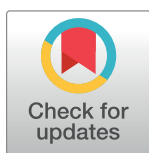RESEARCH ARTICLE

Changes in hospital staff' mental health during the Covid-19 pandemic: Longitudinal results from the international COPE-CORONA study

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Abstract

This longitudinal study aimed to explore anxiety and depressive symptoms, individual resources, and job demands in a multi-country sample of 612 healthcare workers (HCWs) during the COVID-19 pandemic. Two online surveys were distributed to HCWs in seven countries (Germany, Andorra, Ireland, Spain, Italy, Romania, Iran) during the first (May-October 2020, T1) and the second (February-April 2021, T2) phase of the pandemic, assessing sociodemographic characteristics, contact with COVID-19 patients, anxiety and depressive symptoms, self-compassion, sense of coherence, social support, risk perception, and health and safety at the workplace. HCWs reported a significant increase in depressive and anxiety symptoms. HCWs with high depressive or anxiety symptoms at T1 and T2 reported a history of mental illness and lower self-compassion and sense of coherence over time. Risk perception, self-compassion, sense of coherence, and social support were strong independent predictors of depressive and anxiety symptoms at T2, even after controlling for baseline depressive or anxiety symptoms and sociodemographic variables. These findings pointed out that HCWs during the COVID-19 outbreak experienced a high burden of psychological distress. The mental health and resilience of HCWs should be supported during disease outbreaks by instituting workplace interventions for psychological support.

Introduction

The outbreak of COVID-19 pandemic has become a major worldwide health crisis and has had a huge impact on almost every area of people's life. In addition to the physical health consequences, public health experts from all over the world have raised concerns over the global

mental health crisis due to quarantine, social isolation, loss, economic hardship, the threat of becoming infected, stigmatization, and uncertainty about the future [1, 2]. These external factors resulted in people's expanded vulnerability to manifest onset of symptoms and exacerbation of already existing psychopathology [3]. This situation came as no surprise in the context of previous epidemics, when numerous studies reported raised levels of psychological distress in the population undergoing such a crisis [4, 5], leading to maladaptive behaviors [6–8]. A systematic review [9] assessed the pandemic's psychological impact on the general population and affirmed that well-being has been lower with higher levels of depression, generalized anxiety symptoms, sleeping problems and distress compared to baseline measures. This systematic review found an association between higher levels of psychological distress and female gender, younger age, chronic medical or psychiatric illness, student status, unemployment, and constant exposure to news or social media. In addition, knowing someone with a COVID-19 infection, being at huge risk of contamination, outside-of-the-home work, or being under an obligatory stay-at-home order have been recognized as factors related to worse mental health, as has also been shown by other studies not included in the review [10–12].

To effectively play their role during the COVID-19 pandemic, it was essential for healthcare workers (HCWs) to maintain their psychological and mental well-being [13, 14], as they were standing at the frontline of the crisis. However, the evidence has shown that the wide spread of COVID-19 has had a remarkable impact on their mental health (such as stress or burnout) [13, 15–18]. Anxiety, insomnia, and somatic complaints were more common among HCWs than among non-medical workers, according to certain meta-analyses and systematic reviews [19–22]. Results from other studies have shown that at least one in five HCWs reported symptoms of depression and anxiety, and almost 4/10 HCWs reported sleep problems [23].

So far, researchers have noticed many stress-related responses among the population of HCWs that were both adaptive and maladaptive [24]. These responses can affect one's psychological comfort and can turn out to be either protective or risk factors for unfavorable mental-health outcomes. What is worth mentioning, there were reported higher scores for positive coping strategies than negative ones among HCWs, indicating that health care personnel are able to employ positive coping strategies when faced with stressful situations like the COVID-19 pandemic. Some studies have explored individual differences in psychological risk and protective factors and their connections with COVID-19-related mental health among HCWs. Utilization of healthy coping strategies such as asking for social support, positive thinking and problem solving was linked to lower levels of traumatic stress, stigma, psychological distress, stress symptoms, anxiety, and depression, as well as psychological distress [24].

Psychological resilience–a construct representing the ability to cope with set-backs and adapt positively in the face of adversity [25]–was connected to better mental well-being during the pandemic and less burnout among HCWs, especially nurses. Additionally, resilience scores showed statistically significant inverse relationships with PTSD, anxiety, and depression [26]. Antonovsky defined the ability to encompass the whole situation and to identify and use the resources available, as the sense of coherence [27]. The sense of coherence is a global orientation, where life is understood as more or less comprehensible, meaningful, and manageable [28]. A strong sense of coherence helps the individual to mobilize resources to cope with stressors and manage tension successfully [29, 30]. Some meta-analyses have shown that self-compassion was negatively associated with psychopathology and positively with well-being [31–33]. Self-compassion can be understood as how we relate to ourselves when experiencing suffering or pain and it is a productive way of coping with distressing thoughts and emotions that impair mental and physical well-being [34]. The study conducted by Hi-Po Lau et al. [35] confirmed the previous findings: self-compassion buffered the association between perceived COVID-related threats and psychological distress. For risk factors associated with feeling

higher levels of mental-health burden during COVID-19 pandemic, the following were listed: disgust sensitivity, anxiety sensitivity, body vigilance, concerns of being infected and general distress [36].

Finally, several nonadaptive personality traits including negative affectivity and detachment were related to higher levels of depression, anxiety, and stress during the COVID-19 pandemic [10, 37].

Accordingly, our study aimed to investigate long-term changes in levels of distress and protective and risk factors in hospital staff during the COVID-19 pandemic. Specifically, our aim was twofold: (1) to assess the sociodemographic factors, job demands (contact with COVID-19 patients, risk perception, health and safety on the workplace), and individual resources (self-compassion, sense of coherence, social support) associated with changes in anxiety and depression symptoms during the COVID-19 pandemic; (2) to explore whether and to what extent sociodemographic factors, job demands, and individual resource predicted high levels of anxiety and depressive symptoms during the COVID-19 pandemic. Based on previous findings, it was hypothesised that: (1) HCWs with high levels of anxiety and depression over time would show higher levels of job demands and lower individual resources during both the first and second phases of the COVID-19 pandemic; (2) higher job demands and lower individual resources would predict higher levels of depression and anxiety during the second phase of the COVID-19 pandemic.

Materials and methods

Procedure and participants

This study is part of the larger Cope-Corona project aimed at assessing protective and risk factors for medical staff during the COVID-19 pandemic [for more details see [17]]. The project was conducted with the support of the European Association of Psychosomatic Medicine (EAPM), along with the coordination of Paracelsus Medical University, Nuremberg General Hospital, and Catholic University Eichstätt-Ingolstadt. All EAPM members were informed of the research initiative and were invited to participate. As a result of this process, an international research group was established. Data presented in this study were provided by seven centers: Hospital Nostra Senyora de Meritxell (Andorra), General Hospital Nuremberg (Germany), Tehran University of Medical Sciences (Iran), Private Health Sector and Public Health Sector (Ireland), University G. d'Annunzio of Chieti and Pescara (Italy), Dexeus University Hospital of Barcelona and Hospital Clínic de Barcelona (Spain), University of Medicine and Pharmacy Iuliu Hatieganu, Cluj-Napoca (Romania). Additional data from China and Poland were available cross-sectionally and were not included in the current study based on longitudinal data.

Two online surveys were distributed to hospital staff during the first (May-October 2020, T1) and the second (February-April 2021, T2) phase of the pandemic. The participants were invited through email to complete the online survey (www.qualtrics.com/it) on both occasions. To optimize ecological validity, all adult (years≥18) employees of the hospitals and their subcontractors were included. To ensure the validity of the responses, the inclusion criterion was a response of at least 50% of the questions. After removing those who did not satisfy the inclusion criteria, a total of 2,097 and 4,240 participants were enrolled at T1 and T2, respectively. By matching the self-generated code, a total of 612 (29.18%) participants were identified for longitudinal analysis.

Ethics statement

All participants completed the survey anonymously and provided online informed consent to take part in the study. A self-generated identification code was used to match subjects at

different assessment points in time. No IP addresses or geographic data was gathered. Participants were informed about privacy, ethical aspects and data treatment and they could cease the process at any time. The study was designed and carried out in accordance with the World Medical Association Declaration of Helsinki and its subsequent revisions [38] and approved by the Institutional Review Board of Paracelsus Medical University, General Hospital Nuremberg (IRB-2020-017).

Measures

Study variables were measured using validated psychometric scales or with ad hoc instruments where adequate measures were not available. All scales were set to local languages (Catalan, English, Farsi, German, Italian, and Spanish) using validated translations when available. When translations were not available, items were translated and back-translated into the original language. Factor and reliability analyses were used to test all ad hoc scales [for details, see [17]].

Sociodemographic characteristics. Ad hoc questions regarding sociodemographic and occupational variables were included in the online survey. Data were self-reported by participants, including age, gender, work experience, and function (physicians, nurses, technicians, administrative, others). History of mental illness was assessed with a single item by asking whether participants had ever suffered from a mental disorder at any time in their life ("yes" or "no").

Job demands

Contact with COVID-19 patients. Professional contact with COVID-19 patients was assessed with a single item by asking whether participants were directly involved in the clinical management of patients with suspected or confirmed coronavirus infection. The answer rated on a 4-point Likert-scale ranging from "not at all" to "very much". Contact with COVID-19 patients and possible changes between T1 to T2 were coded as "any", "increase in contact", "decrease in contact", "much". The dichotomous variable of contact with COVID-19 patients was used in the comparisons, coded as no (never had contact at both T1 and T2) and yes (contact at T1 and/or T2).

Risk perception. The risk perception COVID-19-related was assessed with three ad hoc items regarding the probability of becoming infected, concern about becoming severely infected, and concern about infecting others. Each item was rated on a 5-point Likert-scale. The total score was calculated by the mean of three items, with higher scores indicating higher levels of risk perception.

Health and safety on the workplace. The subjective feelings about health and safety at the workplace were assessed with two ad hoc items regarding the availability of personal protective equipment, and confidence on stay healthy at work. Both items were rated on a 5-point Likert-scale. The total score was calculated by the mean of two items reversed, with higher scores indicating higher feelings of health and safety.

Individual resources

Self-Compassion. The State Self-Compassion Scale-Short form (SSCS-S) was used to assess the tendency to respond in a self-compassionate way to a current painful situation or life difficulty [39]. The SCSS-S is a 6-item questionnaire rated on 5-point Likert-scale ranging from 1 ("not at all true for me") to 5 ("pretty much true for me"). The total score was calculated by the sum of the six items, with higher scores indicating higher levels of self-compassion.

Sense of coherence. The 3-item Sense of Coherence (SOC-3) questionnaire was used to assess the tendency to have an enduring and dynamic sense of confidence based on three

components: understandability, manageability, and meaning [40, 41]. The SOC is rated on 7-point Likert-scale. The total score was calculated by the sum of three items, with higher scores indicating higher levels of sense of coherence.

Social support. The ENRICHD Social Support Inventory (ESSI) is a 5-item scale used to evaluate four domains of social support: emotional, instrumental, informational, and appraisal [42]. Respondents are asked to estimate how helpful they perceive people close to them to be on a 5-point Likert-scale ranging from 1 ("none of the time") to 5 ("all of the time"). The total score was calculated by the sum of five items. A score of ≤ 3 on at least 2 of the 5 items with a total score of ≤ 18 indicates a lack of social support.

Emotional distress

Depressive symptoms. The 2-item Patient Health Questionnaire (PHQ-2) was used to assess the presence of depression symptoms [43]. The PHQ-2 is a self-report measure designed to screen for depressed mood and anhedonia over the past two-weeks. Each item is rated on a 4-point Likert-scale, with total scores varying from 0 ("not at all") to 3 ("nearly every day"). The total score was calculated by the sum of two items. A score of 3 or above is to be considered positive at a screening for depression symptoms. To evaluate the possible changes in depressive symptoms between T1 to T2, the PHQ-2 scores were coded as "never" (no symptoms at both T1 and T2), "decrease in symptoms" (high symptoms at T1), "increase in symptoms" (high symptoms at T2), "persistent" (high symptoms at both T1 and T2).

Anxiety symptoms. The 2-item General Anxiety Disorder-2 (GAD-2) was used to measure the presence of anxiety symptoms [44]. The GAD-2 is a self-report questionnaire used to assess feeling nervous and not being able to control thoughts/worries, two core criteria for anxiety. Respondents are asked to estimate the frequency of these symptoms over the past two-weeks on a 4-point Likert-scale ranging from 0 ("not at all") to 3 ("nearly every day"). The total score was calculated by the sum of two items. A score of 3 or above is to be considered positive at a screening for anxiety symptoms. To evaluate the possible changes in anxiety symptoms between T1 to T2, the GAD-2 scores were coded as "never" (no symptoms at both T1 and T2), "decrease in symptoms" (high symptoms at T1), "increase in symptoms" (high symptoms at T2), "persistent" (high symptoms at both T1 and T2).

Statistical analyses

Data analysis was performed using SPSS 26.0. Descriptive statistics were reported in terms of frequencies.

A 3-step strategy was used for data analysis.

First, a paired-sample Student's t-test was used to evaluate within-subjects differences in emotional distress in the two time-points assessments. The standardized mean difference (Cohen's d) was used as a measure of effect size considered as small (0.20–0.50), moderate (0.50–0.80), and large (>0.80) [45].

Second, two chi-square (χ^2) tests and two repeated-measures analyses of variance (ANOVAs) were used to compare between-group differences in sociodemographic characteristics, job demands, and individual resources for depression-related groups and anxiety-related groups during the two time-points. The repeated-measures ANOVAs included measures of anxiety and depressive symptoms, self-compassion, sense of coherence, social support, risk perception, and health and safety as the dependent variable, the time points T1 and T2 as a within-subject factor, and depression-related/anxiety-related groups as the between-subject comparison. Effect sizes for categorical variables were assessed by using Cramér's V ranging from 0 to +1, where 0 indicates the complete independence of two variables and +1 indicates a

perfect association. The Eta-squared (η^2) was used as a measure of effect size for continuous variables. A standardized effect size of 0.01–0.05 is considered small, 0.06–0.14 moderate, and >0.14 large [46].

Third, two hierarchical regressions were used to identify those factors that best predict depressive symptoms and anxiety symptoms at T2. The PHQ-2 and GAD-2 scores at T2 were considered as the dependent variable and the independent variables were the baseline GAD-2 or PHQ-2, age, gender, function, job experience, history of mental illness, contact with COVID-19 patients, risk perception (T1,T2), health and safety (T1,T2), SCS (T1,T2), SOC (T1, T2), and ESSI (T1,T2). The predictors were entered in separate blocks to determine how well each variable predicted the outcome.

Results

Characteristics of the sample

The participants were mostly women (n = 462, 75.5%), nurses (n = 182, 29.7%), with more than 35 years (n = 446, 72.9%) and 6 years of job experience (n = 474, 77.6%), and had not a history of mental illness (n = 474, 77.4%) or contact with COVID-19 patients at neither T1 nor T2 (n = 358, 58.6%) (see Table 1). The number of participants for each country was reported in S1 Table.

Participants reported a significant worsening of depressive (d = 0.21) and anxiety (d = 0.25) symptoms during the two phases of pandemic-related restrictions (see S2 Table).

Overall, 59.9% and 71.2% of the sample reported anxiety or depressive symptoms during the two waves of the COVID-19 pandemic (see Table 1). Specifically: 1) 32.6% and 39.8% of the sample reported symptoms of anxiety or depressive symptoms during the first and second waves of the pandemic; 2) 17.8% and 21.9% reported an increase in symptoms during the second wave; 3) and 9.5% reported a decrease in symptoms during the second wave.

Between-group comparisons

The results of comparisons of sociodemographic and occupational factors in depression-related and anxiety-related groups are reported in Table 1.

Only the history of mental illness (χ^2 = 30.38, p < .001) showed significant between depression-related groups differences, with the effect size in the small range.

There were significant differences between anxiety-related groups on gender (χ^2 = 6.53, p = .09), function (χ^2 = 22.77, p = .03), job experience (χ^2 = 12.08, p = .007), and history of mental illness (χ^2 = 39.42, p < .001), with effect sizes in the small ranges.

The results of repeated measure ANOVA in depression-related groups are reported in Table 2.

A significant effect of time on risk perception (F = 12.95, p < .001) and health and safety (F = 49.56, p < .001) was found. Comparing depression-related groups, participants with high depressive symptoms at both T1 and T2 (group D) reported higher anxiety symptoms (F = 22.39, p < .001), lower self-compassion (F = 3.99, p = .008), and lower sense of coherence over time (F = 3.12, p = .03) than other groups.

The results of repeated measure ANOVA in anxiety-related groups are reported in Table 3.

A significant effect of time on depression (F = 7.46, p = .006), risk perception (F = 15.67, p < .001) and health and safety (F = 64.39, p < .001) was found. Comparing anxiety-related groups, participants with high anxiety symptoms at both T1 and T2 (group D) reported higher depressive symptoms (F = 26.86, p < .001), lower self-compassion (F = 6.49, p < .001), and lower sense of coherence over time (F = 9, p < .001) than other groups.

Table 1. Comparisons of sociodemographic and occupational characteristics in total sample, depression-related and anxiety-related groups.

Variable, N (%)	Total sample N = 612	Depression-related groups[a]				χ^2	Cramer's V	Anxiety-related groups[a]				χ^2	Cramer's V
		Never N = 177 (28.8%)	Decreased N = 58 (9.5%)	Increased N = 134 (21.9%)	Persistent N = 243 (39.8%)			Never N = 246 (40.1%)	Decreased N = 58 (9.5%)	Increased N = 109 (17.8%)	Persistent N = 199 (32.6%)		
Age													
≤35 years	166 (27.1)	38 (21.5)	15 (25.9)	42 (31.3)	71 (29.2)	4.66	.09	62 (25.2)	13 (22.4)	29 (26.6)	62 (31.2)	2.76	.07
>35 years	446 (72.9)	139 (78.5)	43 (74.1)	92 (68.7)	172 (70.8)			183 (74.8)	45 (77.6)	80 (73.4)	137 (68.8)		
Gender													
Men	150 (24.5)	53 (29.9)	12 (20.7)	28 (20.9)	57 (23.5)	4.37	.08	74 (30.1)	12 (20.7)	26 (23.9)	38 (19.1)	6.53	.11
Women	462 (75.5)	124 (70.1)	46 (79.3)	106 (79.1)	186 (76.5)			172 (69.9)	46 (79.3)	83 (76.1)	161 (80.9)		
Function													
Physicians	84 (13.7)	30 (16.9)	6 (10.3)	20 (14.9)	28 (11.5)	11.91	.08	42 (17.1)	10 (17.2)	16 (14.7)	16 (8)	22.77*	.11
Nurses	182 (29.7)	45 (25.4)	17 (29.3)	46 (34.3)	74 (30.5)			72 (29.3)	20 (34.6)	34 (31.2)	56 (28.1)		
Technicians	79 (12.9)	24 (13.6)	6 (10.3)	12 (9)	37 (15.2)			31 (12.6)	9 (15.5)	12 (11)	27 (13.6)		
Administrative	147 (24)	48 (27.2)	15 (25.9)	33 (24.6)	51 (21)			64 (26)	9 (15.5)	30 (27.5)	44 (22.2)		
Others[1]	120 (19.6)	30 (16.9)	14 (24.1)	23 (17.2)	53 (21.8)			37 (15)	10 (17.2)	17 (15.6)	56 (28.1)		
Job experience													
≤6 years	137 (22.4)	35 (19.8)	11 (19)	26 (19.4)	65 (26.7)	4.43	.08	45 (18.3)	9 (15.5)	22 (20.2)	61 (30.6)	12.08**	.14
>6 years	475 (77.6)	142 (80.2)	47 (81)	108 (80.6)	178 (73.3)			201 (81.7)	49 (84.5)	87 (79.8)	138 (69.4)		
Contact with COVID-19 patients													
No	358 (58.5)	108 (61)	38 (65.5)	78 (58.2)	134 (55.1)	2.77	.07	154 (62.6)	32 (55.2)	63 (57.8)	109 (54.8)	3.13	.07
Yes	254 (41.5)	69 (39)	20 (34.5)	56 (41.8)	109 (44.9)			92 (37.4)	26 (44.8)	46 (42.2)	90 (45.2)		
History of mental illness													
Yes	138 (22.6)	20 (11.9)	10 (17.2)	27 (20.1)	81 (33.3)	30.38***	.22	74 (30.1)	12 (20.7)	26 (23.8)	38 (19.1)	39.42***	.25
No	474 (77.4)	157 (88.1)	48 (82.8)	107 (79.9)	162 (66.7)			172 (69.9)	46 (79.3)	83 (76.2)	161 (80.9)		

[a]Never = absence of anxiety symptoms at both T1 and T2; Decreased = presence of anxiety symptoms at T1 but no longer at T2; Increased = presence of anxiety symptoms at T2 but not at T1; Persistent = presence of anxiety symptoms at both T1 and T2.

Predicting depressive and anxiety symptoms at follow-up

A hierarchical regression analysis was performed to assess which variables contribute to explain the depressive symptoms at the T2 (see Table 4).

In the first model, entering baseline depressive symptoms significantly explained 24% of variance (β = 0.49, p < .001). Adding sociodemographic characteristics in Model 2 did not contribute to explain a significant added variance. Adding job demands in Model 3 produced

Table 2. Comparisons of anxiety symptoms, job demands, and individual resources over time in depression-related groups.

Variables, mean (SD)	Depression-related groups[a]				Time		Time*Group		Within-Groups comparisons
	A Never N = 177	B Decreased N = 58	C Increased N = 134	D Persistent N = 243	F	η²	F	η²	Post-hoc Bonferroni
GAD-2									
T1	0.73 (0.90)	1.56 (1.18)	0.87 (0.97)	2.32 (1.46)	0.59	.001	22.39***	.11	A < B, C, D;
T2	0.72 (0.83)	0.87 (0.85)	1.71 (1.19)	2.36 (1.39)					D > A, B, C
SSCS-S									
T1	22.68 (3.01)	20.67 (2.72)	21.64 (3.59)	19.38 (3.66)	0.09	-	3.99**	.02	A > B, C, D;
T2	22.55 (3.21)	21.67 (3.29)	20.89 (3.51)	19.09 (3.50)					D < A, B, C
SOC-3									
T1	13.85 (2.14)	12.74 (2.90)	13.30 (2.52)	12.08 (3.08)	0.11	-	3.12*	.02	A > C, D;
T2	13.86 (2.05)	13.48 (2.48)	12.72 (2.65)	12.07 (2.91)					D < A, B, C
ESSI									
T1	22.38 (2.77)	20.18 (3.89)	21.42 (3.81)	19.61 (4.50)	0.85	.001	2.17	.01	A > B, C, D;
T2	22.37 (2.83)	20.61 (3.99)	20.79 (3.77)	19.31 (4.61)					D < A, C
Risk perception									
T1	3.05 (0.72)	3.09 (0.75)	3.17 (0.71)	3.32 (0.69)	12.95***	.02	1.31	.01	A < D
T2	3.09 (0.74)	3.22 (0.70)	3.29 (0.80)	3.49 (0.72)					
Health and safety									
T1	4.13 (0.69)	4.04 (0.80)	4 (0.73)	3.67 (0.87)	49.56***	.08	0.61	.003	A > D;
T2	4.34 (0.56)	4.27 (0.68)	4.22 (0.60)	3.97 (0.72)					D < A, B, C

[a]Never = absence of anxiety symptoms at both T1 and T2; Decreased = presence of anxiety symptoms at T1 but no longer at T2; Increased = presence of anxiety symptoms at T2 but not at T1; Persistent = presence of anxiety symptoms at both T1 and T2.

Notes: GAD-2 = General Anxiety Disorder-2; SSCS-S = Self-Compassion Scale; SOC-3 = Sense of Coherence; ESSI = ENRICHD Social Support Instrument.

All values are standardized regression weights

*p < .05

**p < .01

***p < .001.

an added 2% of explained variance, with risk perception (T2) scores showing greater β value of 0.13 (p = .005). Adding the individual resources in Model 4 produced an added 9% of explained variance, with SCS (T2), SOC (T2), ESSI (T1 and T2) scores showing greater β values of -0.24, -0.18, 0.11, -0.19 respectively (p < .001; p < .001; p = .04; p < .001, respectively). The final model predicted 37% of the explained PHQ-2 variance.

A hierarchical regression analysis was performed to assess which variables contribute to explain the anxiety symptoms at the T2 (see Table 5).

In the first model, entering baseline anxiety symptoms significantly explained 28% of variance (β = 0.54, p < .001). Adding sociodemographic characteristics in Model 2 produced an added 1% of explained variance, with history of mental illness scores showing greater β value of 0.09 (p = .01). Adding job demands in Model 3 produced an added 3% of explained variance, with risk perception (T2) and health and safety (T2) scores showing greater β values of 0.11 and -0.10 respectively (p = .01, p = .02, respectively). Adding individual resources in Model 4 produced an added of 14% of explained variance, with SCS (T2), SOC (T2), ESSI (T1,T2) scores showing greater β values of -0.24, -0.24, 0.11, -0.14 (p < .001, p < .001, p = .03, p = .003, respectively). The final model predicted 46% of the explained GAD-2 variance.

Table 3. Comparisons of depressive symptoms, job demands, and individual resources in anxiety-related groups.

Variables, mean (SD)	Anxiety-related groups[a]				Time		Time*Group		Within-Groups comparisons
	A Never N = 246	B Decreased N = 58	C Increased N = 109	D Persistent N = 199	F	η^2	F	η^2	Post-hoc Bonferroni
PHQ-2									
T1	0.89 (0.88)	1.93 (1.33)	1.17 (1.01)	2.39 (1.33)	7.46**	.01	26.86***	.12	A < B, C, D; D > A, B, C
T2	1.12 (1.04)	1.17 (1.04)	2.23 (1.18)	2.53 (1.31)					
SSCS-S									
T1	22.53 (3.11)	20.81 (2.85)	21.60 (2.89)	18.74 (3.74)	0.68	.001	6.49***	.03	A > B, C, D; D < A, B, C
T2	22.46 (3.14)	21.83 (2.75)	20.38 (3.22)	18.51 (3.57)					
SOC-3									
T1	13.99 (1.91)	12.26 (3.06)	13.31 (2.27)	11.59 (3.25)	1.33	.002	9***	.05	A > B, C, D; D < A, B, C
T2	13.84 (2.06)	13.79 (2.40)	12.52 (2.76)	11.59 (2.85)					
ESSI									
T1	21.76 (3.30)	20.81 (4.55)	21.13 (3.68)	19.68 (4.54)	2.42	.004	2.49	.01	A > D
T2	21.61 (3.34)	21.07 (4.62)	20.27 (3.88)	19.57 (4.61)					
Risk perception									
T1	2.93 (0.68)	3.34 (0.65)	3.23 (0.67)	3.43 (0.70)	15.67***	.03	1.11	.01	A < B, C, D
T2	2.99 (0.75)	3.44 (0.70)	3.43 (0.73)	3.56 (0.67)					
Health and safety									
T1	4.11 (0.75)	3.81 (0.73)	3.98 (0.77)	3.64 (0.85)	64.29***	.10	2.11	.01	A > D; D < A, B, C
T2	4.35 (0.56)	4.27 (0.59)	4.13 (0.59)	3.90 (0.75)					

[a]Never = absence of anxiety symptoms at both T1 and T2; Decreased = presence of anxiety symptoms at T1 but no longer at T2; Increased = presence of anxiety symptoms at T2 but not at T1; Persistent = presence of anxiety symptoms at both T1 and T2.

Notes: PHQ-2 = Patient Health Questionnaire-2; SSCS-S = Self-Compassion Scale; SOC-3 = Sense of Coherence; ESSI = ENRICHD Social Support Instrument.

All values are standardized regression weights

*$p < .05$

**$p < .01$

***$p < .001$.

Sensitivity analysis

To check the validity of the results, we compared the participants from Nuremberg (n = 426) with those from the other centers (n = 186) using repeated-measures ANOVA analysis, as the Nuremberg participants were the largest group in the longitudinal survey (see S3 Table). We found a significant effect of time on depressive symptoms in the entire sample, indicating a significant worsening of psychological distress in hospital staff between the first and second waves of COVID-19. However, we did not find significant differences comparing the two groups over time, showing that the main results were not influenced by group size from different institutions. Finally, for a comparison of the longitudinal sample (completers) with respondents from the cross-sectional sample at T1 who did not participate in the second survey at T2 (non-completers), see [17].

Discussion

This longitudinal study aimed to examine long-term changes in job demands and individual resources associated with emotional distress symptoms in hospital staff during the COVID-19 pandemic. The results of our survey point out some relevant aspects.

Table 4. Summary of hierarchical regression model predicting depressive symptoms (PHQ-2) at T2.

Variables	Model 1			Model 2			Model 3			Model 4		
	B	SE	β	B	SE	B	B	SE	β	B	SE	β
PHQ-2 (T1)	.50	.04	.49***	.48	.04	.47***	.44	.04	.43***	.35	.04	.34***
Age				-.15	.14	-.05	-.11	.14	-.04	-.03	.13	-.01
Gender				-.01	.11	-.002	-.02	.11	-.01	-.07	.10	-.02
Function				-.07	.04	-.07	-.07	.04	-.03	-.07	.04	-.07
Job experience				-.13	.16	-.04	-.07	.16	.02	-.12	.15	-.04
History of mental illness				.20	.12	.06	.21	.12	.07	.12	.11	.04
Contact with COVID-19 patients							-.01	.11	-.003	.03	.10	.01
Risk perception (T1)							-.03	.09	-.02	-.05	.08	-.03
Risk perception (T2)							.24	.08	.14**	.20	.08	.11*
Health and safety (T1)							-.04	.07	-.03	-.02	.07	-.01
Health and safety (T2)							-.14	.09	-.07	-.06	.08	-.03
SSCS-S (T1)										.01	.02	.03
SSCS-S (T2)										-.09	.02	-.24***
SOC-3 (T1)										.02	.02	.04
SOC-3 (T2)										-.09	.02	-.18***
ESSI (T1)										.04	.02	.11*
ESSI (T2)										-.06	.02	-.19***
R^2			.24			.24			.26			.37
F for change in R^2			176.90***			1.71			4.60***			16.70***

Notes: PHQ-2 = Patient Health Questionnaire-2; SSCS-S = Self-Compassion Scale; SOC-3 = Sense of Coherence; ESSI = ENRICHD Social Support Instrument.

All values are standardized regression weights

*$p < .05$

**$p < .01$

***$p < .001$.

Alarmingly, our data showed that 59.9% to 71.2% of HCWs reported anxiety or depression symptoms during the COVID-19 pandemic. This result is in line with the literature showing a rate of distress symptoms of up to 71.3% among HCWs during the COVID-19 outbreak [19]. Our first important finding was that hospital staff showed an overall increase in depressive (21.9%) and anxiety (17.8%) symptoms between the first and second waves of the COVID-19 pandemic. This finding suggests that the burden for the hospitals during the COVID-19 pandemic had a long-term impact on HCWs' emotional distress. Previous longitudinal studies have shown that HCWs have experienced high levels of anxiety, depression, burnout, and post-traumatic stress disorder (PTSD) as a result of their work during the pandemic [47–49]. The prolonged nature of the pandemic, as well as long working hours, exposure to critically ill patients, and the risk of contracting the virus itself, added to the stress and emotional toll on HCWs [50].

In our first hypothesis, we expected that HCWs with higher levels of anxiety and depression over time would show higher levels of job demands and lower individual resources during both the first and second phases of the COVID-19 pandemic. This hypothesis was partially confirmed. Compared with the other groups, individuals with high symptoms of depression or anxiety at both T1 and T2 were more likely to report a previous history of mental illness and lower levels of self-compassion and sense of coherence over time. Contrary to previous studies [e.g., 51], no differences were found between groups on levels of social support and job demands (i.e., contact with COVID-19 patients, risk perception, and health and safety).

Table 5. Summary of hierarchical regression model predicting anxiety symptoms (GAD-2) at T2.

Variables	Model 1			Model 2			Model 3			Model 4		
	B	SE	β	B	SE	β	B	SE	β	B	SE	β
GAD-2 (T1)	.53	.03	.54***	.50	.04	.51***	.43	.04	.44***	.30	.04	.31***
Age				-.06	.14	-.02	-.01	.14	-.004	-.15	.13	.05
Gender				.07	.11	.02	.06	.11	.02	.004	.10	.001
Function				-.05	.04	-.05	-.05	.04	-.05	-.04	.04	-.04
Job experience				-.07	.16	-.02	-.02	.16	-.01	-.10	.14	-.03
History of mental illness				.30	.12	.09*	.33	.12	.10**	.24	.11	.08*
Contact with COVID-19 patients							-.02	.11	-.01	.05	.10	.02
Risk perception (T1)							.01	.09	.005	.04	.08	.02
Risk perception (T2)							.21	.08	.11*	.18	.07	.10*
Health and safety (T1)							-.04	.07	-.03	.005	.07	.003
Health and safety (T2)							-.21	.09	-.10*	-.15	.08	-.02
SSCS-S (T1)										-.01	.02	-.03
SSCS-S (T2)										-.09	.02	-.24***
SOC-3 (T1)										.03	.02	.05
SOC-3 (T2)										-.12	.02	-.24***
ESSI (T1)										.04	.02	.11*
ESSI (T2)										-.05	.02	-.14**
R^2			.28			.29			.32			.46
F for change in R^2			232.01***			1.67			5.67***			23.85***

Notes: GAD-2 = General Anxiety Disorder-2; SSCS-S = Self-Compassion Scale; SOC-3 = Sense of Coherence; ESSI = ENRICHD Social Support Instrument.

All values are standardized regression weights

*p < .05

**p < .01

***p < .001

Noteworthily, the level of subjective stress due to lower psychological resources seems to be more related to emotional symptoms than the objective level of stress due to work-related factors. Recently, a study on 7,765 HCWs in Germany found that high levels of psychological resources were negatively associated with symptoms of anxiety and depression [52], even and above the effect of sociodemographic and work-related factors (such as female gender or contact with COVID-19-infected patients). There is evidence that psychological resources, such as self-compassion [53, 54] and a sense of coherence [55–57], may be strongly related to lower distress symptoms in hospital staff. HCWs who practice self-compassion may be better able to accept difficult emotions and experiences and maintain perspective during the pandemic [53, 54]. On the same line, HCWs who have a high sense of coherence seem to have greater coping abilities and resilience in the face of stress [58].

It is also interesting to note that anxiety, but not depressive, symptoms over time were less present within physicians and more experienced workers in our sample. It is possible to suppose that physicians and staff with greater professional experience have specific resilience to psychological pressure that might be related to professional fulfillment [59], self-empowerment [60] and greater experience with complex clinical problems and challenging situations.

Consistent with our second hypothesis, we found that risk perception, self-compassion, and sense of coherence at T2 and social support at both T1 and T2 were strong independent predictors of both depressive and anxiety symptoms at T2, even after controlling for baseline depressive or anxiety symptoms and sociodemographic variables. In addition, having a history

of mental illness was a significant predictor of anxiety symptoms at T2. Once again, these results suggest that emotional symptoms are influenced more by psychological resources than by sociodemographic or work-related factors. Our finding is consistent with a growing number of studies that have investigated the role of psychological resources, such as resilience and coping strategies, as protective factors for HCWs during the COVID-19 pandemic [47, 48]. A systematic review of 31 studies found that HCWs who reported higher levels of psychological resilience, optimism, and positive coping strategies, such as problem-solving and active coping, were less likely to experience symptoms of anxiety and depression during the pandemic [24]. Additionally, HCWs who reported higher levels of social support from colleagues and supervisors also had lower levels of anxiety and depression [61]. Another study found that HCWs who reported higher levels of emotional intelligence, self-compassion, and mindfulness were less likely to experience burnout and PTSD symptoms during the pandemic [62].

Strengths and limitations

The strengths of this study are the longitudinal perspective design, multi-center international sample, large sample size, and use of well-validated psychometric measures. However, some limitations are to be acknowledged. First, the number of participants who had responded to both T1 and T2 was relatively low compared to both cross-sectional surveys. This may be related to the characteristics of recruitment: HCWs were explicitly invited to participate in the survey at T2, even though they had not responded to the first questionnaire at T1. Second, our sample of HCWs included an unbalanced proportion between females and males and between the different countries. Moreover, although the Covid-19 pandemic has affected the entire world, the pandemic peak was possibly reached at different times in the countries included in the study. These points limit the generalizability of the results. Third, the online administration of a survey is subject to responder bias. Particularly with HCWs during the dramatic pandemic, people who agreed to answer questions on their psychological health might be much more motivated to participate if psychologically distressed. This may have overestimated the emotional distress. Fourth, although most of the measures used have been validated, some questions were constructed ad hoc for the survey (e.g., job demands). Even though this may be a helpful way to measure, given time constraints, their validity in the current context may be up for debate. Fifth, the history of mental illness was self-reported with a single item. This type of assessment could be compromised by participants' subjective biases and social desirability. Finally, many possible confounding variables were not assessed and could not be controlled for, such as personality traits, PTSD symptoms or sleep disturbances.

Conclusion

Overall, this multicountry study pointed out that HCWs during the COVID-19 outbreak experienced a high burden of psychological distress. Regardless of personal vulnerability, relying on individual and contextual resources helps HCWs to cope with high-risk emergencies such as the COVID-19 pandemic. Our results strongly highlight that the mental health and resilience of HCWs should be supported during disease outbreaks by instituting workplace interventions for psychological support. Moreover, there is evidence that interventions focused on improving individual resources (such as mindfulness programs) helps HCWs cope with the health emergency situation [63].

Supporting information

S1 Table. Participants by countries.
(DOCX)

S2 Table. Comparisons of psychological symptoms, protective and risk factors over time in total sample. Notes: PHQ-2 = Patient Health Questionnaire-2; GAD-2 = General Anxiety Disorder-2.
(DOCX)

S3 Table. Comparisons of anxiety and depressive symptoms between participants from Nuremberg and other centers. Notes: PHQ-2 = Patient Health Questionnaire– 2; GAD-2 = General Anxiety Disorder-2. All values are standardized regression weights. *p < .05; **p < .01; ***p < .001.
(DOCX)

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References

1. World Health Organization, Mental health and psychosocial considerations during the COVID-19 outbreak. 2020 Mar 18 [Cited 2023 March]. Available from: https://www.who.int/docs/default-source/coronaviruse/mental-health-considerations.pdf

2. Pfefferbaum B, North CS. Mental Health and the Covid-19 Pandemic. N Engl J Med. 2020; 383(6):510–512. https://doi.org/10.1056/NEJMp2008017 PMID: 32283003

3. Morioka H, Ijichi S, Ijichi N, Ijichi Y, King BH. Developmental social vulnerability as the intrinsic origin of psychopathology: A paradigm shift from disease entities to psychiatric derivatives within human diversity. Med Hypotheses. 2019; 126:95–108. https://doi.org/10.1016/j.mehy.2019.03.015 PMID: 31010507

4. Wheaton MG, Abramowitz JS, Berman NC, Fabricant LE, Olatunji BO. Psychological predictors of anxiety in response to the H1N1 (swine flu) pandemic. Cognit Ther Res. 2012; 36: 210–218. https://doi.org/10.1007/s10608-011-9353-3

5. Cheng SK, Wong CW, Tsang J, Wong KC. Psychological distress and negative appraisals in survivors of severe acute respiratory syndrome (SARS). Psychol Med. 2004; 34(7):1187–1195. https://doi.org/10.1017/s0033291704002272 PMID: 15697045

6. Asmundson GJG, Taylor S. Coronaphobia: Fear and the 2019-nCoV outbreak. J Anxiety Disord. 2020; 70:102196. https://doi.org/10.1016/j.janxdis.2020.102196 PMID: 32078967

7. Torales J O'Higgins M, Castaldelli-Maia JM, Ventriglio A. The outbreak of COVID-19 coronavirus and its impact on global mental health. Int J Soc Psychiatry. 2020; 66(4):317–320. https://doi.org/10.1177/0020764020915212 PMID: 32233719

8. Asmundson GJG, Taylor S. How health anxiety influences responses to viral outbreaks like COVID-19: What all decision-makers, health authorities, and health care professionals need to know. J Anxiety Disord. 2020; 71:102211. https://doi.org/10.1016/j.janxdis.2020.102211 PMID: 32179380

9. Xiong J, Lipsitz O, Nasri F, et al. Impact of COVID-19 pandemic on mental health in the general population: A systematic review. J Affect Disord. 2020; 277:55–64. https://doi.org/10.1016/j.jad.2020.08.001 PMID: 32799105

10. Mazza C, Ricci E, Biondi S, et al. A Nationwide Survey of Psychological Distress among Italian People during the COVID-19 Pandemic: Immediate Psychological Responses and Associated Factors. Int J Environ Res Public Health. 2020; 17(9):3165. Published 2020 May 2. https://doi.org/10.3390/ijerph17093165 PMID: 32370116

11. Cao W, Fang Z, Hou G, et al. The psychological impact of the COVID-19 epidemic on college students in China. Psychiatry Res. 2020; 287:112934. https://doi.org/10.1016/j.psychres.2020.112934 PMID: 32229390

12. Tull MT, Edmonds KA, Scamaldo KM, Richmond JR, Rose JP, Gratz KL. Psychological Outcomes Associated with Stay-at-Home Orders and the Perceived Impact of COVID-19 on Daily Life. Psychiatry Res. 2020; 289:113098. https://doi.org/10.1016/j.psychres.2020.113098 PMID: 32434092

13. Mo Y, Deng L, Zhang L, et al. Work stress among Chinese nurses to support Wuhan in fighting against COVID-19 epidemic. J Nurs Manag. 2020; 28(5):1002–1009. https://doi.org/10.1111/jonm.13014 PMID: 32255222

14. Catton H. Global challenges in health and health care for nurses and midwives everywhere. Int Nurs Rev. 2020; 67(1):4–6. https://doi.org/10.1111/inr.12578 PMID: 32083728

15. Wu Y, Wang J, Luo C, et al. A Comparison of Burnout Frequency Among Oncology Physicians and Nurses Working on the Frontline and Usual Wards During the COVID-19 Epidemic in Wuhan, China. J Pain Symptom Manage. 2020; 60(1):e60–e65. https://doi.org/10.1016/j.jpainsymman.2020.04.008 PMID: 32283221

16. Xiong NN, Fan TT, Leonhart R, et al. Workplace factors can predict the stress levels of healthcare workers during the COVID-19 pandemic: First interim results of a multicenter follow-up study. Front Public Health. 2022; 10:1002927. Published 2022 Nov 1. https://doi.org/10.3389/fpubh.2022.1002927 PMID: 36388352

17. Müller MM, Baillès E, Blanch J, et al. Burnout among hospital staff during the COVID-19 pandemic: Longitudinal results from the international Cope-Corona survey study [published correction appears in J Psychosom Res. 2023 Apr;167:111205]. J Psychosom Res. 2023; 164:111102. https://doi.org/10.1016/j.jpsychores.2022.111102 PMID: 36508846

18. Conti C, Fontanesi L, Lanzara R, Rosa I, Porcelli P. Fragile heroes. The psychological impact of the COVID-19 pandemic on health-care workers in Italy. PLoS One. 2020; 15(11):e0242538. Published 2020 Nov 18. https://doi.org/10.1371/journal.pone.0242538 PMID: 33206714

19. Ching SM, Ng KY, Lee KW, et al. Psychological distress among healthcare providers during COVID-19 in Asia: Systematic review and meta-analysis. PLoS One. 2021; 16(10):e0257983. Published 2021 Oct 14. https://doi.org/10.1371/journal.pone.0257983 PMID: 34648526

20. Marvaldi M, Mallet J, Dubertret C, Moro MR, Guessoum SB. Anxiety, depression, trauma-related, and sleep disorders among healthcare workers during the COVID-19 pandemic: A systematic review and meta-analysis. Neurosci Biobehav Rev. 2021; 126:252–264. https://doi.org/10.1016/j.neubiorev.2021.03.024 PMID: 33774085

21. Fernandez R, Sikhosana N, Green H, et al. Anxiety and depression among healthcare workers during the COVID-19 pandemic: a systematic umbrella review of the global evidence. BMJ Open. 2021; 11(9):e054528. Published 2021 Sep 21. https://doi.org/10.1136/bmjopen-2021-054528 PMID: 34548373

22. Pappa S, Ntella V, Giannakas T, Giannakoulis VG, Papoutsi E, Katsaounou P. Prevalence of depression, anxiety, and insomnia among healthcare workers during the COVID-19 pandemic: A systematic review and meta-analysis [published correction appears in Brain Behav Immun. 2021 Feb;92:247]. Brain Behav Immun. 2020; 88:901–907. https://doi.org/10.1016/j.bbi.2020.05.026 PMID: 32437915

23. De Kock JH, Latham HA, Leslie SJ, et al. A rapid review of the impact of COVID-19 on the mental health of healthcare workers: implications for supporting psychological well-being. BMC Public Health. 2021; 21(1):104. Published 2021 Jan 9. https://doi.org/10.1186/s12889-020-10070-3 PMID: 33422039

24. Labrague LJ. Psychological resilience, coping behaviours and social support among health care workers during the COVID-19 pandemic: A systematic review of quantitative studies. J Nurs Manag. 2021; 29(7):1893–1905. https://doi.org/10.1111/jonm.13336 PMID: 33843087

25. Luthar SS, Cicchetti D. The construct of resilience: implications for interventions and social policies. Dev Psychopathol. 2000; 12(4):857–885. https://doi.org/10.1017/s0954579400004156 PMID: 11202047

26. Baskin RG, Bartlett R. Healthcare worker resilience during the COVID-19 pandemic: An integrative review. J Nurs Manag. 2021; 29(8):2329–2342. https://doi.org/10.1111/jonm.13395 PMID: 34182609

27. Antonovsky A, Health stress and coping. San Francisco: Jossey-Bass; 1979.

28. Antonovsky A. Unraveling the Mystery of Health. How people manage stress and stay well. San Francisco: Jossey-Bass; 1987.

29. Moksnes UK. Sense of Coherence. In: Haugan G, Eriksson M, editors. Health Promotion in Health Care–Vital Theories and Research. Cham (CH): Springer; 2021. Chapter 4.

30. Eriksson M. The Sense of Coherence in the Salutogenic Model of Health. In: Mittelmark MB, Sagy S, Eriksson M, Bauer GF, Pelikan JM, Lindström B, Espnes GA, editors. The Handbook of Salutogenesis. Cham (CH): Springer; 2017. Chapter 11.

31. Zessin U, Dickhäuser O, Garbade S. The Relationship Between Self-Compassion and Well-Being: A Meta-Analysis. Appl Psychol Health Well Being. 2015; 7(3):340–364. https://doi.org/10.1111/aphw.12051 PMID: 26311196

32. MacBeth A, Gumley A. Exploring compassion: a meta-analysis of the association between self-compassion and psychopathology. Clin Psychol Rev. 2012; 32(6):545–552. https://doi.org/10.1016/j.cpr.2012.06.003 PMID: 22796446

33. Muris P, Petrocchi N. Protection or Vulnerability? A Meta-Analysis of the Relations Between the Positive and Negative Components of Self-Compassion and Psychopathology. Clin Psychol Psychother. 2017; 24(2):373–383. https://doi.org/10.1002/cpp.2005 PMID: 26891943

34. Neff KD. Self-Compassion: Theory, Method, Research, and Intervention. Annu Rev Psychol. 2023; 74:193–218. https://doi.org/10.1146/annurev-psych-032420-031047 PMID: 35961039

35. Lau BH, Chan CL, Ng SM. Self-Compassion Buffers the Adverse Mental Health Impacts of COVID-19-Related Threats: Results From a Cross-Sectional Survey at the First Peak of Hong Kong's Outbreak. Front Psychiatry. 2020; 11:585270. Published 2020 Nov 5. https://doi.org/10.3389/fpsyt.2020.585270 PMID: 33250793

36. Waqas M, Hania A, Hongbo L. Psychological Predictors of Anxious Responses to the COVID-19 Pandemic: Evidence from Pakistan. Psychiatry Investig. 2020; 17(11):1096–1104. https://doi.org/10.30773/pi.2020.0167 PMID: 33190456

37. Conti C, Lanzara R, Rosa I, Müller MM, Porcelli P. Psychological correlates of perceived loneliness in college students before and during the COVID-19 stay-at-home period: a longitudinal study. BMC Psychol. 2023; 11(1):60. Published 2023 Mar 6. https://doi.org/10.1186/s40359-023-01099-1 PMID: 36879326

38. General Assembly of the World Medical Association. World Medical Association Declaration of Helsinki: ethical principles for medical research involving human subjects. J JAMA. 2013; 310: 2191–2194. https://doi.org/10.1001/jama.2013.281053 PMID: 24141714

39. Neff KD, Tóth-Király I, Knox MC, Kuchar A, Davidson O. The development and validation of the State Self-Compassion Scale (long- and short form). Mindfulness. 2021; 12: 121–140. https://doi.org/10.1007/s12671-020-01505-4

40. Lundberg O, Peck MN. A simplified way of measuring sense of coherence: experiences from a population survey in Sweden. Eur J Public Health. 1995; 5: 56–59. https://doi.org/10.1093/EURPUB%2F5.1.56

41. Schumann A, Hapke U, Meyer C, Rumpf HJ, John U. Measuring sense of coherence with only three items: a useful tool for population surveys. Br J Health Psychol. 2003; 8: 409–421. https://doi.org/10.1348/135910703770238275 PMID: 14614789

42. Investigators ENRICHD. Enhancing Recovery in Coronary Heart Disease (ENRICHD) study intervention: rationale and design. Psychosom Med. 2001; 63(5):747–755. PMID: 11573023

43. Kroenke K, Spitzer RL, Williams JB. The Patient Health Questionnaire-2: validity of a two-item depression screener. Med Care. 2003; 41(11):1284–1292. https://doi.org/10.1097/01.MLR.0000093487.78664.3C PMID: 14583691

44. Kroenke K, Spitzer RL, Williams JB, Monahan PO, Löwe B. Anxiety disorders in primary care: prevalence, impairment, comorbidity, and detection. Ann Intern Med. 2007; 146(5):317–325. https://doi.org/10.7326/0003-4819-146-5-200703060-00004 PMID: 17339617

45. Cohen J. Statistical Power Analysis for the Behavioral Sciences. 2nd ed. London: Routledge; 1988.

46. Cohen J. Eta-Squared and Partial Eta-Squared in Fixed Factor Anova Designs. Educ Psychol Meas. 1973; 33: 107–112. https://doi.org/10.1177/001316447303300111

47. López Steinmetz LC, Herrera CR, Fong SB, Godoy JC. A Longitudinal Study on the Changes in Mental Health of Healthcare Workers during the COVID-19 Pandemic. Psychiatry. 2022; 85(1):56–71. https://doi.org/10.1080/00332747.2021.1940469 PMID: 34328825

48. Luceño-Moreno L, Talavera-Velasco B, Vázquez-Estévez D, Martín-García J. Mental Health, Burnout, and Resilience in Healthcare Professionals After the First Wave of COVID-19 Pandemic in Spain: A Longitudinal Study. J Occup Environ Med. 2022; 64(3):e114–e123. https://doi.org/10.1097/JOM.0000000000002464 PMID: 34935681

49. Th'ng F, Rao KA, Ge L, et al. Longitudinal Study Comparing Mental Health Outcomes in Frontline Emergency Department Healthcare Workers through the Different Waves of the COVID-19 Pandemic. Int J Environ Res Public Health. 2022; 19(24):16878. Published 2022 Dec 15. https://doi.org/10.3390/ijerph192416878 PMID: 36554759

50. Chigwedere OC, Sadath A, Kabir Z, Arensman E. The Impact of Epidemics and Pandemics on the Mental Health of Healthcare Workers: A Systematic Review. Int J Environ Res Public Health. 2021; 18(13):6695. Published 2021 Jun 22. https://doi.org/10.3390/ijerph18136695 PMID: 34206264

51. Hao Q, Wang D, Xie M, et al. Prevalence and Risk Factors of Mental Health Problems Among Health-care Workers During the COVID-19 Pandemic: A Systematic Review and Meta-Analysis. Front Psychiatry. 2021; 12:567381. Published 2021 Jun 15. https://doi.org/10.3389/fpsyt.2021.567381 PMID: 34211406

52. Schug C, Morawa E, Geiser F, et al. Social Support and Optimism as Protective Factors for Mental Health among 7765 Healthcare Workers in Germany during the COVID-19 Pandemic: Results of the VOICE Study. Int J Environ Res Public Health. 2021; 18(7):3827. Published 2021 Apr 6. https://doi.org/10.3390/ijerph18073827 PMID: 33917493

53. Harmanci H, Akdeniz S. Self-Compassion and COVID-19 Stress in Turkish Healthcare Workers: The Mediating Role of Psychological Resilience. Psychol Rep. 2023; 126(2):775–790. https://doi.org/10.1177/00332941221149173 PMID: 36573899

54. Ruiz-Fernández MD, Ramos-Pichardo JD, Ibáñez-Masero O, Carmona-Rega MI, Sánchez-Ruiz MJ, Ortega-Galán ÁM. Professional quality of life, self-compassion, resilience, and empathy in healthcare professionals during COVID-19 crisis in Spain. Res Nurs Health. 2021; 44(4):620–632. https://doi.org/10.1002/nur.22158 PMID: 34036600

55. Berger-Estilita J, Abegglen S, Hornburg N, Greif R, Fuchs A. Health-Promoting Quality of Life at Work during the COVID-19 Pandemic: A 12-Month Longitudinal Study on the Work-Related Sense of Coherence in Acute Care Healthcare Professionals. Int J Environ Res Public Health. 2022; 19(10):6053. Published 2022 May 16. https://doi.org/10.3390/ijerph19106053 PMID: 35627590

56. Stoyanova K, Stoyanov DS. Sense of Coherence and Burnout in Healthcare Professionals in the COVID-19 Era. Front Psychiatry. 2021; 12:709587. Published 2021 Aug 2. https://doi.org/10.3389/fpsyt.2021.709587 PMID: 34408684

57. Tanaka K, Tahara M, Mashizume Y, Takahashi K. Effects of Lifestyle Changes on the Mental Health of Healthcare Workers with Different Sense of Coherence Levels in the Era of COVID-19 Pandemic. Int J Environ Res Public Health. 2021; 18(6):2801. Published 2021 Mar 10. https://doi.org/10.3390/ijerph18062801 PMID: 33801912

58. Sommerlatte S, Lugnier C, Schoffer O, Jahn P, Kraeft AL, Kourti E, et al. Mental burden and moral distress among oncologists and oncology nurses in Germany during the third wave of the COVID-19 pandemic: a cross-sectional survey. J Cancer Res Clin Oncol. 2023 Jan 26:1–13. https://doi.org/10.1007/s00432-023-04580-x Epub ahead of print. PMID: 36700979; PMCID: PMC9878480.

59. Zwack J, Schweitzer J. If every fifth physician is affected by burnout, what about the other four? Resilience strategies of experienced physicians. Acad Med. 2013; 88(3):382–389. https://doi.org/10.1097/ACM.0b013e318281696b PMID: 23348093

60. Zwack J, Abel C, Schweitzer J. Physicians' resilience—salutogenetic practices and attitudes of experienced physicians. Psychother Psychosom Med Psychol. 2011; 61: 495–502. https://doi.org/10.1055/s-0031-1291276

61. Skogsberg M, Jarl G, Matérne M. Health care workers' need for support from managers during the initial phase of the COVID-19 pandemic. BMC Health Serv Res. 2022; 22(1):1563. Published 2022 Dec 21. https://doi.org/10.1186/s12913-022-08937-9 PMID: 36544137

62. Kwon CY, Lee B. Systematic Review of Mind-Body Modalities to Manage the Mental Health of Health-care Workers during the COVID-19 Era. Healthcare (Basel). 2022; 10(6):1027. Published 2022 Jun 1. https://doi.org/10.3390/healthcare10061027 PMID: 35742076

63. Miyoshi T, Ida H, Nishimura Y, Ako S, Otsuka F. Effects of Yoga and Mindfulness Programs on Self-Compassion in Medical Professionals during the COVID-19 Pandemic: An Intervention Study. Int J Environ Res Public Health. 2022; 19(19):12523. Published 2022 Sep 30. https://doi.org/10.3390/ijerph191912523 PMID: 36231820