BMJ Open

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

Flóra Dezso,[1] Béla Birkás,[2] Gabriella Vizin,[3,4] Szilárd Váncsa,[5,6] Henrietta Szőcs,[3] Attila Erőss,[1] Dániel Lex,[1] Noémi Gede,[5] Zsolt Molnar ,[6,7] Péter Hegyi ,[5,6,8] Árpád Csathó [2]

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

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

PH and ÁC contributed equally. FD, BB and GV contributed equally.

Received 27 November 2021
Accepted 03 August 2022

For numbered affiliations see end of article.

Correspondence to
Dr Árpád Csathó;
arpad.csatho@aok.pte.hu

ABSTRACT

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

Design Cross-sectional surveys.

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

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

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

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

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

STRENGTHS AND LIMITATIONS OF THIS STUDY

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

INTRODUCTION

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

resilience strategies to avoid exacerbation of mental health problems among healthcare workers.[10–12]

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

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

Therefore, in this self-report-based study, we examined the effects of COVID-19-related worries and individual resilience as indicators of distress (eg, level of anxiety and depression) in the first and second waves of the pandemic. The aims of the study were to investigate, whether (1) during the second wave of the pandemic, healthcare workers were more worried and had lower well-being as compared with the first wave of COVID-19; (2) both higher scores on worries related to COVID-19 and lower scores on resilience are associated with higher levels of distress; (3) worries significantly predict the level of distress in both waves; (4) resilience mediates the associations between worries and distress, or not.

METHODS

In our study, we followed the recommendations of the STrengthening the Reporting of OBservational studies in Epidemiology statement[27] (see online supplemental table 1) 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 healthcare institutions including units for patients with COVID-19 in Hungary. We collected data over the first (from 17 July 2020 to 30 September 2020) and second waves (from 1 October 2020 to 31 December 2020) of the COVID-19 epidemic period in Hungary. In total, 782 participants completed the survey (N-first wave=376, N-second wave=406; see demographic characteristics in table 1). All participants agreed to a consent form with information about the study before completing the questionnaires (online supplemental appendix 1). Participants were asked to complete the survey consisting of demographical questions (ie, age, gender, occupation, fields, position, care for COVID-19-positive patients) and four self-report questionnaires (see below and online supplemental table 2).

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

Patient and public involvement

No patient involved.

Measures

Worries of Epidemic in Healthcare Scale

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

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

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

Mann-Whitney U test was performed for the continuous variables (ie, age, experiences), and Fisher's exact test for categorical variables.
P values indicating significant differences are printed in bold.
*The total number of physicians does not add up to the sum of job specialties, as while several physicians indicated more than one specialty, some did not indicate specialty at all.

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

Depression, Anxiety and Stress Scale

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

Brief Resilience Scale

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

WHO-5 Well-Being Scale

The five-item WHO Well-Being Scale (WHO-5) is a short rating scale measuring the general subjective well-being.[32] WHO-5 items are positive statements, and the respondent is asked to decide how true these statements for him or her considering the last 2 weeks. Each item was scored on a 6-point Likert scale (5=all of the time; 0=at no time) (Cronbach's α=0.90).

Analysis

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

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

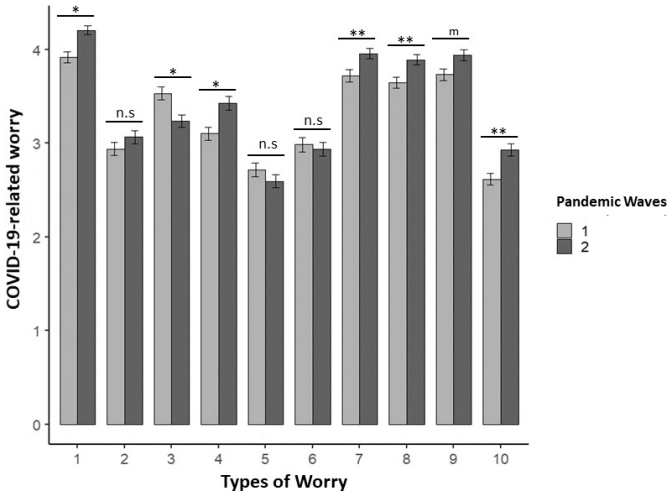

Figure 1 The different COVID-19-related worries during the two waves. Data are presented as mean and the SE of means. Types of worry—1: I become infected and become seriously ill/die, 2: I infect a family member, 3: I did not receive sufficient professional training, 4: Little or poor-quality protective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

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

RESULTS

Sample characteristics

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

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

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

The level of worry related to COVID-19 was significantly higher in the second than in the first wave (β=−0.17, Wald's χ^2=4.36, p=0.04). The overall level of worry in both waves can be considered high with approximate mean scores of 3 (ie, wave 1: mean=3.29, SD=0.77; wave 2: mean=3.42, SD=0.71), measured on a 5-point scale.

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

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

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

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

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

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

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

Results of multiple linear regression analyses are shown in table 2.

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

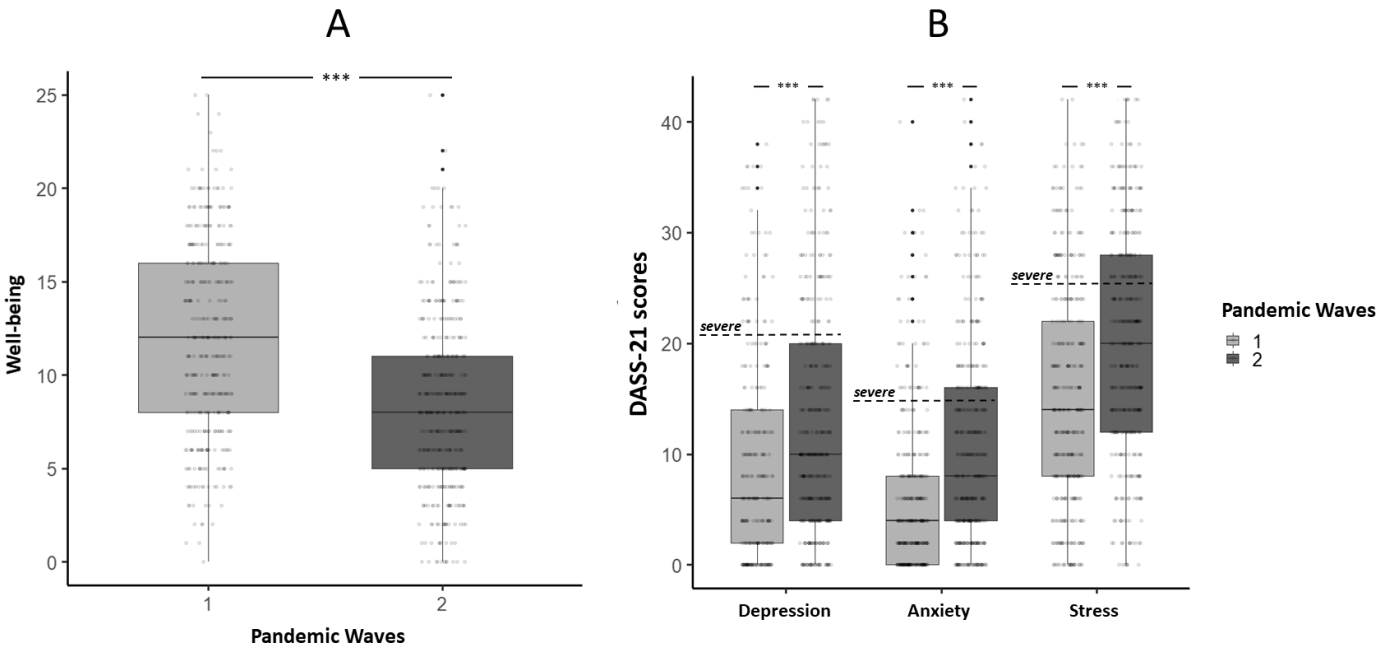

Figure 2 Well-being in the first and the second waves of the pandemic (A) and depression, anxiety, and stress in the first and the second waves of the pandemic (B). Data are presented as boxplot: median (black line), IQR (box) and minimum and maximum scores without outliers. Cut-off scores of the severe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

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

The results of the mediation analyses are presented in figure 4 and summarised here. The analysis revealed significant direct effect of COVID-19-related worry both on well-being and distress: greater level of worry predicted significantly lower well-being (total effect: t=−7.26, p<0.001, β=−0.24, 95% CI: −1.24 to −0.24; direct effect: t=−3.91, p<0.001, β=−0.12, 95% CI: −1.32 to −0.44) but higher distress (total effect: t=12.56, p<0.001, β=0.42, 95% CI: 6.34 to 8.69; direct effect: t=8.82, p<0.001, β=0.27, 95% CI: 3.85 to 6.06).

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

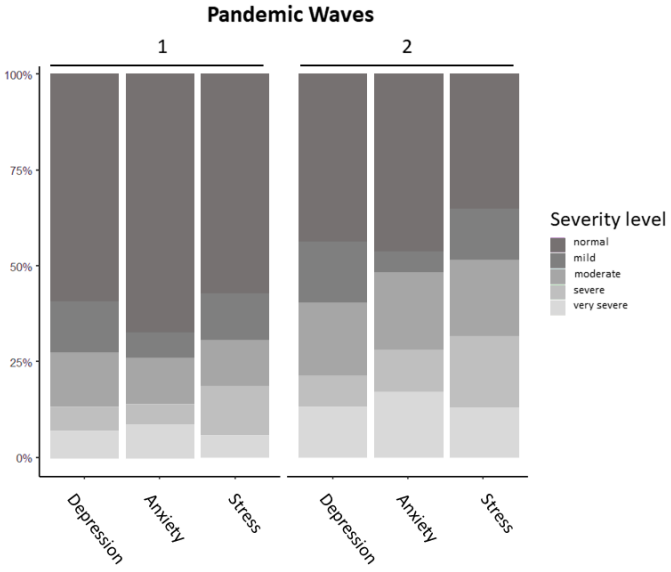

Figure 3 Proportion of the severity levels in depression, anxiety, and stress in the first and the second waves of the pandemic.

DISCUSSION

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

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

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

Worry: COVID-19-related worry; wave: pandemic waves; contact: contact with patients with COVID-19. b: regression estimates.
*P<0.05; **p<0.01; ***p<0.001.
HB, higher bound; LB, lower bound.

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

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

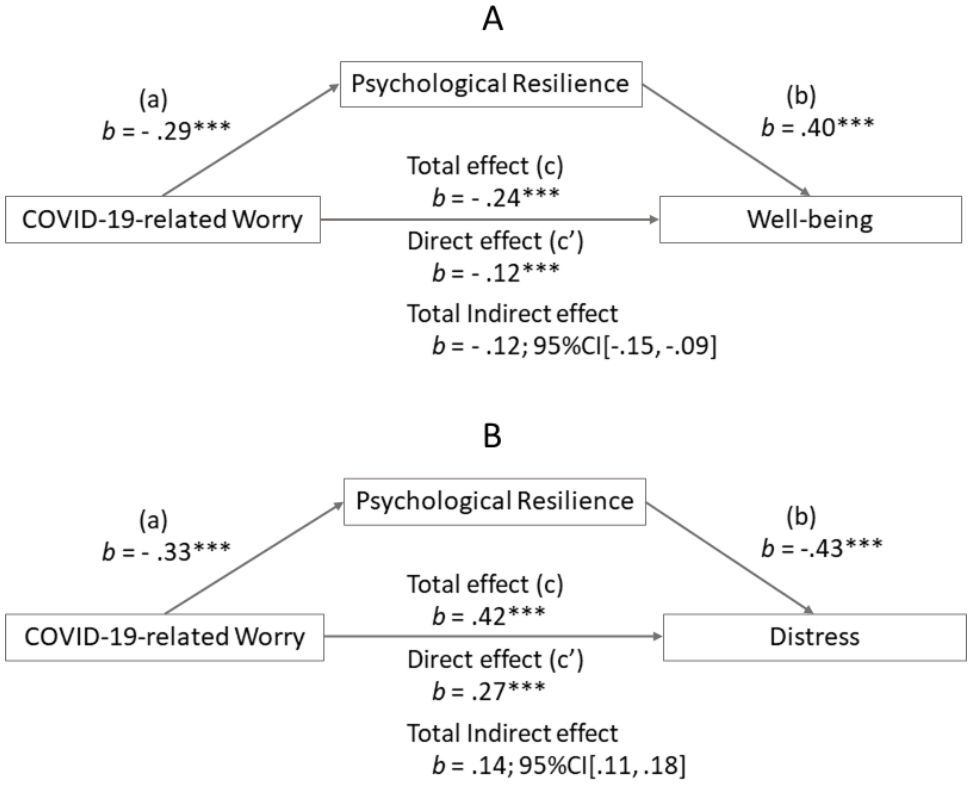

Figure 4 Results of the mediation analyses for the effects of COVID-19-related worry on well-being (A) and distress (B) mediated by psychological resilience. The values along the arrows are regression estimates (standardised). The 95% CIs are shown for the indirect effects. Both indirect effects are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

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

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

The possible ways of intervention and prevention include identifying and reducing the major concerns (ie, worries), and enhancing those psychological defence mechanisms that may reduce the severe psychological manifestation of the concerns. The relevance of these interventions is supported by our results showing that worry predicts the degree of distress and well-being. The short worry questionnaire used in the present study may be able to fulfil a dual role: it differentiates between types of worries the healthcare workers face with and it also predicts their distress level.

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

Strengths and limitations

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

Summary

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

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

Author affiliations
[1]Department of Anaesthesiology and Intensive Therapy, Hungarian Defence Forces Medical Centre, Budapest, Hungary
[2]Department of Behavioral Sciences, University of Pécs Medical School, Pécs, Hungary
[3]Institute of Psychology, Eötvös Loránd University, Budapest, Hungary
[4]Department of Clinical Psychology, Semmelweis University, Budapest, Hungary
[5]Institute for Translational Medicine, Szentágothai Research Centre, University of Pecs Medical School, Pécs, Hungary
[6]Centre for Translational Medicine, Semmelweis University, Budapest, Hungary
[7]Department of Anesthesiology and Intensive Therapy, Semmelweis University, Budapest, Hungary
[8]Division of Pancreatic Diseases, Heart and Vascular Center, Semmelweis University, Budapest, Hungary

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

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

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

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

Competing interests None declared.

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

Patient consent for publication Not required.

Ethics approval This study involves human participants and was approved by the Scientific and Research Ethics Committee of the Hungarian Medical Research Council (IV/5079-2/2020/EKU, online supplemental appendix 2). All the participants provided written informed consent to participate in this study. The ethics committee has carefully checked and approved the consent procedure.

Provenance and peer review Not commissioned; externally peer reviewed.

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

ORCID iDs
Zsolt Molnar http://orcid.org/0000-0002-1468-4058
Péter Hegyi http://orcid.org/0000-0003-0399-7259
Árpád Csathó http://orcid.org/0000-0002-0284-654X

REFERENCES

1 Cooper LA, Williams DR. Excess deaths from COVID-19, community bereavement, and restorative justice for communities of color. *JAMA* 2020;324:1491–2.
2 World Health Organization. The impact of COVID-19 on global health goals; 2021. https://www.who.int/news-room/spotlight/the-impact-of-covid-19-on-global-health-goals [Accessed 27 Aug 2021].
3 McAlonan GM, Lee AM, Cheung V, *et al*. Immediate and sustained psychological impact of an emerging infectious disease outbreak on health care workers. *Can J Psychiatry* 2007;52:241–7.
4 Chew NWS, Lee GKH, Tan BYQ, *et al*. A multinational, multicentre study on the psychological outcomes and associated physical symptoms amongst healthcare workers during COVID-19 outbreak. *Brain Behav Immun* 2020;88:559–65.
5 Kang L, Ma S, Chen M, *et al*. Impact on mental health and perceptions of psychological care among medical and nursing staff in Wuhan during the 2019 novel coronavirus disease outbreak: a cross-sectional study. *Brain Behav Immun* 2020;87:11–17.
6 Lai J, Ma S, Wang Y, *et al*. Factors associated with mental health outcomes among health care workers exposed to coronavirus disease 2019. *JAMA Netw Open* 2020;3:e203976.
7 Liang Y, Chen M, Zheng X, *et al*. Screening for Chinese medical staff mental health by SDS and SAS during the outbreak of COVID-19. *J Psychosom Res* 2020;133:110102.
8 Que J, Shi L, Deng J, *et al*. Psychological impact of the COVID-19 pandemic on healthcare workers: a cross-sectional study in China. *Gen Psychiatr* 2020;33:e100259–e59.
9 Greenberg N, Docherty M, Gnanapragasam S, *et al*. Managing mental health challenges faced by healthcare workers during covid-19 pandemic. *BMJ* 2020;368:m1211.
10 Heath C, Sommerfield A, von Ungern-Sternberg BS. Resilience strategies to manage psychological distress among healthcare workers during the COVID-19 pandemic: a narrative review. *Anaesthesia* 2020;75:1364–71.
11 Carmassi C, Foghi C, Dell'Oste V, *et al*. PTSD symptoms in healthcare workers facing the three coronavirus outbreaks: what can we expect after the COVID-19 pandemic. *Psychiatry Res* 2020;292:113312–12.
12 Spoorthy MS, Pratapa SK, Mahant S. Mental health problems faced by healthcare workers due to the COVID-19 pandemic-a review. *Asian J Psychiatr* 2020;51:102119.
13 Folkman S, Lazarus RS, Dunkel-Schetter C, *et al*. Dynamics of a stressful encounter: cognitive appraisal, coping, and encounter outcomes. *J Pers Soc Psychol* 1986;50:992–1003.
14 González-Sanguino C, Ausín B, Castellanos Miguel Ángel, *et al*. Mental health consequences during the initial stage of the 2020

coronavirus pandemic (COVID-19) in Spain. *Brain Behav Immun* 2020;87:172–6.
15 Taylor S, Landry CA, Paluszek MM, *et al*. COVID stress syndrome: concept, structure, and correlates. *Depress Anxiety* 2020;37:706–14.
16 H-j J, Nan J, Z-y L. Psychological impacts of the COVID-19 epidemic on Chinese people: exposure, post-traumatic stress symptom, and emotion regulation. *Asian Pac J Trop Med* 2020;13:252–9.
17 Borkovec TD, Robinson E, Pruzinsky T, *et al*. Preliminary exploration of worry: some characteristics and processes. *Behav Res Ther* 1983;21:9–16.
18 Diefenbach GJ, McCarthy-Larzelere ME, Williamson DA, *et al*. Anxiety, depression, and the content of worries. *Depress Anxiety* 2001;14:247–50.
19 Boyraz G, Legros DN, Tigershtrom A. COVID-19 and traumatic stress: the role of perceived vulnerability, COVID-19-related worries, and social isolation. *J Anxiety Disord* 2020;76:102307.
20 Barzilay R, Moore TM, Greenberg DM, *et al*. Resilience, COVID-19-related stress, anxiety and depression during the pandemic in a large population enriched for healthcare providers. *Transl Psychiatry* 2020;10:291.
21 Deb A. *Psychology of resilience. psychosocial interventions for health and well-being*. Springer, 2018: 43–57.
22 Jackson D, Firtko A, Edenborough M. Personal resilience as a strategy for surviving and thriving in the face of workplace adversity: a literature review. *J Adv Nurs* 2007;60:1–9.
23 Bozdağ F, Ergün N. Psychological resilience of healthcare professionals during COVID-19 pandemic. *Psychol Rep* 2020;0:1–20.
24 Paredes MR, Apaolaza V, Fernandez-Robin C, *et al*. The impact of the COVID-19 pandemic on subjective mental well-being: the interplay of perceived threat, future anxiety and resilience. *Pers Individ Dif* 2021;170:110455–55.
25 Havnen A, Anyan F, Hjemdal O, *et al*. Resilience moderates negative outcome from stress during the COVID-19 pandemic: a moderated-mediation approach. *Int J Environ Res Public Health* 2020;17. doi:10.3390/ijerph17186461. [Epub ahead of print: 04 Sep 2020].
26 Fava GA, McEwen BS, Guidi J, *et al*. Clinical characterization of allostatic overload. *Psychoneuroendocrinology* 2019;108:94–101.
27 von Elm E, Altman DG, Egger M, *et al*. The strengthening the reporting of observational studies in epidemiology (STROBE) statement: guidelines for reporting observational studies. *Ann Intern Med* 2007;147:573–7.
28 World Medical Association. World Medical association Declaration of Helsinki: ethical principles for medical research involving human subjects. *JAMA* 2013;310:281053:2191–4.
29 Lovibond PF, Lovibond SH. The structure of negative emotional states: comparison of the depression anxiety stress scales (DASS) with the Beck depression and anxiety inventories. *Behav Res Ther* 1995;33:335–43.
30 Lee D. The convergent, discriminant, and nomological validity of the depression anxiety stress Scales-21 (DASS-21). *J Affect Disord* 2019;259:136–42.
31 Smith BW, Dalen J, Wiggins K, *et al*. The brief resilience scale: assessing the ability to bounce back. *Int J Behav Med* 2008;15:194–200.
32 Bech P, Gudex C, Johansen KS. The who (ten) well-being index: validation in diabetes. *Psychother Psychosom* 1996;65:183–90.
33 Kumar A, Nayar KR. COVID 19 and its mental health consequences. *J Ment Health* 2021;30:1–2.
34 Hossain MA, Rashid MUB, Khan MAS, *et al*. Healthcare workers' knowledge, attitude, and practice regarding personal protective equipment for the prevention of COVID-19. *J Multidiscip Healthc* 2021;14:229–38.
35 Sarma R, Vig S, Rathore P, *et al*. Concerns of health care professionals managing non-COVID patients during the COVID-19 pandemic: a descriptive cross- sectional study. *Indian J Palliat Care* 2020;26:S21–6.
36 Sandesh R, Shahid W, Dev K, *et al*. Impact of COVID-19 on the mental health of healthcare professionals in Pakistan. *Cureus* 2020;12:e8974–e74.
37 Elbay RY, Kurtulmuş A, Arpacıoğlu S, *et al*. Depression, anxiety, stress levels of physicians and associated factors in Covid-19 pandemics. *Psychiatry Res* 2020;290:113130.
38 Hammond NE, Crowe L, Abbenbroek B, *et al*. Impact of the coronavirus disease 2019 pandemic on critical care healthcare workers' depression, anxiety, and stress levels. *Aust Crit Care* 2021;34:146–54.
39 Gündoğmuş İbrahim, Ünsal C, Bolu A, *et al*. The comparison of anxiety, depression and stress symptoms levels of healthcare workers between the first and second COVID-19 peaks. *Psychiatry Res* 2021;301:113976.
40 Killgore WDS, Taylor EC, Cloonan SA, *et al*. Psychological resilience during the COVID-19 lockdown. *Psychiatry Res* 2020;291:113216.
41 Lupe SE, Keefer L, Szigethy E. Gaining resilience and reducing stress in the age of COVID-19. *Curr Opin Gastroenterol* 2020;36:295–303.
42 Barton MA, Christianson M, Myers CG, *et al*. Resilience in action: leading for resilience in response to COVID-19. *BMJ Leader* 2020;4:117–9.