

## RESEARCH ARTICLE

# Prevalence and associated factors of mental health disorders among Brazilian healthcare workers in times of the COVID-19 pandemic: A web-based cross-sectional study

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## Abstract

The COVID-19 pandemic in Brazil affected mental health among healthcare workers. To objective of this study was to evaluate the mental health of healthcare workers in in the central-west region of the Brazil, estimating the prevalence of mental health disorders, and investigating associated factors, perceptions of safety, and self-perceptions about mental health in times of the COVID-19 pandemic. The questionnaire was divided into two parts that included general information and perceptions about the work process and identified symptoms using the Depression Anxiety Stress Scale-21 (DASS-21), and multiple linear regression analysis was conducted. A total of 1,522 healthcare workers participated in the survey. Overall prevalence of symptoms was calculated for depression (58.7%), anxiety (59.7%), and stress (61.7%). Physicians had 3.75 times greater risk of depression (1.59–8.85, 95% CI). Independent variables associated with depression symptoms were not feeling safe with the way services were organized (1.12:1.03–1.21, 95% CI) and self-perception of poor mental health (8.06: 4.03–16.10% CI). Working in management was protective, and married professionals had 12% lower risk of exhibiting symptoms of depression (0.79–0.99, 95% CI). Participants with self-perception of poor mental health had 4.63 greater risk for symptoms of anxiety (2.58–8.31, 95% CI). Protective factors were not having sought support for mental health (0.90: 0.82–0.99, 95% CI), having a graduate degree (0.71: 0.54–0.94, 95% CI), and not having been diagnosed with COVID-19 (0.90: 0.83–0.98, 95% CI). Perception of poor mental health was associated with 6.95-fold greater chance of developing stress symptoms. Protective factors from stress were having a degree in dentistry (0.81: 0.68–0.97, 95% CI), residing in Mato Grosso do Sul (0.91: 0.85–0.98, 95% CI), and not having sought mental health support services (0.88: 0.82–0.95, 95% CI). The prevalence of mental health disorders is high among healthcare workers, and is associated with

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professional category, organization of services provided, and self-perception of poor mental health, reinforcing the need for preventative measures.

## Introduction

The COVID-19 pandemic and the implementation of related isolation measures led to an increase in mental health problems around the world, including depression and generalized anxiety disorder [1,2].

Globally, the impact of common mental disorders among healthcare workers is underestimated [1]. Prior to the arrival of COVID-19, attention to the health of workers (including mental health) had never been a priority in healthcare policy. Understanding that health professionals are on the front line and need to be protected to ensure better health for everyone, as emphasized in the 2030 Sustainable Development Goals, remains an ongoing challenge, especially in countries where resources are limited [3].

Healthcare workers as a group should be considered vulnerable to sickness and even mortality during health crises. Besides biological risk, their mental health is more likely to be affected compared to the general population [4–6]. An estimated one fourth of the healthcare workforce exposed to COVID-19 developed anxiety, depression, acute stress, insomnia, post-traumatic stress symptoms, and burnout [7,8].

Fear, social distancing, and continuous feelings of anguish and concern were observed throughout society during the pandemic [9–11]; healthcare professions, however, involve specific challenges [12–14] such as poor working conditions and remuneration [7], insufficient and inadequate patient beds [15], poor quality and insufficient quantities of individual protective equipment [16,17], as well as longer working periods and consequently fewer rest hours [18]. Unusual situations involving moral suffering and other ongoing dilemmas inherent to routine activities in healthcare that were noted during the COVID-19 pandemic have also been described [19,20].

The mental illness of healthcare workers is a complex and multifaceted phenomenon, influenced by individual, interpersonal, organizational, and social factors [21,22]. To protect the mental health of these professionals, it is important to implement protective measures, such as organizational support, effective communication, adequate training, and access to mental health resources, to mitigate risks and promote the resilience of healthcare workers in times of health crisis [23].

Despite the investigation of psychosocial risks and protective measures for the mental health of healthcare workers during the COVID-19 pandemic [21–23], further research is still needed. New virus variants are emerging and the pandemic is still evolving, which may have a different impact on the mental health of healthcare professionals [24]. In addition, working conditions for healthcare professionals can vary significantly across different countries and regions, and the support and protection measures offered to workers can also vary [25].

Therefore, it is important to continue studying the mental health of healthcare workers to understand the specific needs of professionals in different contexts and to develop tailored interventions that can meet their needs [26].

The objective of this study was to evaluate the mental health of healthcare workers in Brazil, estimating the prevalence of mental health disorders, and investigating associated factors, perceptions of safety, and self-perceptions about mental health in times of the COVID-19 pandemic.

## Methodology

### Study type

This web-based cross-sectional study was conducted from November 2020 to October 2021, according to the STROBE recommendations [27].

### Selection and sample

Initially, we obtained the consent of each professional class boards, in order to carry out invitations to professionals and obtain active professional records for validation of research data. After approval by the Research Ethics Committee, the invitations initially came from the class boards.

Only medical professionals, nurses, nurse technicians, dentists, dentists technicians, pharmacists, or physical therapists with active status with Brazilian professional boards were included.

In Brazil, there are health professionals with technical qualifications and high school education, recognized and registered in their professional bodies. To ensure the participation of only professionals, we requested in the Informed Consent Form (ICF), that they inform the Class Boards number, which was later validated with the active subscribers of each boards.

A total of 56,298 healthcare professionals were registered with their respective professional boards; the sample size was calculated based on the prevalence of mental health disorders among health professionals during the COVID-19 pandemic, using a rate of 34% and sample error of 5%, according to the following formula:  $n = (z_{\alpha/2})^2 p(1-p)/e^2$ , where  $e = z_{\alpha/2} \sqrt{p(1-p)}$  [28]. This yielded an estimated total of 1,280 participants, considering 10% sample loss. The non-probabilistic sampling was proportionally distributed between Mato Grosso do Sul and the Federal District and among the various professions.

### Data collect

An electronic form on the REDCap platform was used to collect the data from voluntary respondents, healthcare workers from two states in the center-west region of Brazil.

The participants responded to an online questionnaire which included questions about sociodemographic aspects related to work and to health. The questionnaire was divided into two parts that included general information and perceptions about the work process.

The following strategies were used to invite participants: email sent to the professional by the profession's class board and dissemination on social networks with the research link.

Data entry into the RedCap system was monitored by research managers, who validated the information. Managers accessed the system using a login and password, keeping the participants' sensitive data confidential.

### Symptoms mental disorders—validated scale

Three outcomes for mental health disorders were considered (symptoms of depression, anxiety, and stress) using the Depression Anxiety Stress Scale-21 (DASS-21), adapted and validated for Portuguese [29]. The DASS-21 is a self-reported assessment containing three subscales graded according to a 4-point Likert scale (0–3, with 0 corresponding to “Disagree completely” and 3 “Agree completely”). Each subscale of the DASS comprises seven items that evaluate the emotional states of depression, anxiety, and stress.

## Data analysis

For the multivariate analysis, only the variables that demonstrated association in univariate analysis were included.

For the dependent variable depression, data were collected on the following: school completion, professional category, physical health classification, mental health classification, COVID-19 diagnosis, level of safety in facing COVID, safety in work organization, leave, psychological/psychiatric follow-up before the pandemic, psychological/psychiatric follow-up during the pandemic, marital status, presence of a partner, occupation, workload, distancing, reallocation, how the pandemic affected income, and state.

For the dependent variable anxiety, the data collected included: sex, school completion, professional category, physical health classification, mental health classification, COVID-19 diagnosis, safety in facing COVID, safety in work organization, leave, psychological/psychiatric follow-up before the pandemic, psychological/psychiatric follow-up during the pandemic, living companions, workload, main work relationship, distancing, work situation, reallocation, and how the pandemic affected income.

For the dependent variable stress, data were collected on the following: sex, school completion, state, professional category, workload, physical health classification, mental health classification, COVID-19 diagnosis, safety in facing COVID, reallocation, leave, psychological/psychiatric follow-up before the pandemic, psychological/psychiatric follow-up during the pandemic, and how the pandemic affected income.

The data were analyzed using Stata SE software version SPSS 27.0 (StataCorp LP, College Station, USA). Associations were determined during univariate analysis using the chi-squared test ( $\chi^2$ ) or Fisher's exact test (for categorical variables with expected frequency  $<5$ ) to evaluate differences between proportions and determine 2-tailed p values. Variables with  $p < 0.20$  were included in linear Poisson regression, and prevalence ratios were calculated with robust adjustment of variance (RPaj) for each of the independent variables (symptoms of depression, anxiety, and stress).

Informed consent was obtained electronically written from all participants, with the approval of the Fiocruz Brasília Ethics Committee (#n. 4.401.333).

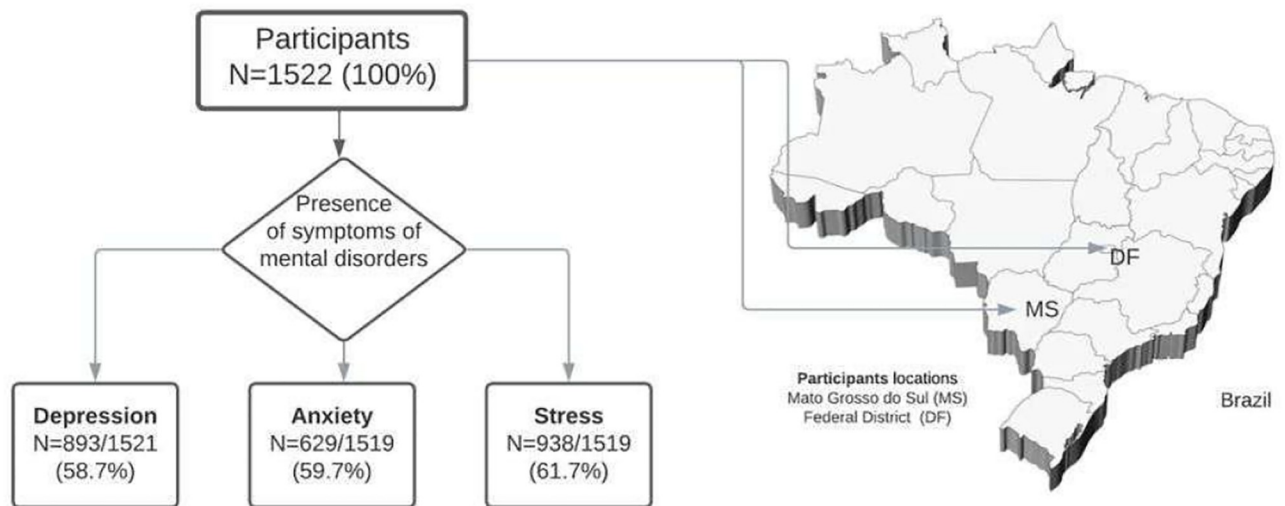
## Results

A total of 1522 healthcare workers in the center-west region were included, 45.4% in the state of Mato Grosso do Sul and 54.6% in the Federal District. The symptoms of mental health disorders found among the healthcare workers were depression (58.7%), anxiety (59.7%), and stress (61.7%), as shown in [Fig 1](#).

The respondents were mostly women (82.6%), self-declared as white (52.7%), and lived with a spouse (45.1%). Nearly 25% of respondents who completed higher education reported the presence of depression or anxiety. Respondents in the Federal District reported higher rates of depression (57.7%), anxiety (56.2%), and stress (57.4%) ([Table 1](#)).

Professionals working in nursing (nurses and nursing technicians) reported higher frequencies of mental disorders; depression, anxiety, and stress were present in approximately 32% of nurses. As for professional credentials, participants with COREN (regional nursing board registration) and CRM (regional board of medicine registration) presented higher rates for the three outcomes ([Table 2](#)).

A high percentage of respondents with depression, anxiety, and stress considered their physical and mental disposition for personal and professional demands during the pandemic to be moderate, varying from 44.30% to 49.40%. Most respondents with depression, anxiety, and stress were diagnosed with COVID-19 (64.22%, 63.30%, and 64.82%, respectively)



**Fig 1. Flowchart of participants with symptoms of mental disorder according to the location of residence.**

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maintained social distancing outside of work (93.82%, 93.96%, and 93.72%). The majority also stated that they did not receive psychological or psychiatric care prior to the pandemic (71.44%, 71.08%, and 70.33%) (Table 2).

The significant results of multivariate analysis using Poisson regression can be found in Table 3.

Physicians were 3.75 times more likely to experience symptoms of depression than the other professional categories (95% CI 1.59; 8.85). Additionally, not feeling safe with regard to the organization and structure of one's work in the face of the pandemic was associated with depression (RPaj: 1.12, 95% CI 1.03; 1.21). Furthermore, married healthcare workers had a 12% lower rate of depression than other marital status categories (RPaj: 0.88, 95% CI 0.79; 0.99). Employment in the areas of management, nursing, and pharmacy were also considered to have a protective effect ( $p < 0.005$ ).

The perception of poor mental health was associated with a 4.63-fold risk for symptoms of anxiety. Factors associated with risk were specialization (RPaj: 0.71, 95% CI 0.54; 0.94) or master's degree (RPaj: 0.70, 95% CI 0.51; 0.95). Protective factors were not having been diagnosed with COVID-19 (RPaj: 0.90, 95% CI 0.83; 0.98) and not having sought psychological and/or psychiatric help or treatment during the pandemic (RPaj: 0.90, 95% CI 0.82; 0.99).

Factors associated with stress were self-assessment of mental health as moderate or poor. These variables had 6.1 to 6.9 times the risk for stress. Having a degree in dentistry (Rpaj: 0.81–95% CI-0.68; 0.97), living in the state of Mato Grosso do Sul (Rpaj:0.91, 95% CI-0.85; 0.98), and not having sought psychological and/or psychiatric help or treatment during the pandemic period (Rpaj: 0.88–0.82; 0.95) were protective factors against signs and symptoms of stress.

## Discussion

This study found that over half of healthcare workers surveyed reported some type of mental health disorder within the context of the COVID-19 pandemic in Brazil.

In Latin America during the early part of the pandemic, signs and symptoms of these disorders were estimated to be high: prevalences of 37% for anxiety, 34% for depression, and 33%

**Table 1. Descriptive analysis and association of variables related to working conditions with outcomes (N = 1,522), MS/DF, Brazil, 2021.**

Variable	N (%)	Depression				Anxiety				Stress									
		Present N = 893 n (%)	Absent N = 629 n (%)	X <sup>2</sup>	p-value	Present N = 911 n (%)	Absent N = 611 n (%)	X <sup>2</sup>	p-value	Present N = 941 n (%)	Absent N = 581 n (%)	X <sup>2</sup>	p-value						
<b>Occupation (professional activity)</b>																			
Nurse	488 (32.1)	291 (32.6%)	197 (31.2%)	5.30	<b>0.021</b>	300 (32.9%)	188 (30.9%)	1	0.138	307 (32.6%)	181 (31.2%)	28.77	<b>0.001</b>						
Nursing technician	363 (23.9)	253 (28.3%)	110 (17.6%)			256 (28.1%)	107 (17.5%)			247 (26.2%)	116 (20.0%)								
Physician	198 (13.0)	112 (12.5%)	86 (13.7%)			101 (11.1%)	97 (15.9%)			118 (12.5%)	80 (13.9%)								
Dentist/Oral surgeon	171 (11.3)	69 (7.7%)	102 (16.2%)			78 (8.7%)	93 (15.2%)			82 (8.8%)	89 (15.3%)								
Pharmacist	101 (6.6)	62 (6.9%)	39 (6.2%)			64 (7.0%)	37 (6.1%)			66 (7.0%)	35 (6.0%)								
Physical therapist	95 (6.3)	49 (5.5%)	46 (7.3%)			54 (6.0%)	41 (6.7%)			64 (6.8%)	31 (5.3%)								
Oral hygienist	14 (0.9)	7 (0.8%)	7 (1.1%)			8 (0.9%)	6 (1.0%)			9 (1.0%)	5 (0.9%)								
Management	32 (2.1)	17 (1.8%)	15 (2.4%)			20 (2.2%)	12 (2.0%)			21 (2.2%)	11 (1.9%)								
Educator	13 (0.9)	6 (0.7%)	7 (1.1%)			5 (0.6%)	8 (1.3%)			5 (0.5%)	8 (1.4%)								
Other	44 (2.9)	26 (2.9%)	18 (2.9%)			23 (2.5%)	21 (3.4%)			21 (2.2%)	23 (4.0%)								
<b>Professional category</b>																			
COREN	907 (59.6)	573 (64.2%)	334 (53.2%)	19.39	<b>0.001</b>	587 (64.4%)	320 (52.3%)	23.68	< <b>0.001</b>	582 (61.8%)	325 (55.9%)	16.49	< <b>0.001</b>						
CRM	205 (13.5)	117 (13.1%)	88 (14.0%)			105 (11.2%)	100 (11.0%)			123 (13.1%)	82 (14.1%)								
CRO	196 (12.9)	80 (9.0%)	116 (18.4%)			90 (9.9%)	160 (17.6%)			93 (9.9%)	103 (17.7%)								
CRF	115 (7.5)	72 (8.1%)	43 (6.8%)			73 (8.0%)	42 (4.6%)			115 (12.2%)	38 (6.5%)								
CREFITO	99 (6.5)	51 (5.6%)	48 (7.6%)			56 (6.1%)	43 (4.7%)			66 (7.0%)	33 (5.7%)								
<b>Do you have more than one professional affiliation?</b>																			
Yes	464 (31.1)	267 (29.8%)	197 (31.3%)			605 (66.4%)	424 (70.2%)	1.62	0.112	636 (67.6%)	393 (67.6%)	0.009	0.954						
No	1029 (68.9)	609 (68.3%)	420 (66.8%)			289 (31.7%)	175 (28.6%)			288 (30.6%)	176 (30.3%)								
<b>What is your main professional affiliation type?</b>																			
Competitive hiring process (generally public)	801 (52.8)	456 (51.1%)	345 (54.8%)	16.64	<b>0.005</b>	461 (50.6%)	340 (55.6%)	6.15	<b>0.013</b>	491 (52.2%)	310 (53.4%)	17.327	<b>0.004</b>						
Salaried position	370 (24.4)	243 (27.2%)	127 (20.2%)			252 (27.7%)	118 (19.3%)			245 (26.0%)	125 (21.5%)								
Independent professional	121 (8.0)	62 (6.9%)	59 (9.4%)			60 (6.6%)	61 (10.0%)			60 (6.4%)	61 (10.5%)								
Cooperative	48 (3.2)	27 (3.0%)	21 (3.3%)			29 (3.2%)	19 (3.1%)			31 (3.3%)	17 (2.9%)								
Scholarship recipient/fellow	95 (6.3)	63 (7.1%)	32 (5.1%)			59 (6.5%)	36 (5.9%)			68 (7.2%)	27 (4.6%)								
Other	81 (5.3)	40 (4.5%)	41 (6.5%)			47 (5.2%)	34 (5.6%)			43 (4.6%)	38 (6.5%)								
<b>Workplace</b>																			

(Continued)

Table 1. (Continued)

Variable	N (%)	Depression				Anxiety				Stress			
		Present N = 893 n (%)	Absent N = 629 n (%)	X <sup>2</sup>	p-value	Present N = 911 n (%)	Absent N = 611 n (%)	X <sup>2</sup>	p-value	Present N = 941 n (%)	Absent N = 581 n (%)	X <sup>2</sup>	p-value
Primary health care	473 (32)	286 (32.0%)	187 (29.7%)	10.74	0.013	283 (31.1%)	190 (31.1%)	1.26	0.260	296 (31.5%)	177 (30.5%)	2.570	0.109
Hospital	563 (38)	348 (39.0%)	215 (34.2%)			362 (39.7%)	201 (32.9%)			369 (39.2%)	194 (33.4%)		
Other	395 (26.7)	205 (22.9%)	190 (30.2%)			209 (22.9%)	186 (30.4%)			221 (23.5%)	174 (29.9%)		
Two professional roles in workplaces	49 (3.3)	31 (3.5%)	18 (2.9%)			34 (3.7%)	15 (2.5%)			31 (3.3%)	18 (3.1%)		
<b>Weekly workload</b>													
1–10 hours	46 (3.0)	26 (2.9%)	20 (3.2%)	9.374	0.154	26 (2.9%)	20 (3.3%)	12.58	<0.001	27 (2.9%)	19 (3.3%)	12.71	<0.001
11–20 hours	64 (4.3)	36 (4.0%)	28 (4.5%)			31 (3.4%)	33 (5.4%)			31 (3.2%)	33 (5.7%)		
21–30 hours	97 (6.5)	51 (5.7%)	46 (7.3%)			52 (5.7%)	45 (7.4%)			58 (6.2%)	39 (6.7%)		
31–40 hours	637 (43)	356 (39.9%)	281 (44.7%)			363 (39.8%)	274 (30.1%)			378 (40.2%)	259 (44.6%)		
41–50 hours	306 (20.6)	191 (21.4%)	115 (18.3%)			193 (21.2%)	113 (12.4%)			192 (20.4%)	114 (19.6%)		
51–60 hours	179 (12.1)	117 (13.1%)	62 (9.8%)			123 (13.5%)	56 (6.1%)			130 (13.8%)	49 (8.4%)		
>60 hours	153 (10.3)	94 (10.5%)	59 (9.6%)			100 (11.0%)	53 (5.8%)			104 (11.0%)	49 (8.4%)		

Note: The total number of responses to the variables are not uniform considering missing. Professional category abbreviations: COREN- Nursing Board; CRM- Board of Medicine; CRO- Board of Dentistry; CRF- Board of Pharmacy CREFITO- Board of Physiotherapy.

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for stress [30]. During the first quarter of 2021 in Brazil, 21.5% of adult Brazilians exhibited severe/extreme signs and symptoms of stress, 19.4% anxiety, and 21.5% depression [11], nearly double the rates during the second quarter of 2020 [10].

The situation was even more concerning among healthcare workers; our findings highlight a higher prevalence of stress (61.4%), anxiety (59.7%), and depression (58.7%) compared to the general population [4–6] and other studies involving healthcare workers [31–34].

Symptoms of depression associated with medical training are not surprising, and were observed during the COVID-19 pandemic [35,36]. The conditions that combine to produce this finding among physicians can be explained by low levels of social support, strenuous workload, scarcity of medical equipment, discriminatory experiences, and even violence in the workplace resulting from communication difficulties between doctors and patients’ family members [16,33].

Physicians’ fears of being infected [36] and even feeling helpless with regard to the services they provide [34] can also justify the association between depression and feelings of insecurity with the organization and structure of services. Physicians are often responsible for final decisions on patient care [37], which may explain why other professional categories were identified with protective factors against depression in this study.

The protective factor associated with marital status has been well described [38]. Single professionals had a higher risk of mental illness symptoms related to stress, anxiety, and depression during social distancing in the pandemic [11]. Married individuals also tend to be healthier [39], possibly due to the positive effects that family stability can have on mental health.

Table 2. Descriptive analysis and association of variables related to Covid-19 and working conditions with outcomes (N = 1,522), MS/DF, Brazil, 2021.

Variable	N (%)	Depression				Anxiety				Stress			
		Present N = 893 n (%)	Absent N = 629 n (%)	X <sup>2</sup>	p-value	Present N = 911 n (%)	Absent N = 611 n (%)	X <sup>2</sup>	p-value	Present N = 941 n (%)	Absent N = 581 n (%)	X <sup>2</sup>	p-value
<b>How would you evaluate your physical health, considering your disposition for current personal and professional demands during the pandemic?</b>													
Excellent	127 (8.5)	30 (3.43)	97 (15.65)	26.24	<0.001	40 (4.47)	40 (8.06)	14.13	<0.001	35 (3.79)	92 (16.14)	27.61	<0.001
Good	577 (38.6)	252 (28.83)	325 (52.42)			260 (29.08)	260 (52.42)			277 (29.98)	300 (52.63)		
Moderate	551 (36.9)	390 (44.62)	161 (25.97)			396 (44.30)	155 (31.25)			404 (43.72)	147 (25.79)		
Poor	239 (16)	202 (23.11)	37 (5.97)			198 (22.15)	41 (8.27)			208 (22.51)	31 (5.44)		
<b>How would you evaluate your mental health, considering your disposition for current personal and professional demands during the pandemic?</b>													
Excellent	90 (6)	9 (1.03)	81 (13.06)	69.54	0.001	11 (1.23)	79 (13.17)	39.22	<0.001	9 (0.98)	81 (9.56)	43.41	<0.001
Good	499 (33.4)	159 (18.21)	340 (54.84)			172 (19.26)	327 (54.50)			165 (17.88)	334 (39.43)		
Moderate	595 (39.1)	411 (47.08)	184 (29.68)			432 (48.38)	163 (27.17)			456 (49.40)	139 (16.41)		
Poor	309 (20.7)	294 (33.68)	15 (2.42)			278 (31.13)	31 (5.17)			293 (31.74)	293 (34.59)		
<b>Have you been diagnosed with Covid?</b>													
Yes	1008 (67.7)	312 (35.78)	169 (27.39)	11.24	0.001	327 (36.70)	154 (25.84)	19.11	<0.001	324 (35.18)	157 (27.64)	8.78	0.003
No	481 (32.3)	560 (64.22)	448 (72.61)			564 (63.30)	444 (74.50)			597 (64.82)	411 (72.36)		
<b>Outside of work, have you practiced social distancing?</b>													
Yes	1377 (92.2)	820 (93.82)	557 (89.84)	7.42	0.006	840 (93.96)	539 (89.53)	9.28	0.002	866 (93.72)	511 (89.65)	7.55	0.006
No	117 (7.8)	54 (6.18)	63 (10.16)			54 (6.04)	63 (10.47)			58 (6.28)	59 (10.35)		
<b>Do you feel safe with regard to activities involving control, prevention, and care for Covid-19?</b>													
Yes	410 (27.4)	179 (20.48)	231 (37.26)	26.60	<0.001	192 (21.48)	218 (36.33)	24.63	<0.001	189 (20.45)	221 (38.77)	30.03	<0.001
No	912 (61)	598 (68.42)	314 (50.65)			605 (67.67)	307 (51.17)			632 (68.40)	280 (49.12)		
I don't know	172 (11.5)	97 (11.10)	75 (12.10)			97 (10.85)	75 (12.50)			103 (11.15)	69 (12.11)		
<b>Do you feel safe with regard to how your work is organized and structured to address the Covid-19 pandemic?</b>													

(Continued)



Table 2. (Continued)

Variable	N (%)	Depression				Anxiety				Stress			
		Present N = 893 n (%)	Absent N = 629 n (%)	X <sup>2</sup>	p-value	Present N = 911 n (%)	Absent N = 611 n (%)	X <sup>2</sup>	p-value	Present N = 941 n (%)	Absent N = 581 n (%)	X <sup>2</sup>	p-value
Yes	387 (26.3)	164 (19.03)	223 (36.50)	18.56	<0.001	175 (19.82)	212 (35.93)	6.24	0.012	325 (35.68)	123 (21.89)	2.804	0.094
No	448 (30.4)	328 (38.05)	120 (19.64)			317 (35.90)	131 (22.20)			170 (18.66)	217 (38.61)		
Partially	638 (43.3)	370 (42.92)	268 (43.86)			391 (44.28)	247 (41.86)			416 (45.66)	222 (39.50)		
<b>How did the pandemic affect your career/work?</b>													
I remained unemployed	15 (1.2)	6 (0.83)	9 (1.67)	8.748	0.120	6 (0.81)	9 (1.73)	6.13	0.013	6 (0.79)	9 (1.78)	2.259	0.133
I kept working	1073 (84.7)	617 (84.87)	456 (84.76)			625 (84.01)	448 (85.99)			642 (84.58)	431 (85.18)		
I kept working, but from home	73 (5.8)	38 (5.23)	35 (6.51)			42 (5.65)	31 (5.95)			45 (5.93)	28 (5.53)		
I started working after the pandemic	70 (%)	41 (5.64)	29 (5.39)			46 (6.18)	24 (4.61)			43 (5.67)	27 (5.34)		
I lost my job	34 (2.7)	25 (3.44)	9 (1.67)			25 (3.36)	9 (1.73)			23 (3.03)	11 (2.17)		
<b>Vacation</b>													
Paid	61 (22.4)	40 (23.53)	21 (29.59)	8.748	0.120	N (%)	N (%)			40 (20.83)	21 (26.25)	0.959	0.330
Suspended	211 (77.6)	130 (76.47)	81 (79.41)			N (%)	N (%)			152 (79.17)	59 (73.75)		
<b>Reallocated</b>													
Yes	124 (8.1)	85 (9.52)	39 (6.20)	4.99	0.025	86 (9.17)	38 (6.22)	4.64	0.031	95 (10.10)	29 (4.99)	11.83	0.001
No	1398 (91.9)	808 (90.48)	590 (93.80)			852 (90.83)	573 (93.78)			846 (89.90)	552 (95.01)		
<b>Leave</b>													
No	1447 (95.1)	829 (92.83)	618 (98.25)	24.72	<0.001	849 (93.19)	598 (97.87)	15.70	<0.001	877 (93.20)	570 (98.11)	18.37	<0.001
Leave for Covid	15 (1.0)	9 (1.01)	6 (0.95)			10 (1.10)	5 (0.82)			10 (1.06)	5 (0.86)		
Leave for mental health	30 (2.0)	29 (3.25)	1 (0.16)			29 (3.18)	1 (0.16)			29 (3.08)	1 (0.17)		
Leave for other reasons	30 (2.0)	26 (2.91)	4 (0.64)			23 (2.52)	7 (1.15)			25 (2.66)	5 (0.86)		
<b>How did the pandemic affect your family income?</b>													
Increased	159 (10.4)	96 (11.09)	63 (10.21)	6.74	0.009	60 (7.08)	60 (10.05)	4.77	0.029	100 (10.92)	59 (10.41)	6.20	0.013
Remained the same	777 (51.1)	432 (49.88)	345 (55.92)			441 (52.07)	336 (56.28)			455 (49.67)	322 (56.79)		
Reduced slightly	365 (24.0)	206 (23.79)	159 (25.77)			218 (25.74)	147 (24.62)			231 (25.22)	134 (23.63)		
Reduced significantly	182 (12.3)	132 (15.24)	50 (8.10)			128 (15.11)	54 (9.05)			130 (14.19)	52 (9.17)		

(Continued)

Table 2. (Continued)

Variable	N (%)	Depression				Anxiety				Stress			
		Present N = 893 n (%)	Absent N = 629 n (%)	X <sup>2</sup>	p-value	Present N = 911 n (%)	Absent N = 611 n (%)	X <sup>2</sup>	p-value	Present N = 941 n (%)	Absent N = 581 n (%)	X <sup>2</sup>	p-value
<b>In 2020, were you receiving psychological and/or psychiatric treatment or follow-up prior to the Covid-19 pandemic?</b>													
Yes	377 (25.3)	249 (28.56)	128 (20.75)	11.24	<b>0.001</b>	258 (28.92)	119 (19.93)	14.81	<0.001	273 (29.67)	104 (18.28)	23.54	<0.001
No	1112 (74.7)	623 (71.44)	489 (79.25)			634 (71.08)	478 (80.07)			647 (70.33)	465 (81.72)		
<b>Did you seek out some type of psychological and/or psychiatric help or treatment during the pandemic?</b>													
Yes	550 (37)	395 (45.30)	155 (25.20)	61.62	<b>&lt;0.001</b>	413 (46.30)	137 (23.03)	81.96	<0.001	434 (47.17)	116 (20.46)	106.28	<0.001
No	937 (63)	477 (54.70)	460 (74.80)			479 (53.70)	458 (76.97)			486 (52.83)	451 (79.54)		

Note: The total number of responses is not uniform, considering *missing*.

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Anxiety was associated with the level of training among healthcare workers, and increased in frequency according to years of education. Lower education level was protective against anxiety symptoms [36,40]. Additional education increases understanding of the events related to the COVID-19 pandemic, and the perceptions of these workers vary according to policies and rapid changes in information. Changes in safety and protection guidelines related to infection control and use of personal protective equipment were sudden, often changing several times in the same week [41], which led to emotional overload [42], especially among individuals with higher levels of education.

Healthcare workers who were directly in contact with COVID-19 or had close relatives diagnosed with this disease exhibited higher levels of anxiety, depression, and stress. (30.36%) In the Brazilian general population, individuals who had COVID-19 exhibited higher risk of severe and extreme depression, suggesting that this experience negatively affects psychological state [11]. Healthcare workers who had physical symptoms of the disease were more likely to exhibit anxiety (OR = 2.1, 5% CI 1.36; 3.48). Professionals who developed symptoms had to choose whether to take sick leave or continue working to fill staff shortages in health care, and were afraid of infecting their colleagues and relatives [43]; for this reason, it is plausible that not being infected with the disease was protective against anxiety.

Paradoxically, not seeking psychological or psychiatric help was a protective factor for signs and symptoms of both anxiety and stress. Seeking psychological or psychiatric treatment requires an ongoing investment of time, another obligation for workers who were already overloaded due to the pandemic. Furthermore, it is not uncommon for individuals with moderate anxiety to consider their health status acceptable [44]. Access to mental health support is neglected in public health and mental health policies, which may discourage people from seeking such services. The search for and availability of mental health services during the pandemic should be better explored to understand this phenomenon.

Self-perception of poor mental health was independently associated with the healthcare workers. In the theoretical transactional stress model [45], individuals are agents and not victims of the stress process, suggesting that psychological resources can act as protective agents

**Table 3. Adjusted analysis of the variables associated with depression, anxiety, and stress among healthcare professionals in the center-west region of Brazil in 2021.**

Variable	Depression	
	RPaj* (95% CI)	p-value
Marital status		
Married	0.88 (0.79; 0.99)	0.034
Professional category		
CRM (professional registration with regional medical board)	3.75 (1.59; 8.85)	0.002
Occupation (professional activity)		
Management	0.67 (0.47; 0.95)	0.027
Nurse	0.75 (0.58; 0.97)	0.031
Pharmacist	0.63 (0.46; 0.85)	0.003
Do you feel safe about how your work is organized and structured to address the Covid-19 pandemic?		
No	1.12 (1.03; 1.21)	0.006
Variable	Anxiety	
	RPaj* (95% CI)	p-value
Education		
Specialization	0.71 (0.54; 0.94)	0.019
Master's degree	0.70 (0.51; 0.95)	0.026
How would you evaluate your mental health, considering your disposition for current personal and professional demands during the pandemic?		
Poor	4.63 (2.58; 8.31)	<0.001
Moderate	4.09 (2.29; 7.28)	<0.001
Have you been diagnosed with Covid-19?		
No	0.90 (0.83; 0.98)	0.034
Did you seek out some type of psychological and/or psychiatric help or treatment during the pandemic?		
No	0.90 (0.82; 0.99)	0.034
Variable	Stress	
	RPaj* (95% CI)	p-value
Where do you live?		
Mato Grosso do Sul	0.91 (0.85; 0.98)	0.017
Professional category		
CRO (professional registration with regional board of dentistry)	0.81 (0.68; 0.97)	0.024
How would you evaluate your mental health, considering your disposition for current personal and professional demands during the pandemic?		

(Continued)

**Table 3.** (Continued)

Poor	6.95 (3.65; 13.23)	<0.001
Moderate	6.11 (3.22; 11.59)	<0.001
Did you seek out some type of psychological and/or psychiatric help or treatment during the pandemic?		
No	0.88 (0.82; 0.95)	0.001

\*RPaj = prevalence ratio with robust adjustment of variance.

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in adverse conditions. Belief in one's own abilities to achieve goals (self-efficacy) and the ability to be flexible in critical situations (resilience) can result in lower or higher degrees of stress among workers [46], depending on their perceptions of the stressor. Strategies for mental health promotion should be directed at healthcare workers, teams, and managers.

A lower prevalence of mental health symptoms was observed in dentistry, a result corroborated in another study [47]. This may reflect the lower number of these professionals who work in hospitals. People who work in areas with high COVID-19 infection rates have reported more severe degrees of all psychological symptoms than other healthcare workers [48].

Living in the state of Mato Grosso do Sul during the pandemic period was a protective factor in our study. The numbers of and trends in accumulated COVID-19 cases varied over time among Brazil's federal units, with the most severe scenario seen in the north and northeast of the country [49]. Within the center-west region, the two states studied (Mato Grosso do Sul and Federal District) did not implement quarantine for the entire population, but rather adopted social distancing measures (suspending events and classes, quarantining risk groups, and introducing partial economic stoppages) [50–52], and the regions are politically and epidemiologically similar. The characteristics and organization of the health services require further investigation to better understand the protective relationship between regions of the country and the psychological impacts identified in healthcare workers.

This study has some limitations that should be addressed. Since it is cross-sectional in nature, there was a limited ability to separate pre-existing and new symptoms, as well as whether mental health in workers was in fact more affected throughout the pandemic, and for these reasons a longitudinal study is required. The application of online questionnaires to assess mental health status adds a non-random selection bias that raises the risk that symptoms may be overestimated. However, this methodological approach was the only ethically acceptable option during the study period. Additionally, evidence suggests that remote online screening results in estimates comparable to face-to-face screening, and these methods in themselves are not a concern [53]. The evaluation was sectional but involved two waves of the COVID-19 pandemic, which could lead to reverse causality, since workers with a history of mental illness symptoms prior to the pandemic may be more likely to present a higher perception of illness risk than those without symptoms of depression, anxiety, or stress.

Given that the COVID-19 pandemic has not been officially declared over, our article remains relevant to the current scenario. It provides an opportunity to assess the present state of the pandemic and explore potential practical strategies for the future. It is important to note that new pandemics are expected to emerge and, as a result of low vaccine coverage worldwide, there is a possibility of reemergence of vaccine-preventable diseases. Hence, further follow-up

studies should be conducted, particularly on the impact of strategies in local contexts, especially in low- and middle-income countries.

Finally, studies suggest that health services should identify and provide ongoing training to verify signs of mental health related illness in healthcare professionals, as well as appropriate coping tools for disaster situations and public emergencies, and should also discuss strategies to alleviate the impact of the ongoing pandemic on mental health in health professionals [54,55]. Considering that different variables were relevant for each type of symptom, these findings can help develop more effective actions to promote and protect mental health among healthcare workers.

## Conclusion

A mental health assessment of healthcare workers in Brazil revealed a worrying prevalence of mental disorders during the COVID-19 pandemic, perceptions of insecurity, and poor self-perception of mental health associated with all symptoms of mental disorders.

Efforts to adopt strategies in health services during the COVID-19 pandemic were not sufficient to protect the mental health of these workers. New interventions adopted to prevent and increase these symptoms are in line with new international mental health agendas.

## Supporting information

### S1 File.

(PDF)

### S2 File.

(DOCX)

### S3 File.

(PDF)

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## References

1. World Health Organization. Comprehensive Mental Health Action Plan 2013–2030. 2021. <https://www.who.int/publications/i/item/9789240031029> Accessed: July 1, 2022.
2. Campos JADB, Martins BG, Campos LA, Marôco J, Saadiq RA, Ruano R. Early Psychological Impact of the COVID-19 Pandemic in Brazil: A National Survey. *J Clin Med*. 15 de setembro de 2020; 9(9): E2976. <https://doi.org/10.3390/jcm9092976> PMID: 32942647
3. Brigden G, Sagili K, Dlodlo RA. Occupational safety and health for respiratory health: a comprehensive approach for an often-forgotten issue. *Int J Tuberc Lung*. 2022; 26(3):183–5.
4. Alshekaili M, Hassan W, Al Said N, Al Sulaimani F, Jayapal SK, Al-Mawali A, et al. Factors associated with mental health outcomes across healthcare settings in Oman during COVID-19: frontline versus non-frontline healthcare workers. *BMJ Open*. 2020; 10(10):e042030. <https://doi.org/10.1136/bmjopen-2020-042030> PMID: 33040019
5. Amer SAAM, Fouad AM, El-Samahy M Hashem AA, Saati AA, Sarhan AA, et al. Mental Stress, Anxiety and Depressive Symptoms and Interleukin-6 Level among Healthcare Workers during the COVID-19 Pandemic. *J Prim Care Community Health*. 2021; 12:21501327211027430. <https://doi.org/10.1177/21501327211027432> PMID: 34166137
6. Chen J, Zhang SX, Yin A, Yáñez JA. Mental health symptoms during the COVID-19 pandemic in developing countries: A systematic review and meta-analysis. *J Glob Health*. 12:05011. <https://doi.org/10.7189/jogh.12.05011> PMID: 35604881
7. Aymerich C, Pedruzo B, Pérez JL, Laborda M, Herrero J, Blanco J, et al. COVID-19 pandemic effects on health worker's mental health: Systematic review and meta-analysis. *Eur Psychiatry*. 2022; 65(1): e10. <https://doi.org/10.1192/j.eurpsy.2022.1> PMID: 35060458
8. Saragih ID, Tonapa SI, Saragih IS, Advani S, Batubara SO, Suarilah I, et al. Global prevalence of mental health problems among healthcare workers during the Covid-19 pandemic: A systematic review and meta-analysis. *Int J Nurs Stud*. 2021; 121:104002. <https://doi.org/10.1016/j.ijnurstu.2021.104002> PMID: 34271460
9. Calegari VC, Ramos-Lima LF, Hoffmann MS, Zoratto G, Kerber N, Costa FCD, et al. Closed doors: Predictors of stress, anxiety, depression, and PTSD during the onset of COVID-19 pandemic in Brazil. *J Affect Disord*. 2022; 310:441–51. <https://doi.org/10.1016/j.jad.2022.05.052> PMID: 35569607
10. Serafim AP, Durães RSS, Rocca CCA, Gonçalves PD, Saffi F, Cappellozza A, et al. Exploratory study on the psychological impact of COVID-19 on the general Brazilian population. *PLoS One*. 2021; 16(2): e0245868. <https://doi.org/10.1371/journal.pone.0245868> PMID: 33534820
11. Souza ASR, Souza GFA, Souza GA, Cordeiro ALN, Pracianno GAF, Alves AC de S, et al. Factors associated with stress, anxiety, and depression during social distancing in Brazil. *Rev Saude Publica*. 2021; 55:5. <https://doi.org/10.11606/s1518-8787.2021055003152> PMID: 33852675
12. Arshad MS, Hussain I, Nafees M, Majeed A, Imran I, Saeed H, et al. Assessing the Impact of COVID-19 on the Mental Health of Healthcare Workers in Three Metropolitan Cities of Pakistan. *Psychol Res Behav Manag*. 2020; 13:1047–55. <https://doi.org/10.2147/PRBM.S282069> PMID: 33244279
13. Azizi M, Kamali M, Moosazadeh M, Aarabi M, Ghasemian R, Hasannezhad Reskati M, et al. Assessing mental health status among Iranian healthcare workers in times of the COVID-19 pandemic: A web-based cross-sectional study. *Brain Behav*. 2021; 11(8):e2304. <https://doi.org/10.1002/brb3.2304> PMID: 34333852
14. Parchani A, Vidhya K, Panda PK, Rawat VS, Bahurupi YA, Kalita D, et al. Fear, Anxiety, Stress, and Depression of Novel Coronavirus (COVID-19) Pandemic Among Patients and Their Healthcare Workers—A Descriptive Study. *Psychol Res Behav Manag*. 2021; 14:1737–46. <https://doi.org/10.2147/PRBM.S324233> PMID: 34712065
15. Hammond NE, Crowe L, Abbenbroek B, Elliott R, Tian DH, Donaldson LH, et al. Impact of the coronavirus disease 2019 pandemic on critical care healthcare workers' depression, anxiety, and stress levels. *Aust Crit Care*. 2021; 34(2):146–54. <https://doi.org/10.1016/j.aucc.2020.12.004> PMID: 33632606

16. Wang W, Lu L, Kelifa MM, Yu Y, He A, Cao N, et al. Mental Health Problems in Chinese Healthcare Workers Exposed to Workplace Violence During the COVID-19 Outbreak: A Cross-Sectional Study Using Propensity Score Matching Analysis. *Risk Manag Healthc Policy*. 2020; 13:2827–33. <https://doi.org/10.2147/RMHP.S279170> PMID: 33299370
17. Iacobucci G. Covid-19: Doctors still at “considerable risk” from lack of PPE, BMA warns. *BMJ*. 2020; 368:m1316. <https://doi.org/10.1136/bmj.m1316> PMID: 32234713
18. Elgohary HM, Sehlo MG, Bassiony MM, Youssef UM, Elrafey DS, Amin SI. Depression among health workers caring for patients with COVID-19 in Egypt. *Egypt J Neurol Psychiatr Neurosurg*. 2021; 57(1):139. <https://doi.org/10.1186/s41983-021-00394-1> PMID: 34690490
19. Drewett GP, Gibney G, Ko D. Practical ethical challenges and moral distress among staff in a hospital COVID-19 screening service. *Intern Med J*. 2021; 51(9):1513–6. <https://doi.org/10.1111/imj.15471> PMID: 34541765
20. Hossain F, Clatty A. Self-care strategies in response to nurses’ moral injury during COVID-19 pandemic. *Nurs Ethics*. 2021; 28(1):23–32. <https://doi.org/10.1177/0969733020961825> PMID: 33124492
21. Lulli LG, Giorgi G, Pandolfi C, Foti G, Finstad GL, Arcangeli G, et al. Identifying Psychosocial Risks and Protective Measures for Workers’ Mental Wellbeing at the Time of COVID-19: A Narrative Review. *Sustainability [Internet]* 2021; 13(24):13869. Available from: <https://doi.org/http%3A/dx.doi.org/10.3390/su132413869>
22. Grazzini M, Lulli LG, Mucci N, Paolini D, Baldassarre A, Gallinoro V, et al. Return to Work of Healthcare Workers after SARS-CoV-2 Infection: Determinants of Physical and Mental Health. *Int J Environ Res Public Health*. 2022 Jun 2; 19(11):6811. <https://doi.org/10.3390/ijerph19116811> PMID: 35682394.
23. Pope Clara M, Babu Alexander J, Khera Sahil, Alyssa D, Brandon, Richard JC, et al. Protecting Health Care Workers during the COVID-19 Coronavirus Outbreak—Lessons from Taiwan’s SARS response”. *Clinical Infectious Diseases*, 71(15), 858–860, 2020.
24. Spoorthy MS, Pratapa SK, Mahant S. Mental health problems faced by healthcare workers due to the COVID-19 pandemic—a review. *Asian Journal of Psychiatry*, 51, 2020. 102119. <https://doi.org/10.1016/j.ajp.2020.102119> PMID: 32339895
25. Chew NWS, Lee GKH, Tan BYQ, Jing M, Goh Y, Ngiam NJH, et al multinational, multicenter study on the psychological outcomes and associated physical symptoms amongst healthcare workers during COVID-19 outbreak. *Brain, Behavior, and Immunity*, 88, 559–565, 2021. <https://doi.org/10.1016/j.bbi.2020.04.049> PMID: 32330593
26. Kisely S, Warren N, McMahon L, Dalais C, Henry I, Siskind D. Occurrence, prevention, and management of the psychological effects of emerging virus outbreaks on healthcare workers: rapid review and meta-analysis. *BMJ*, 369, m1642, 2020. <https://doi.org/10.1136/bmj.m1642> PMID: 32371466
27. Cuschieri S. The STROBE guidelines. *Saudi J Anaesth*. 2019; 13(Suppl 1):S31–4. [https://doi.org/10.4103/sja.SJA\\_543\\_18](https://doi.org/10.4103/sja.SJA_543_18) PMID: 30930717
28. Rosner B. *Fundamentals of Biostatistics*. 7<sup>th</sup> ed. Massachusetts: Brooks/cole; 2021.
29. Vignola RCB, Tucci AM. Adaptation and validation of the depression, anxiety and stress scale (DASS) to Brazilian Portuguese. *J Affect Disord*. 2014; 155:104–9. <https://doi.org/10.1016/j.jad.2013.10.031> PMID: 24238871
30. Zhang SX, Batra K, Xu W, Liu T, Dong RK, Yin A, et al. Mental disorder symptoms during the COVID-19 pandemic in Latin America—a systematic review and meta-analysis. *Epidemiology and Psychiatric Sciences*. 2022; 31. Available from: <https://www.cambridge.org/core/journals/epidemiology-and-psychiatric-sciences/article/mental-disorder-symptoms-during-the-covid19-pandemic-in-latin-america-a-systematic-review-and-metaanalysis/B4D6A7437AF42C1D168C23F4AABC8BAE> Accessed: July 1, 2022. <https://doi.org/10.1017/S2045796021000767> PMID: 35438066
31. Garcia G P A, Fracarolli I F L, Dos Santos H E C, de Oliveira S A, Martins B G, Santin L J Junior, et al. Depression, Anxiety and Stress in Health Professionals in the COVID-19 Context. *Int J Environ Res Public Health*. 2022; 19(7):4402. <https://doi.org/10.3390/ijerph19074402> PMID: 35410085
32. Li Y, Scherer N, Felix L, Kuper H. Prevalence of depression, anxiety and post-traumatic stress disorder in health care workers during the COVID-19 pandemic: A systematic review and meta-analysis. *PLoS One*. 2021; 16(3):e0246454. <https://doi.org/10.1371/journal.pone.0246454> PMID: 33690641
33. Silva-Costa A, Griep R H, Rotenberg L. Perceived risk from COVID-19 and depression, anxiety, and stress among workers in healthcare units. *Cad Saude Publica*. 2022; 38(3):e00198321.
34. Camacho K G, Gomes S C D S Junior, Reis A T, de F Junqueira-Marinho M, França L C M, Abramov D M, et al. Repercussions of the COVID-19 pandemic on health professionals in the state of Rio de Janeiro/Brazil. *PLoS One*. 2022; 17(1):e0261814. <https://doi.org/10.1371/journal.pone.0261814> PMID: 35061719

35. Yan H, Ding Y, Guo W. Mental Health of Medical Staff During the Coronavirus Disease 2019 Pandemic: A Systematic Review and Meta-Analysis. *Psychosom* 2021; 83(4):387–96. <https://doi.org/10.1097/PSY.0000000000000922> PMID: 33818054
36. Zhao Y, Guo J, Liu S, Aizezi M, Zeng Q, Sidike A, et al. Prevalence and Related Factors of Depression, Anxiety, Acute Stress, and Insomnia Symptoms Among Medical Staffs Experiencing the Second Wave of COVID-19 Pandemic in Xinjiang, China. *Front Public Health*. 2021; 9:671400. <https://doi.org/10.3389/fpubh.2021.671400> PMID: 34079787
37. Dosi M, Ozamiz-Etxebarria N, Redondo I, Picaza M, Jaureguizar J. Psychological Symptoms in Health Professionals in Spain After the First Wave of the COVID-19 Pandemic. *Front Psychol*. 2020; 11:606121. <https://doi.org/10.3389/fpsyg.2020.606121> PMID: 33391125
38. Ahn M H, Shin Y W, Suh S, Kim J H, Kim H J, Lee K U, et al. High Work-Related Stress and Anxiety as a Response to COVID-19 Among Health Care Workers in South Korea: Cross-sectional Online Survey Study. *JMIR Public Health Surveill*. 2021; 7(10):e25489. <https://doi.org/10.2196/25489> PMID: 34478401
39. González-Sanguino C, Ausín B, Castellanos M Á, Saiz J, López-Gómez A, Ugidos C, 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. <https://doi.org/10.1016/j.bbi.2020.05.040> PMID: 32405150
40. Shi L, Lu Z A, Que JY, Huang X L, Liu L, Ran M S, et al. Prevalence of and Risk Factors Associated With Mental Health Symptoms Among the General Population in China During the Coronavirus Disease 2019 Pandemic. *JAMA Netw Open*. 2020; 3(7):e2014053. <https://doi.org/10.1001/jamanetworkopen.2020.14053> PMID: 32609353
41. Crowe S, Howard A F, Vanderspank-Wright B, Gillis P, McLeod F, Penner C, et al. The effect of COVID-19 pandemic on the mental health of Canadian critical care nurses providing patient care during the early phase pandemic: A mixed method study. *Intensive Crit Care Nurs*. 2021; 63:102999. <https://doi.org/10.1016/j.iccn.2020.102999> PMID: 33342649
42. Dong M, Zheng J. Letter to the editor: Headline stress disorder caused by Netnews during the outbreak of COVID-19. *Health Expect*. 2020; 23(2):259–60. <https://doi.org/10.1111/hex.13055> PMID: 32227627
43. Chew NWS, Lee G K H, Tan BYQ, Jing M, Goh Y, Ngiam NJH, 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. <https://doi.org/10.1016/j.bbi.2020.04.049> PMID: 32330593
44. Tee ML, Tee CA, Anlacan JP, Aligam KJG, Reyes PWC, Kuruchittham V, et al. Psychological impact of COVID-19 pandemic in the Philippines. *J Affect Disord*. 2020; 277:379–91. <https://doi.org/10.1016/j.jad.2020.08.043> PMID: 32861839
45. Lazarus R, Folkman S. *Stress, Appraisal, and Coping*. New York: Springer; 1984.
46. Peñacoba C, Catala P, Velasco L, Carmona-Monge FJ, Garcia-Hedra FJ, Gil-Almagro F. Stress and quality of life of intensive care nurses during the COVID-19 pandemic: Self-efficacy and resilience as resources. *Nurs Crit Care*. 2021; 26(6):493–500. <https://doi.org/10.1111/nicc.12690> PMID: 34387905
47. Peixoto KO, de Resende CMBM, de Almeida E O, Almeida-Leite CM, Conti PCR, Barbosa GAS, et al. Association of sleep quality and psychological aspects with reports of bruxism and TMD in Brazilian dentists during the COVID-19 pandemic. *J Appl Oral Sci*. 2021; 29:e20201089. <https://doi.org/10.1590/1678-7757-2020-1089> PMID: 34320119
48. Vizheh M, Qorbani M, Arzaghi SM, Muhidin S, Javanmard Z, Esmaeili M. The mental health of health-care workers in the COVID-19 pandemic: A systematic review. *J Diabetes Metab Disord*. 2020; 19(2):1967–78. <https://doi.org/10.1007/s40200-020-00643-9> PMID: 33134211
49. Lobo A de P, Cardoso-dos-Santos AC, Rocha MS, Pinheiro RS, Bremm JM, Macário EM, et al. COVID-19 epidemic in Brazil: Where are we at? *International Journal of Infectious Diseases*. 2020; 97:382–5. <https://doi.org/10.1016/j.ijid.2020.06.044> PMID: 32561425
50. Silva LLS da Lima AFR, Polli DA, Razia PFS, Pavão LFA, de H Cavalcanti MAF, et al. Social distancing measures in the fight against COVID-19 in Brazil: description and epidemiological analysis by state. *Cad Saúde Pública*. 2020; 36.
51. Portal COVID 19. <http://www.coronavirus.df.gov.br/> Accessed: July 22, 2022.
52. Boletim Epidemiológico COVID-19–2022.06.28.:9. <https://www.coronavirus.ms.gov.br/wp-content/uploads/2022/06/Boletim-Epidemiologico-COVID-19-2022.06.28.pdf> Accessed: July 22, 2022.
53. Cronly J, Duff AJ, Riekert KA, Perry IJ, Fitzgerald AP, Horgan A, et al. Online versus paper-based screening for depression and anxiety in adults with cystic fibrosis in Ireland: a cross-sectional exploratory study. *BMJ Open*. 2018; 8(1):e019305. <https://doi.org/10.1136/bmjopen-2017-019305> PMID: 29358445



54. Serrano-Ripoll MJ, Ricci-Cabello I, Jiménez R, Zamanillo-Campos R, Yañez-Juan AM, Bennasar-Veny M, et al. Effect of a mobile-based intervention on mental health in frontline healthcare workers against COVID-19: Protocol for a randomized controlled trial. *J Adv Nurs*. 2021; 77(6):2898–907. <https://doi.org/10.1111/jan.14813> PMID: 33675247
55. da Silva MCMV, Ioschpe B, Diniz FS, de Oliveira GMR, Saffi F, Soares ARA, et al. Psychological demands of health professionals in the initial phase of the COVID-19 pandemic. *Psicol Reflex Crit*. 2022; 35(1):2. <https://doi.org/10.1186/s41155-021-00204-w> PMID: 34982281