disease 2019 (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 mediate the association of worry with well-being and distress. Multiple Linear Regression analyses were performed.

Results

The results indicated that healthcare workers had high level of worry and distress in both pandemic waves. When comparing the two waves, enhanced levels of worry [Wald's $\chi^2 = 4.36$, $p = .04$] and distress [Wald's $\chi^2 = 25.18$, $p < .001$], as well as compromised well-being [Wald's $\chi^2 = 58.64$, $p < .001$], 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).

Keywords

COVID-19, healthcare providers, COVID-19-related worry, well-being, distress, resilience, SARS-CoV-2

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 (e.g., 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 coronavirus disease 2019 (COVID-19) pandemic has 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 (SARS) 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 to 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 (e.g., anxiety, depression, posttraumatic stress disorder, burnout) proliferate and require individual, organizational, 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 (i.e., 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 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 adversities are 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, engage in protective and preventive behaviors 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, healthcare workers might 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 (e.g., level of anxiety and depression) in the first and second wave 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 to the first peak 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 (STROBE) Statement [27] (see Table S1) and adhered to the Declaration of Helsinki [28] concerning ethical principles for medical researches involving human subjects.

Participants and Procedure

Participants were recruited through an online survey which was delivered to different health care institutions including units for COVID-19 patients 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 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 (Appendix S1). The research was approved by Scientific and Research Ethics Committee of the Hungarian Medical Research Council (IV/5079-2/2020/EKU, Appendix S2). Participants were asked to complete the survey consisting of demographical questions (i.e., age, gender, occupation, fields, position, care for COVID-19 positive patients) and four self-report questionnaires (see below 2.2. and Table S2).

Due to technical failure, during wave 1, responses from 92 participants for one of the items of the DASS Depression scale [29] were not recorded. Depression score 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, 5 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. (5) Patients should be discharged due to lack of capacity. (6) My financial difficulties arise/ worsen. (7) I have to go to quarantine. (8) Non-COVID-19 patients 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 five-point Likert scale (1=not at all – 5=to a very large extent). The internal consistency of the items was acceptable (Cronbach-α = .77).

Depression, Anxiety and Stress Scale

To estimate the level of Distress, Depression, Anxiety and Stress DASS-21 with 21 items was used [29]. DASS-21 includes three subscales (7 items each): depression, anxiety, and stress. Each item was scored on a five-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 et al. (2019) [30]. All scales demonstrated good or excellent internal consistency (Depression: Cronbach-α = .92; Anxiety: Cronbach-α = .84; Stress: Cronbach-α = .89; Total: Cronbach-α = .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 6 items, and each item is rated on a five-point Likert scale (1 = Strongly Disagree – 5 = Strongly Agree), (Cronbach-α = .87).

WHO-5 Well-Being Scale

The 5-item World Health Organization Well-Being Index (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 two weeks. Each item was scored on a six-point Likert scale (5 = all of the time – 0 = at no time). (Cronbach-α =.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 for categorical variables. To examine the difference between the two pandemic waves in worries, distress, and well-being, we assessed Generalized Linear Models (GLM) with robust standard error estimates. As predictors, each model included pandemic wave, occupational status (i.e. Physician or Nurse) and contact with COVID patients (i.e. a variable showing whether the healthcare worker had contact with COVID patients 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-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 (version 3.5.3, model 4, 5000 bootstrap samples). Continuous variables were mean-centered. Two separate analyses were performed for Well-being and Distress as outcome variables. In both models (i.e. 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 the contact with COVID-19 patients.

Data were analysed with SPSS version 25 (International Business Machines Corporation, USA), and figures were made using R version 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 summarized in Table 1. The analysis showed no differences in age, work experience, and gender; however, occupational status comparing the participants in the two waves were different. In addition, we found no significant difference between the two waves in the number of health care workers who worked on COVID-19 patient units. However, there was a significant difference in the number of healthcare workers contacted with COVID-19 patients 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 (β = -.17, Wald's χ^2 = 4.36, p = .04). The overall level of worry in both waves can be considered high with approximate mean scores of 3 (i.e., wave 1: mean = 3.29, SD = .77; wave 2: mean = 3.42, SD = .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 (β = -.17, Wald's χ^2 = 4.36, p = .04), the poor quality of the protective equipment (β = -.24, Wald's χ^2 = 9.50, p < .01), quarantining (β = -.22, Wald's χ^2 = 7.49, p < .01), the risk of less optimal care of non-COVID-19 patients (β = -.23, Wald's χ^2 = 9.12, p < .01), the significant surplus of work because of the many postponed patient care (β = -.25, Wald's χ^2 = 10.28, p = .001), and finally, with marginal significance, the restart of the epidemic (β = -.15, Wald's χ^2 = 3.63, p = .057)

There was one type of worry where we found a decrement in the second wave compared to the first: participants reported significantly less worry about their non-sufficient professional training in second wave than in the first (β = .19, Wald's χ^2 = 5.56, p = .02).

No significant changes were also obtained in relation to the possibility of infecting a family member (β = -.14, Wald's χ^2 = 3.06, p = .08), about that patient should be discharged due to lack of healthcare capacity (β = .10, Wald's χ^2 = 1.59, p = .21), and regarding the potential financial difficulties arisen due to the epidemic (β = .09, Wald's χ^2 = 1.17, p = .28).

Lower Well-being and Higher Distress in the Second than in the First Wave

Results indicted lower well-being in the second wave than in the first (β = .61, Wald's χ^2 = 58.64, p < .001; see Figure 2A). In addition, again in the second wave, healthcare workers had significantly higher distress both overall (β = -.43, Wald's χ^2 = 25.18, p < .001) and in the three distress subscales separately (Depression: β = -.35, Wald's χ^2 = 16.21, p < .001, Anxiety: β = -.40, Wald's χ^2 = 24.89, p < .001, Stress: β = -.39, Wald's χ^2 = 23.88, p < .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: β = .56, Wald's χ^2 = 10.22, p < .01, OR = 1.75; Anxiety: β = .73, Wald's χ^2 = 19.24, p < .001, OR = 2.08, p = .001; Stress: β = .59, Wald's χ^2 = 11.47, p < .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 COVID patients, and pandemic waves showed that higher level of COVID-related worry was significantly associated with higher distress and lower well-being among the healthcare workers.

The results of the mediation analyses are presented in Figure 4 and summarized 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: $t = -7.26$, $p < .001$, $\beta = -.24$, 95%CI: -1.24 – -.24; direct effect: $t = -3.91$, $p < .001$, $\beta = -.12$, 95%CI: -1.32 – -.44) but higher Distress (total effect: $t = 12.56$, $p < .001$, $\beta = .42$, 95%CI: 6.34 – 8.69; direct effect: $t = 8.82$, $p < .001$, $\beta = .27$, 95%CI: 3.85 – 6.06).

In addition, in both mediator models, indirect effects were also significant showing the mediator role of Resilience (Well-being model: $\beta = -.12$, 95%CI: -.15 – -.09, proportion of mediation: 50%; Distress model: $\beta = .14$, 95%CI: .11 – -.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.

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 needs to be handled by healthcare managements. 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 COVID-19 and non-COVID-19 patients. It is therefore essential to understand the concerns (i.e. worries) 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 COVID-19 patients healthcare providers reported higher levels of COVID-19-related worries overall. However, not all type of worries showed significant difference between the two waves. For example, worries about professional unpreparedness (i.e., insufficient professional training) to care for COVID-19 patients decreased in the second wave suggesting that participants had probably gained considerable treatment experience in the first

wave of the outbreak. Despite of 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 non-COVID-19 patients may be jeopardized. 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 than as compared to the first wave. Although to varying degrees, but previous studies with healthcare providers also confirmed that distress among healthcare workers may be exceptionally high during the COVID 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 study [37] (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 of 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 renders the need of urgent interventions if we want to avoid personal tragedies and a drastic reduction in the stability of the health care 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 (i.e., worries), and enhancing those psychological defense 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 a 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 frequency religious activities, exercised more, 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 (e.g., 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 summarize, 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 level of worry and distress in both pandemic waves. When comparing the two waves, enhanced level of worry and distress as well as compromised well-being were found in the second wave: more than 50% percent 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 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.

STATEMENTS

CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

FINANCIAL SUPPORT STATEMENT

Funding was provided by an Economic Development and Innovation Operative Pro-gramme 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).

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

CREDIT AUTHOR CONTRIBUTIONS

Conceptualization, F.D., P.H., G.V., and Z.M.; methodology, A.C., B.B, and S.V.; software, N.G., G.V., and A.C.; validation, H.S., D.L. and A.E.; formal analysis, N.G.; investigation, F.D.; resources, P.H.; data curation, H.S., D.L., and A.E.; writing—original draft preparation, G.V., H.S., B.B., and A.C.; writing—review and editing, F.D., G.V., S.V., H.S., D.L., A.E., Z.M., P.H., and N.G.; visualization, A.C.; supervision, P.H.; project administration, S.V.; funding acquisition, P.H. All authors have read and agreed to the published version of the manuscript.

INSTITUTIONAL REVIEW BOARD STATEMENT

The study was approved by the Scientific and Research Ethics Committee of the Medical Research Council (IV/5079-2/2020/EKU). All the participants provided written informed consent to participate in this study. The ethics committee have carefully checked and approved the consent procedure.

INFORMED CONSENT STATEMENT

Online informed consent was obtained from all subjects involved in the study.

PATIENT AND PUBLIC INVOLVEMENT STATEMENT

Did not involve.

DATA AVAILABILITY STATEMENT

The original contributions generated for the study are included in the article/Supplementary Material, further inquiries can be directed to the corresponding author.

ACKNOWLEDGMENTS

The authors thank Dr. András Matuz (Dept. Behavioural Sciences, Medical School, Univ. Pécs) for the valuable statistical advice.

SUPPLEMENTARY MATERIALS

Table S1: STROBE checklist, Table S2: Questionnaire, Appendix S1: Information for study participants, Appendix S2: Ethical approval

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

Variables	1st wave	2nd wave	*p*-value
N	376	406	
Age, mean (SD)	44.46 (11.82)	44.33 (11.14)	.92
Experience (years), mean (SD)	18.26 (12.60)	19.62 (12.16)	.09
Female/male, n (%)	251/125 (33.2/66.8%)	288/118 (29.1/70.9%)	.22
*Physicians, n (%)	258 (68.6%)	236 (58.1%)	***.003***
Internists	94 (36.4%)	89 (37.7%)	.78
Intensive care professionals	40 (15.5%)	65 (27.5%)	***.001***
Anesthesiologists	41 (15.9%)	62 (26.3%)	***.005***
Emergency medicine	28 (10.9%)	23 (9.7%)	.77
Surgical profession	35 (13.6%)	23 (9.7%)	.21
Nurses, n (%)	70 (18.6%)	129 (31.8%)	***<.001***
Working at COVID-19 patient unit, n (%)	105 (27.9%)	128 (31.5%)	.27
Contact with COVID-19 patients, n (%)	115 (30.6%)	310 (76.4%)	***<.001***

Note. Mann–Whitney U-test was performed for the continuous variables (i.e. 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.

Table 2. Multiple linear regression results of COVID-related Worry and control variables predicting Well-being and Distress.

Predictors	**Well-being**				**Distress**			
	β	t	CI_{LB}	CI_{HB}	*β*	t	CI_{LB}	CI_{HB}
Worry	-.24	-7.26***	-2.16	-1.24	.42	12.56***	-22.59	-9.84
Wave	-.29	-7.70***	-3.74	-2.22	.18	4.82***	6.34	8.69
Age	.07	2.09*	.00	.06	-.08	-2.48*	2.86	6.80
Gender	-.09	-2.65**	-1.74	-.26	.12	3.45***	-.17	-.02
Contact	-.02	-.39	-.93	.62	.06	1.67	1.44	5.23
df	5,776				5,684			
R^2	.14				.27			
F	33.95***				51.87***			

Note: Worry: COVID-19-related Worry; Wave: Pandemic waves; Contact: Contact with COVID patients

β: standardized *β* values; CI_{LB}: 95% Confidence Interval Lower bound; CI_{HB}: 95% Confidence Interval Higher bound; * $p < .05$; ** $p < .01$; *** $p < .001$

FIGURE LEGEND

Figure 1. The different COVID-19-related worries during the two waves. Data are presented as mean and the standard error 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: Non-COVID-19 patients receive less optimal care than before, 9: The epidemic restarts, 10: Missing cases cause / will cause a significant surplus of work; n.s.: non-significant, m: $p = .057$, *$p < .05$, **$p < .01$. The statistical comparison of the two waves was controlled for occupational status, and the contact with COVID patients.

Figure 2. Well-being in the first and the second wave of the pandemic (A) and Depression, anxiety, and stress in the first and the second wave of the pandemic (B). Data are presented as boxplot: median (black line), interquartile range (box) and minimum and maximum scores without outliers. Cut-off scores of the severe level are indicated by the horizontal dashed lines. ***$p < .001$. The statistical comparison of the two waves was controlled for occupational status, and the contact with COVID patients.

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

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 standardized beta values. The 95% confidence intervals (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 COVID-19 patients.

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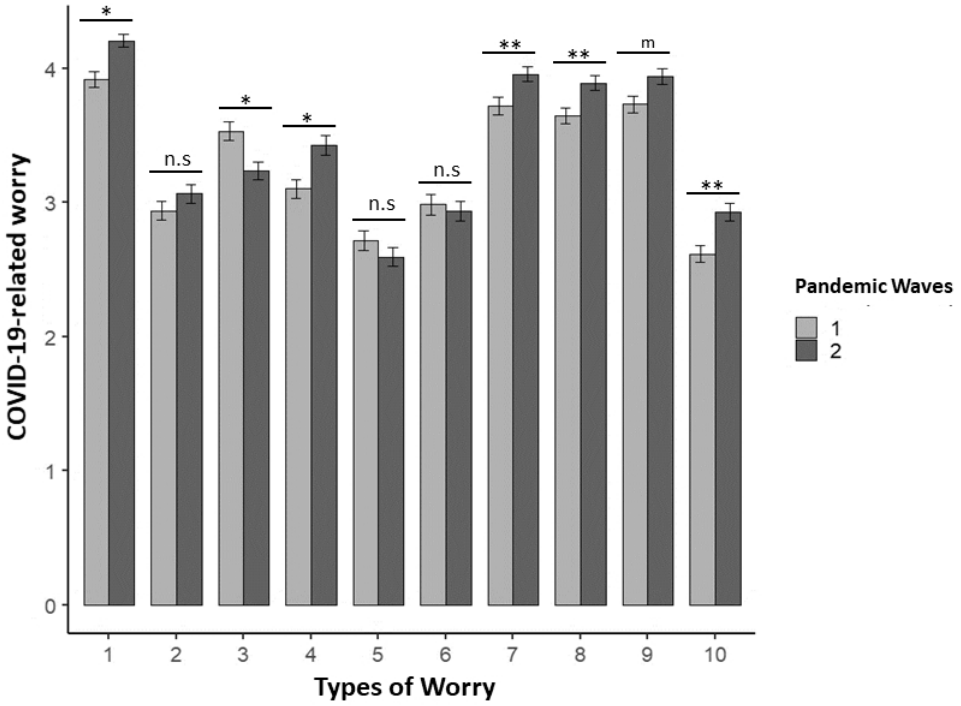

Figure 1. The different COVID-19-related worries during the two waves. Data are presented as mean and the standard error of means. Types of worry, 1: I become infected and become seriously ill / die, 2: I infect a family member, 3: I did not receive sufficient professional training, 4: Little or poor 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: Non-COVID-19 patients receive less optimal care than before, 9: The epidemic restarts, 10: Missing cases cause / will cause a significant surplus of work; n.s.: non-significant, m: p = .057, *p < .05, **p < .01. The statistical comparison of the two waves was controlled for occupational status, and the contact with COVID patients.

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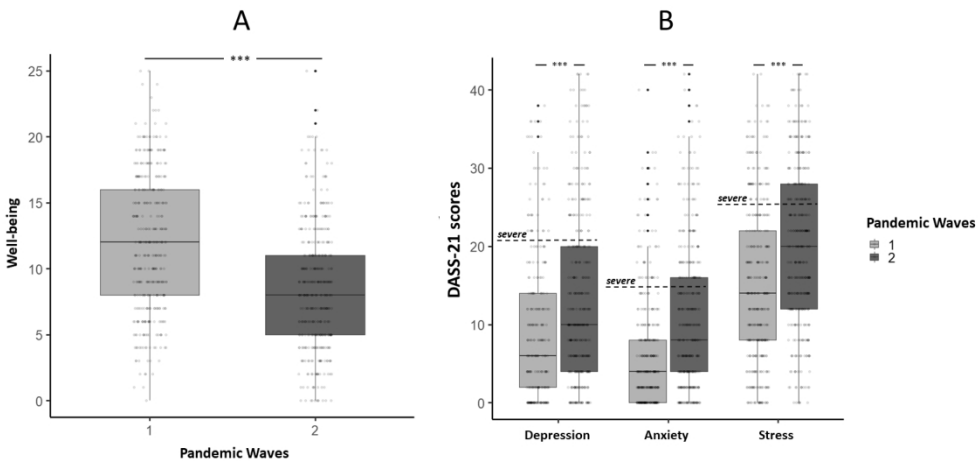

Figure 2. Well-being in the first and the second wave of the pandemic (A) and Depression, anxiety, and stress in the first and the second wave of the pandemic (B). Data are presented as boxplot: median (black line), interquartile range (box) and minimum and maximum scores without outliers. Cut-off scores of the severe level are indicated by the horizontal dashed lines. ***p < .001. The statistical comparison of the two waves was controlled for occupational status, and the contact with COVID patients.

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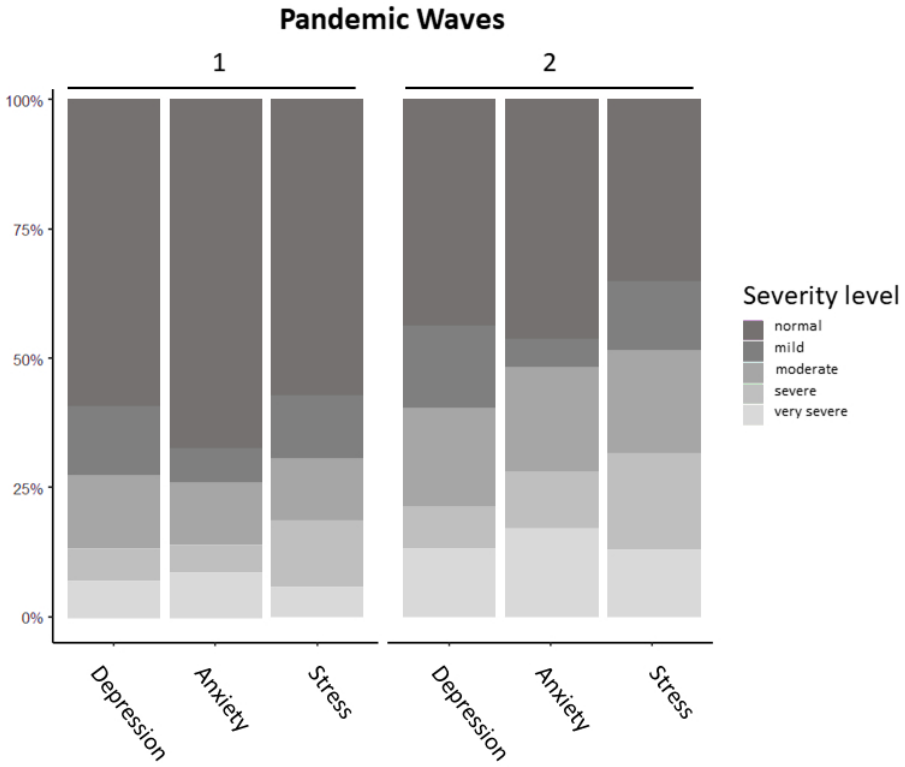

Figure 3. Proportion of the severity levels in depression, anxiety, and stress in the first and the second wave of the pandemic.

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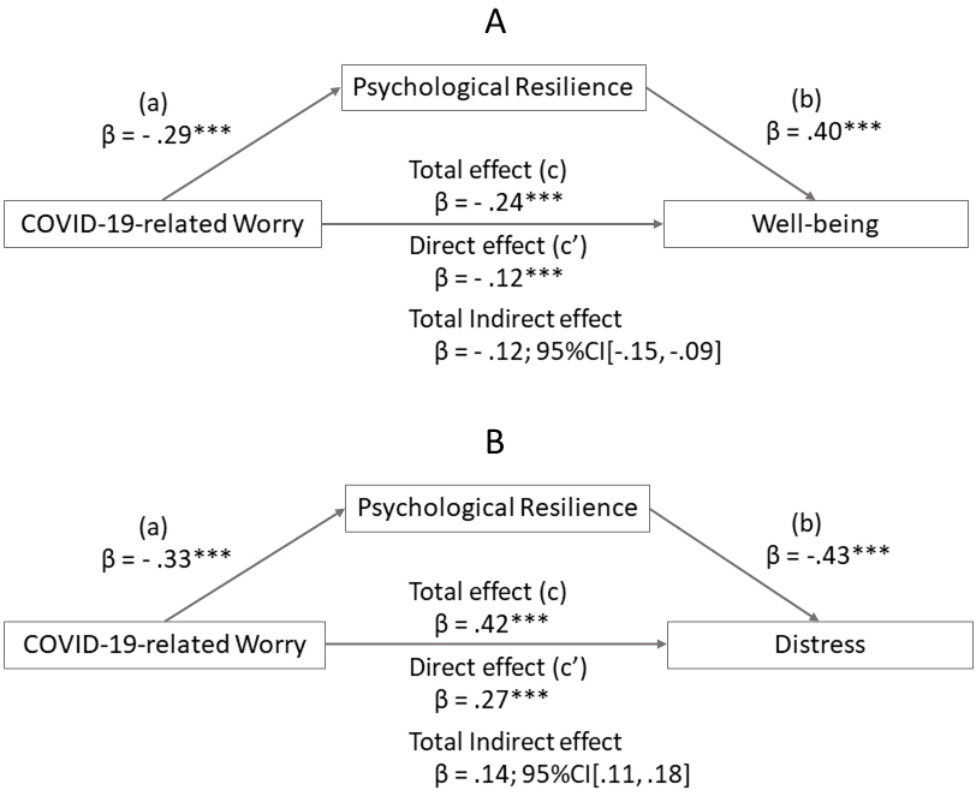

Figure 4. Results of the mediation analyses for the effects of COVID-19-related worry on Well-being (A) and Distress (B) mediated by Psychological resilience. The values along the arrows are standardized beta values. The 95% confidence intervals (CIs) are shown for the indirect effects. Both indirect effects are significant. The analyses were controlled for pandemic waves, gender, age, and the contact with COVID-19 patients.

220x179mm (96 x 96 DPI)

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	• Number of years between 18 and 100	Number	Yes
2	Please enter your sex	• 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.)	• 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.)	• 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)	• 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?	• Doctor • Nurse, assistant • Other professional staff	Single choice	Yes
7	How many years of clinical experience do you have?	• 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?	• 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?	• 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?	• 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?	• No • Yes	Single choice	Yes
12	Have you been diagnosed with coronavirus?	• 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.)	• 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.)	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	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?	• 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?	• 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?	• 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.	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	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	• 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.	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?	• It got a lot worse • It got a bit worse	Single choice	Yes

	(Considering the duration and quality of sleep.)	• 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)	• 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.	• 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.	• 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?	• 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	• 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.")	• 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:

Dr. Flóra Dezső

(anesthesiologist, psychotherapist)

dflorad@gmail.com

MH EK Military Hospital KAITO

HU-1134 Budapest, Róbert Károly krt. 44.

Appendix S1. Information for study participants - continued

Questionnaire 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 TUKEB)

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**
Administrator: **Dr Tamás Kardon Secretary**
E-mail: tukeb@emmi.gov.hu
Phone: **+(36) 1 795-1197**

Subject: Authorization Decree

Research Center: Military Hospital – State Health Centre, Central Department of Anaesthesiology and Intensive Care (44 Róbert Károly Blvd. Budapest 1134) University of Pécs Medical School Institute for Translational Medicine (12 Szigeti Street Pécs 7624)

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.

Prof. Dr. Péter Hegyi
Head of Institute

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

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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

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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

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ABSTRACT

Objectives

The current global health crisis of the coronavirus disease 2019 (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 mediate the association of worry with well-being and distress. Multiple Linear Regression analyses were performed.

Results

The results indicated that healthcare workers had high level of worry and distress in both pandemic waves. When comparing the two waves, enhanced levels of worry [Wald's $\chi^2 = 4.36$, $p = .04$] and distress [Wald's $\chi^2 = 25.18$, $p < .001$], as well as compromised well-being [Wald's $\chi^2 = 58.64$, $p < .001$], 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).

Keywords

COVID-19, healthcare providers, COVID-19-related worry, well-being, distress, resilience, SARS-CoV-2

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 (e.g., 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 coronavirus disease 2019 (COVID-19) pandemic has 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 (SARS) 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 to 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 (e.g., anxiety, depression, posttraumatic stress disorder, burnout) proliferate and require individual, organizational, 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 (i.e., 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 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 adversities are 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, engage in protective and preventive behaviors 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, healthcare workers might 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 (e.g., level of anxiety and depression) in the first and second wave 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 to the first peak 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 (STROBE) Statement [27] (see Table S1) and adhered to the Declaration of Helsinki [28] concerning ethical principles for medical researches involving human subjects.

Participants and Procedure

Participants were recruited through an online survey which was delivered to different health care institutions including units for COVID-19 patients 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 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 (Appendix S1). The research was approved by Scientific and Research Ethics Committee of the Hungarian Medical Research Council (IV/5079-2/2020/EKU, Appendix S2). Participants were asked to complete the survey consisting of demographical questions (i.e., age, gender, occupation, fields, position, care for COVID-19 positive patients) and four self-report questionnaires (see below 2.2. and Table S2).

Due to technical failure, during wave 1, responses from 92 participants for one of the items of the DASS Depression scale [29] were not recorded. Depression score 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, 5 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. (5) Patients should be discharged due to lack of capacity. (6) My financial difficulties arise/ worsen. (7) I have to go to quarantine. (8) Non-COVID-19 patients 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 five-point Likert scale (1=not at all – 5=to a very large extent). The internal consistency of the items was acceptable (Cronbach-α = .77).

Depression, Anxiety and Stress Scale

To estimate the level of Distress, Depression, Anxiety and Stress DASS-21 with 21 items was used [29]. DASS-21 includes three subscales (7 items each): depression, anxiety, and stress. Each item was scored on a five-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 et al. (2019) [30]. All scales demonstrated good or excellent internal consistency (Depression: Cronbach-α = .92; Anxiety: Cronbach-α = .84; Stress: Cronbach-α = .89; Total: Cronbach-α = .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 6 items, and each item is rated on a five-point Likert scale (1 = Strongly Disagree – 5 = Strongly Agree), (Cronbach-α = .87).

WHO-5 Well-Being Scale

The 5-item World Health Organization Well-Being Index (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 two weeks. Each item was scored on a six-point Likert scale (5 = all of the time – 0 = at no time). (Cronbach-α =.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 for categorical variables. To examine the difference between the two pandemic waves in worries, distress, and well-being, we assessed General Linear Models (GLM) with robust standard error estimates. As predictors, each model included pandemic wave, occupational status (i.e. Physician or Nurse) and contact with COVID patients (i.e. a variable showing whether the healthcare worker had contact with COVID patients 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-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 (version 3.5.3, model 4, 5000 bootstrap samples). Continuous variables were mean-centered. Two separate analyses were performed for Well-being and Distress as outcome variables. In both models (i.e. 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 the contact with COVID-19 patients.

Data were analysed with SPSS version 25 (International Business Machines Corporation, USA), and figures were made using R version 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 summarized in Table 1.

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

Variables	1st wave	2nd wave	*p*-value
N	376	406	
Age, mean (SD)	44.46 (11.82)	44.33 (11.14)	.92
Experience (years), mean (SD)	18.26 (12.60)	19.62 (12.16)	.09
Female/male, n (%)	251/125 (33.2/66.8%)	288/118 (29.1/70.9%)	.22
*Physicians, n (%)	258 (68.6%)	236 (58.1%)	***.003***
Internists	94 (36.4%)	89 (37.7%)	.78
Intensive care professionals	40 (15.5%)	65 (27.5%)	***.001***
Anesthesiologists	41 (15.9%)	62 (26.3%)	***.005***
Emergency medicine	28 (10.9%)	23 (9.7%)	.77
Surgical profession	35 (13.6%)	23 (9.7%)	.21
Nurses, n (%)	70 (18.6%)	129 (31.8%)	***<.001***
Working at COVID-19 patient unit, n (%)	105 (27.9%)	128 (31.5%)	.27
Contact with COVID-19 patients, n (%)	115 (30.6%)	310 (76.4%)	***<.001***

Note. Mann–Whitney U-test was performed for the continuous variables (i.e. 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.

The analysis showed no differences in age, work experience, and gender; however, occupational status comparing the participants in the two waves were different. In addition, we found no significant difference between the two waves in the number of health care workers who worked on COVID-19 patient units. However, there was a significant difference in the number of healthcare workers contacted with COVID-19 patients 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 (β = -.17, Wald's χ^2 = 4.36, p = .04). The overall level of worry in both waves can be considered high with approximate mean scores of 3 (i.e., wave 1: mean = 3.29, SD = .77; wave 2: mean = 3.42, SD = .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 (β = -.17, Wald's χ^2 = 4.36, p = .04), the poor quality of the protective equipment (β = -.24, Wald's χ^2 = 9.50, p < .01), quarantining (β = -.22, Wald's χ^2 = 7.49, p < .01), the risk of less optimal care of non-COVID-19 patients (β = -.23, Wald's χ^2 = 9.12, p < .01), the significant surplus of work because of the many postponed patient care (β = -.25, Wald's χ^2 = 10.28, p = .001), and finally, with marginal significance, the restart of the epidemic (β = -.15, Wald's χ^2 = 3.63, p = .057)

There was one type of worry where we found a decrement in the second wave compared to the first: participants reported significantly less worry about their non-sufficient professional training in second wave than in the first (β = .19, Wald's χ^2 = 5.56, p = .02).

No significant changes were also obtained in relation to the possibility of infecting a family member (β = -.14, Wald's χ^2 = 3.06, p = .08), about that patient should be discharged due to lack of healthcare capacity (β = .10, Wald's χ^2 = 1.59, p = .21), and regarding the potential financial difficulties arisen due to the epidemic (β = .09, Wald's χ^2 = 1.17, p = .28).

Lower Well-being and Higher Distress in the Second than in the First Wave

Results indicted lower well-being in the second wave than in the first (β = .61, Wald's χ^2 = 58.64, p < .001; see Figure 2A). In addition, again in the second wave, healthcare workers had significantly higher distress both overall (β = -.43, Wald's χ^2 = 25.18, p < .001) and in the three distress subscales separately (Depression: β = -.35, Wald's χ^2 = 16.21, p < .001, Anxiety: β = -.40, Wald's χ^2 = 24.89, p < .001, Stress: β = -.39, Wald's χ^2 = 23.88, p < .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: β = .56, Wald's χ^2 = 10.22, p < .01, OR = 1.75; Anxiety: β = .73, Wald's χ^2 = 19.24, p < .001, OR = 2.08, p = .001; Stress: β = .59, Wald's χ^2 = 11.47, p < .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.

Table 2. Multiple linear regression results of COVID-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	-.24	-7.26***	-2.16	-1.24	.42	12.56***	-22.59	-9.84
Wave	-.29	-7.70***	-3.74	-2.22	.18	4.82***	6.34	8.69
Age	.07	2.09*	.00	.06	-.08	-2.48*	2.86	6.80
Gender	-.09	-2.65**	-1.74	-.26	.12	3.45***	-.17	-.02
Contact	-.02	-.39	-.93	.62	.06	1.67	1.44	5.23
df	5,776				5,684			
R^2	.14				.27			
F	33.95***				51.87***			

Note: Worry: COVID-19-related Worry; Wave: Pandemic waves; Contact: Contact with COVID patients

b: regression estimates; CI_{LB}: 95% Confidence Interval Lower bound; CI_{HB}: 95% Confidence Interval Higher bound; * *p* < .05; ** *p* < .01; *** *p* < .001

The analyses controlling for gender, age, contact with COVID patients, and pandemic waves showed that higher level of COVID-related worry was significantly associated with higher distress and lower well-being among the healthcare workers.

The results of the mediation analyses are presented in Figure 4 and summarized 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: $t = -7.26$, $p < .001$, $\beta = -.24$, 95%CI: -1.24 – -.24; direct effect: $t = -3.91$, $p < .001$, $\beta = -.12$, 95%CI: -1.32 – -.44) but higher Distress (total effect: $t = 12.56$, $p < .001$, $\beta = .42$, 95%CI: 6.34 – 8.69; direct effect: $t = 8.82$, $p < .001$, $\beta = .27$, 95%CI: 3.85 – 6.06).

In addition, in both mediator models, indirect effects were also significant showing the mediator role of Resilience (Well-being model: $\beta = -.12$, 95%CI: -.15 – -.09, proportion of mediation: 50%; Distress model: $\beta = .14$, 95%CI: .11 – -.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.

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 needs to be handled by healthcare managements. 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 COVID-19 and non-COVID-19 patients. It is therefore essential to understand the concerns (i.e. worries) 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 COVID-19 patients healthcare providers reported higher levels of COVID-19-related worries overall. However, not all type of worries showed significant difference between the two waves. For example, worries about professional unpreparedness (i.e., insufficient professional training) to care for COVID-19 patients decreased in the second wave suggesting that participants had probably gained considerable treatment experience in the first wave of the outbreak. Despite of 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 non-COVID-19 patients may be jeopardized. 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 than as compared to the first wave. Although to varying degrees, but previous studies with healthcare providers also confirmed that distress among healthcare workers may be exceptionally high during the COVID 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 study [37] (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 of 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 renders the need of urgent interventions if we want to avoid personal tragedies and a drastic reduction in the stability of the health care 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 (i.e., worries), and enhancing those psychological defense 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 a 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 frequency religious activities, exercised more, 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 (e.g., 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 summarize, 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 level of worry and distress in both pandemic waves. When comparing the two waves, enhanced level of worry and distress as well as compromised well-being were found in the second wave: more than 50% percent 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 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.

STATEMENTS

CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

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

CREDIT AUTHOR CONTRIBUTIONS

Conceptualization, F.D., P.H., G.V., and Z.M.; methodology, A.C., B.B, and S.V.; software, N.G., G.V., and A.C.; validation, H.S., D.L. and A.E.; formal analysis, N.G.; investigation, F.D.; resources, P.H.; data curation, H.S., D.L., and A.E.; writing—original draft preparation, G.V., H.S., B.B., and A.C.; writing—review and editing, F.D., G.V., S.V., H.S., D.L., A.E., Z.M., P.H., and N.G.; visualization, A.C.; supervision, P.H.; project administration, S.V.; funding acquisition, P.H. All authors have read and agreed to the published version of the manuscript.

INSTITUTIONAL REVIEW BOARD STATEMENT

The study was approved by the Scientific and Research Ethics Committee of the Medical Research Council (IV/5079-2/2020/EKU). All the participants provided written informed consent to participate in this study. The ethics committee have carefully checked and approved the consent procedure.

INFORMED CONSENT STATEMENT

Online informed consent was obtained from all subjects involved in the study.

PATIENT AND PUBLIC INVOLVEMENT STATEMENT

Did not involve.

DATA AVAILABILITY STATEMENT

The original contributions generated for the study are included in the article/Supplementary Material, further inquiries can be directed to the corresponding author.

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SUPPLEMENTARY MATERIALS

Table S1: STROBE checklist, Table S2: Questionnaire, Appendix S1: Information for study participants, Appendix S2: Ethical approval

FIGURE LEGEND

Figure 1. The different COVID-19-related worries during the two waves. Data are presented as mean and the standard error 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: Non-COVID-19 patients receive less optimal care than before, 9: The epidemic restarts, 10: Missing cases cause / will cause a significant surplus of work; n.s.: non-significant, m: $p = .057$, *$p < .05$, **$p < .01$. The statistical comparison of the two waves was controlled for occupational status, and the contact with COVID patients.

Figure 2. Well-being in the first and the second wave of the pandemic (A) and Depression, anxiety, and stress in the first and the second wave of the pandemic (B). Data are presented as boxplot: median (black line), interquartile range (box) and minimum and maximum scores without outliers. Cut-off scores of the severe level are indicated by the horizontal dashed lines. ***$p < .001$. The statistical comparison of the two waves was controlled for occupational status, and the contact with COVID patients.

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

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 (standardized). The 95% confidence intervals (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 COVID-19 patients.

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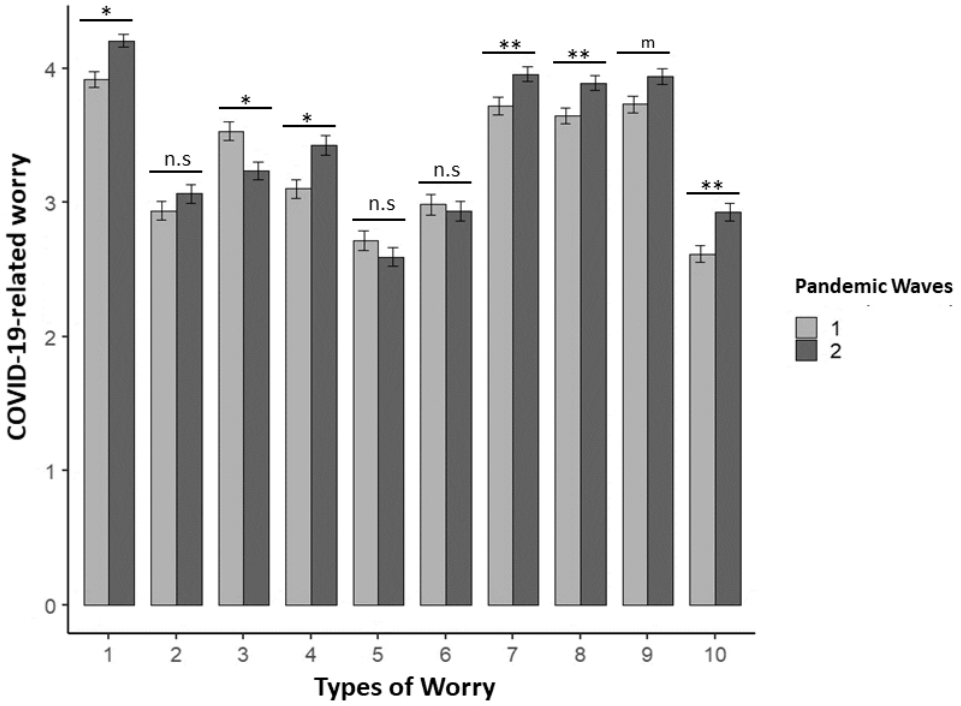

Figure 1. The different COVID-19-related worries during the two waves. Data are presented as mean and the standard error of means. Types of worry, 1: I become infected and become seriously ill / die, 2: I infect a family member, 3: I did not receive sufficient professional training, 4: Little or poor 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: Non-COVID-19 patients receive less optimal care than before, 9: The epidemic restarts, 10: Missing cases cause / will cause a significant surplus of work; n.s.: non-significant, m: p = .057, *p < .05, **p < .01. The statistical comparison of the two waves was controlled for occupational status, and the contact with COVID patients.

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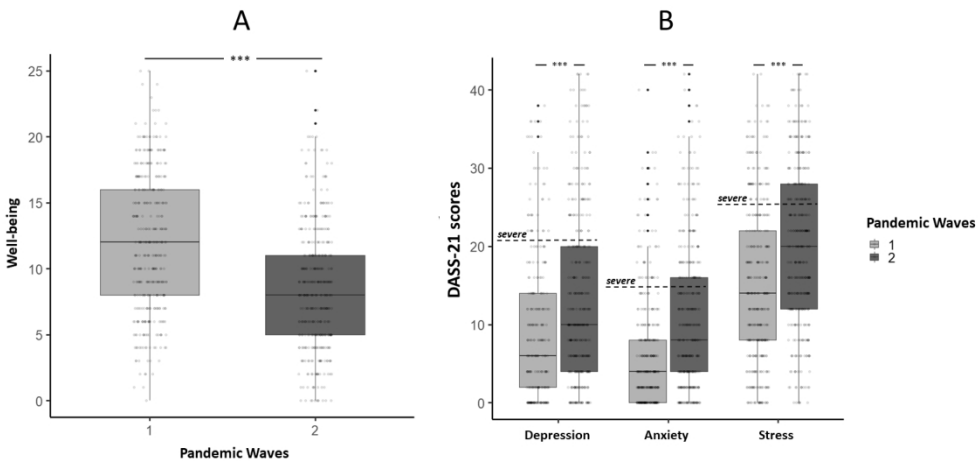

Figure 2. Well-being in the first and the second wave of the pandemic (A) and Depression, anxiety, and stress in the first and the second wave of the pandemic (B). Data are presented as boxplot: median (black line), interquartile range (box) and minimum and maximum scores without outliers. Cut-off scores of the severe level are indicated by the horizontal dashed lines. ***p < .001. The statistical comparison of the two waves was controlled for occupational status, and the contact with COVID patients.

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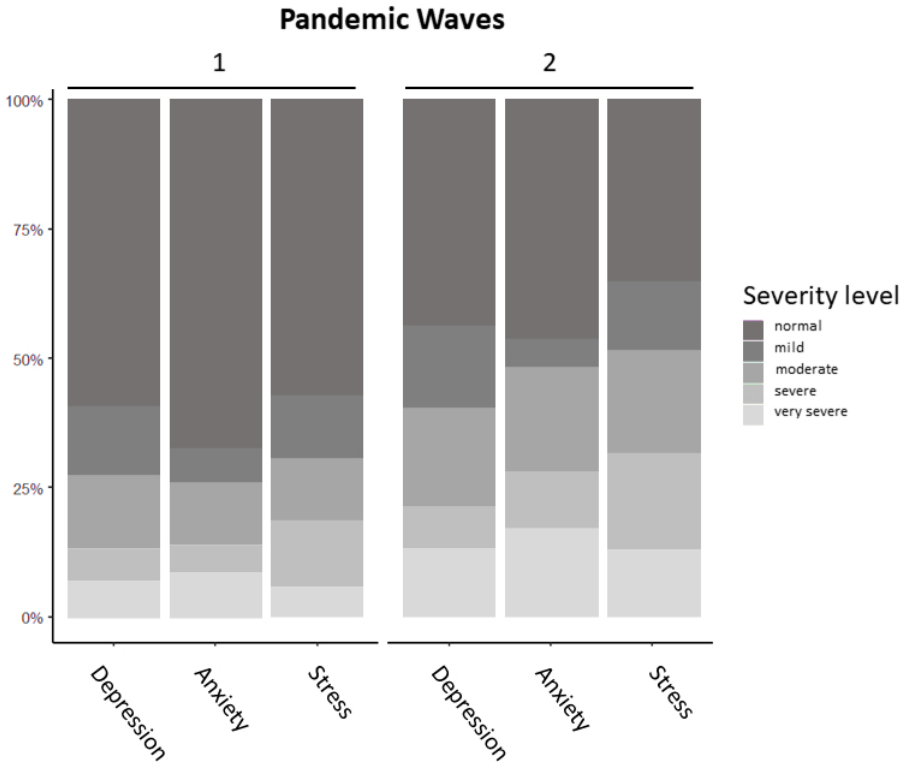

Figure 3. Proportion of the severity levels in depression, anxiety, and stress in the first and the second wave of the pandemic.

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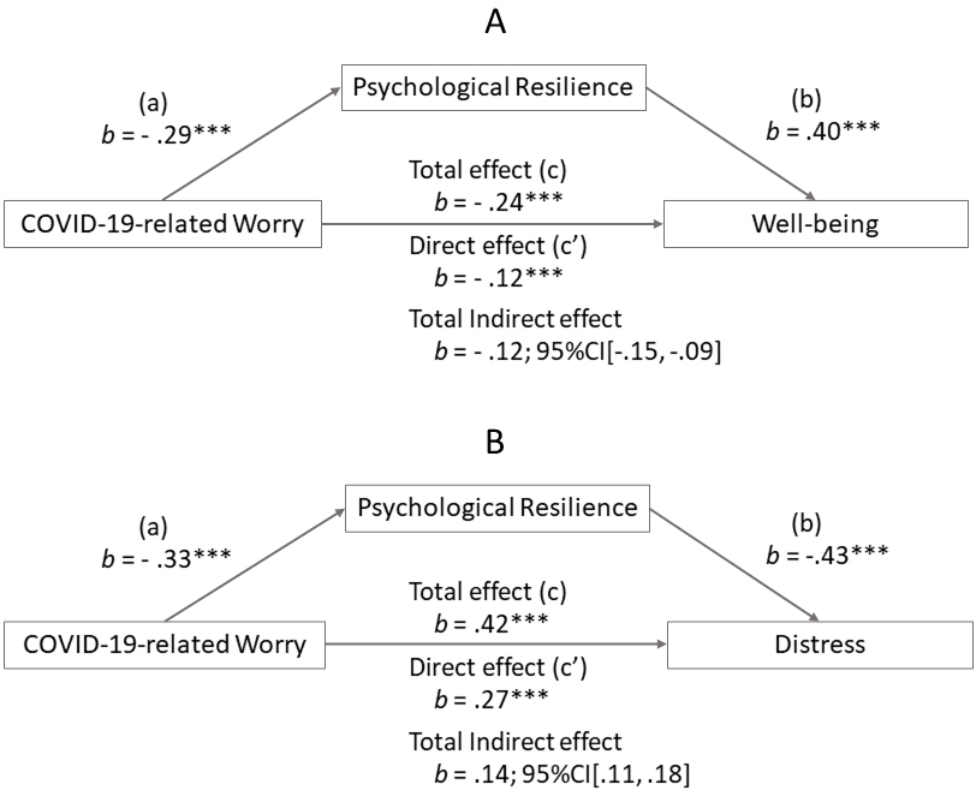

Figure 4. Results of the mediation analyses for the effects of COVID-19-related worry on Well-being (A) and Distress (B) mediated by Psychological resilience. The values along the arrows are regression estimates (standardized). The 95% confidence intervals (CIs) are shown for the indirect effects. Both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

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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
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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	• Number of years between 18 and 100	Number	Yes
2	Please enter your sex	• 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.)	• 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.)	• 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)	• 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?	• Doctor • Nurse, assistant • Other professional staff	Single choice	Yes
7	How many years of clinical experience do you have?	• 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?	• 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?	• 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?	• 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?	• No • Yes	Single choice	Yes
12	Have you been diagnosed with coronavirus?	• 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.)	• 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.)	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	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?	• 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?	• 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?	• 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.	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	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	• 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.	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?	• It got a lot worse • It got a bit worse	Single choice	Yes

	(Considering the duration and quality of sleep.)	• 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)	• 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.	• 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.	• 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?	• 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	• 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.")	• 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:

Dr. Flóra Dezső

(anesthesiologist, psychotherapist)

dflorad@gmail.com

MH EK Military Hospital KAITO

HU-1134 Budapest, Róbert Károly krt. 44.

Appendix S1. Information for study participants - continued

Questionnaire 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 TUKEB)

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**
Administrator: **Dr Tamás Kardon Secretary**
E-mail: tukeb@emmi.gov.hu
Phone: **+(36) 1 795-1197**

Subject: Authorization Decree

Research Center: *Military Hospital – State Health Centre, Central Department of Anaesthesiology and Intensive Care (44 Róbert Károly Blvd. Budapest 1134) University of Pécs Medical School Institute for Translational Medicine (12 Szigeti Street Pécs 7624)*

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.

Prof. Dr. Péter Hegyi
Head of Institute

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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
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