DOI: 10.1590/1413-812320232810.10102023EN

COVID-19 and health systems in Brazil and around the world: effects on the working conditions and health of health workers

Antônio Vieira Machado (https://orcid.org/0000-0002-8021-7538) [1,2]
Wagner Eduardo Ferreira (https://orcid.org/0009-0000-0426-5207) [2]
Marco Antônio de Ávila Vitória (https://orcid.org/0000-0002-1687-6723) [3]
Helvécio Miranda Magalhães Júnior (http://orcid.org/0000-0002-7628-7509) [1,4,5]
Letícia Lemos Jardim (http://orcid.org/0000-0003-3358-0075) [1,4]
Marco Antônio Carneiro Menezes (https://orcid.org/0009-0003-0330-9425) [6]
Renato Penha de Oliveira Santos (http://orcid.org/0000-0001-5206-6392) [7]
Filipe Leonel Vargas (https://orcid.org/0000-0002-7698-9260) [6]
Everson Justino Pereira (http://orcid.org/0000-0002-4389-306X) [8]

Abstract *This article discusses the impacts of the COVID-19 pandemic on health systems and its effects on the working conditions and mental health of health professionals and invisible health workers. It presents data on deaths among health professionals, highlighting the need for better and safer working conditions and improvements in public management. We emphasize WHO/PAHO recommendations and the need for equitable vaccine distribution, including poor countries and vulnerable populations. We also highlight the impacts of interrupting essential health services, such as the treatment of chronic conditions and infectious disease prevention, and the damage caused by the dissemination of fake news, stressing the need to improve access to correct and safe health information.*

Key words *Pandemic, COVID-19, Health, Health professional, Death, Infodemic*

[1] Faculdade de Ciências Médicas de Minas Gerais. Alameda Ezequiel Dias 275, Centro. 30130-110 Belo Horizonte MG Brasil. antonio.machado@cienciasmedicasmg.edu.br
[2] Fundação Educacional Lucas Machado (Feluma). Belo Horizonte MG Brasil.
[3] Programa Global para HIV, Hepatites Virais e Infecções Sexualmente Transmíssiveis, Organização Mundial da Saúde. Genebra Suíça.
[4] Instituto Renê Rachou – Fiocruz Minas. Belo Horizonte MG Brasil.
[5] Secretaria de Atenção Especializada, Ministério da Saúde. Brasília DF Brasil.
[6] Escola Nacional de Saúde Pública Sergio Arouca (ENSP), Fundação Oswaldo Cruz (Fiocruz). Rio de Janeiro RJ Brasil.
[7] Universidade Federal do Recôncavo da Bahia. Cruz das Almas BA Brasil.
[8] Núcleo de Estudos e Pesquisas em Recursos Humanos em Saúde, Escola Nacional de Saúde Pública Sergio Arouca, Fundação Oswaldo Cruz. Rio de Janeiro RJ Brasil.

Introduction

To contribute to the reflection proposed in this article it is important to first provide a succinct retrospective of the episodes that defined the course of the public health emergency caused by the COVID-19 pandemic. The novel coronavirus (SARS-CoV-2) was first reported by the World Health Organization (WHO) on 31/12/2019, a week after the first patient was diagnosed and admitted to Wuhan Central Hospital in the province of Hubei, China on 26/12/2019[1].

On 10/01/2020, scientists performed the first sequencing of the Wuhan CoV genome (WH-Human1). On 30/01/2020, the WHO declared the novel coronavirus a public health emergency of international concern and on 11/03/2020 the outbreak was characterized as a pandemic, with 110,000 cases across 114 countries.

In Brazil, in January 2020, the Ministry of Health Center for Strategic Information on Health Surveillance (CIEVS), which is part of the National Public Health Emergency Alert and Response Network, was notified of the first suspected cases of COVID-19. Ministerial Order 188 (03/02/2020) declared COVID-19 a Public Health Emergency of National Significance (ESPIN)[2] and Law 13979 (6/02/2020) created measures to respond to the ESPIN caused by the coronavirus responsible for the outbreak in 2019[3].

Seven human coronaviruses (HCoVs) have been identified to date: HCoVs-229-E, OC43, NL63, HKV1, SARS-CoV (severe acute respiratory syndrome), MERS-CoV (Middle East respiratory syndrome) and SARS-CoV-2 (novel coronavirus). The knowledge base of the family of coronaviruses acquired over the years has been extremely valuable in improving our understanding of and response to the pandemic. However, the unpreparedness of health systems was a determining factor in the outcome of the pandemic.

On 26/02/2020, Brazilian researchers completed the genomic sequencing of the first case of coronavirus in Latin America. This sequencing was of utmost importance. providing data to monitor the pandemic, detect mutations and inform the manufacturing of vaccines[4]. However, disinformation and the large-scale spread of fake news on the topic created fertile ground for the emergence of miracle cures and non-adherence to effective health measures.

Despite the adverse circumstances, the WHO and Pan American Health Organization (PAHO) worked to provide technical support, recommending that countries kept surveillance systems on constant alert and maintained the early identification and isolation of patients. Everything was new and planning of the response to the pandemic was ad hoc. Today we have a clearer understanding of the complex clinical manifestations of COVID-19 and best treatment strategies. Nonetheless, the COVID-19 pandemic became an unprecedented calamity, whose effects have yet to be fully estimated.

The present study explores the repercussions of the COVID-19 pandemic within health systems in Brazil and around the world and its effects on the working conditions and mental health of frontline health workers. Finally, we analyze the social and work-related impact of the widespread dissemination of fake news about the topic (infodemic).

Methodology

We conducted an exploratory descriptive reflective study using data derived from searches of the following sources: the databases PubMed, Lilacs, EBSCOhost, SciELO, Bireme, Scopus, BVS, Google Scholar; DATASUS, Ministry of Health, PAHO and WHO websites; and news websites, television news programs and the critical press. The data were synthesized and scrutinized using content analysis and drawing on the studies "Working Conditions of Health Professionals in Brazil within the Context of COVID-19" and "Invisible Health Workers: Working Conditions and Mental Health in Brazil in the Context of COVID-19", coordinated by Professor Maria Helena Machado, CEE/ENSP/FIOCRUZ.

COVID-19 pandemic response overview

Global overview

The infection caused by SARS CoV-2 was the first great pandemic of the twenty-first century. Since its identification in China at the end of 2019, there have been more than 755 million cases of the disease and around 6.8 million deaths across 231 countries and territories[5]. Not even remote and sparsely populated regions such small islands in the Western Pacific region or Antarctic have been spared. It is estimated that the true figures are 3 to 4 times higher than official numbers[6]. Approximately 90% of global COVID-19 deaths were in low- and medium-income countries (with numbers being 3 to 6 times higher than in high-income countries) and these nations have seen a significant increase in the

proportion of deaths among younger age groups and people without comorbidities[8] (Graph 1).

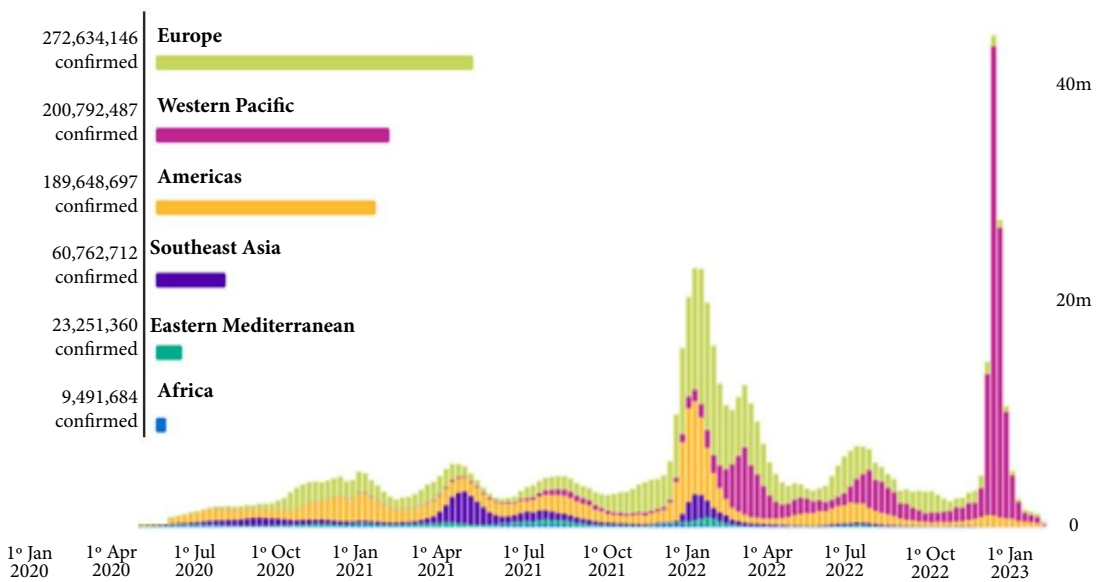
In addition to older people and individuals with immunodeficiency or multiple comorbidities, children and pregnant women should receive timely vaccination.

COVID-19 showed itself to be a much more complex disease than initially thought as the pandemic progressed, frequently presenting hyperinflammatory multisystem manifestations followed by serious chronic complications, even in younger people and individuals without comorbidities. These chronic complications have been described as "long COVID", characterized by a set of more than 20 symptoms that persist after the acute phase of the disease[9,10]. Longitudinal studies estimate that long COVID can affect up to 50% of patients to a varying degree and have a significant impact on quality of life, requiring a multidisciplinary approach[10].

A global epidemiological study showed that risk of COVID-19 hospitalization and death and chance of infection was 50 times and 15 times lower, respectively, in fully vaccinated people[11]. Despite unequal access to vaccines in different parts of the planet, especially in Africa, it is estimated that mass vaccination against COVID-19 has avoided more than 20 million deaths worldwide[12]. However, it is estimated that one million additional lives could have been saved with vaccine sharing across low- and middle-income countries[13], with the impact of the pandemic being higher on socially and economically vulnerable individuals and groups. Figure 1 clearly demonstrates inequalities in the distribution and onset of vaccination around the world.

The pandemic is not over. In November 2022, COVID-19 was the fourth leading cause of death worlwide, with 5.1 million deaths over the last 12 months (49% in the poorest half of the world). Moreover, 2.4 billion people have not been vaccinated (70% in the poorest half of the world) and booster coverage is 33% worldwide (15% in the poorest half of the world). In other words, the pandemic continues to affect poor countries disproportionately[7,8] (Figure 2).

The pandemic has had a huge direct and indirect impact on health services worldwide[14]. The rapid increase in demand for consultations and hospital admission during the acute phase of the pandemic overwhelmed health services and professionals. To avoid health system collapse, it was necessary to reduce other services such as the diagnosis and routine screening of diseases like tuberculosis, diabetes, high blood pressure and certain types of neoplasms, adversely affecting



Graph 1. Worlwide confirmed cases of COVID-19 by region.

Source: Authors, adapted from the World Health Organization – 17/02/2023.

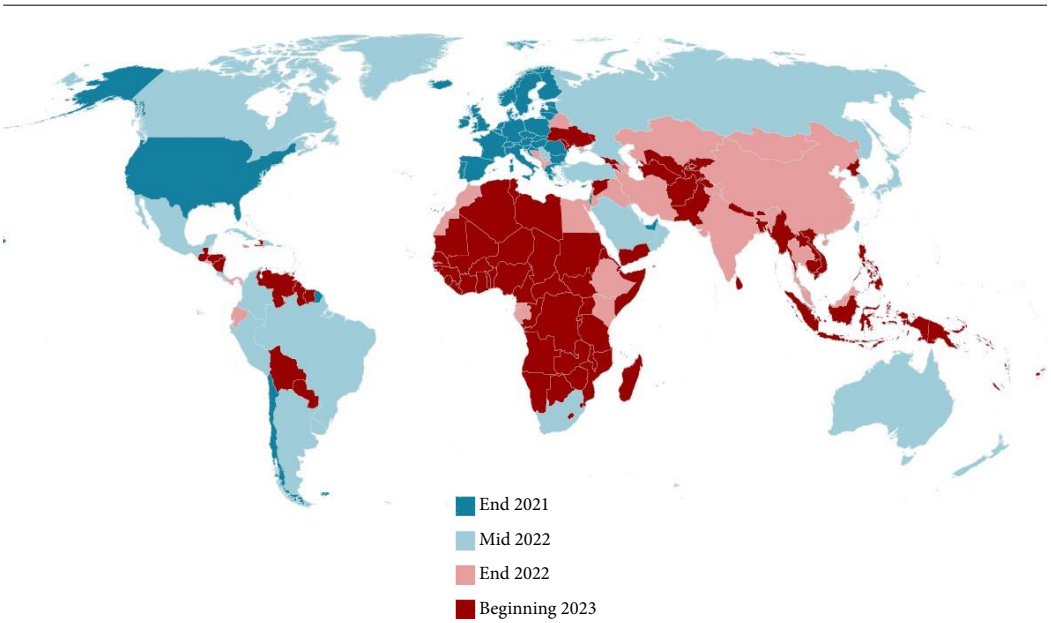


Figure 1. World COVID-19 vaccination map.

Source: The Economist Intelligence Unit – 01/03/2021.

the prevention and treatment of these diseases. Mother and infant care and immunization programs were also affected. As a result, an increase in vaccine preventable diseases is expected in the short- to medium-term[14].

Evidence shows that social distancing also had an impact on mental health, leading to increased incidence of obesity, sedentarism, and alcohol and drug abuse during the acute phase of the pandemic. On the other hand, the use of innovative digital health strategies such as telemedicine has expanded. These technologies will need to be kept updated in the post-pandemic period[15].

National overview

In Brazil, the fact that the country has a universal health system and vast experience in responding to epidemics should be an advantage when it comes to combatting COVID-19[16,17]. Brazil is a country of continental proportions characterized by deep social and regional disparities, and approximately 80% of the population depend exclusively on the public health system, *o Sistema* Único *de Saúde* (SUS) or Unified Health System. The pandemic reproduced social inequalities, disproportionately affecting more vulnerable groups.

In response to the omission of the federal government and dreadful management during the pandemic, state and municipal health managers were forced to develop their own strategies to contain the rapid spread of the disease. Measures include the establishment of a pandemic response committee, with regular meetings to guide municipal health managers and the population in a timely, precise and transparent manner[18]. Partnerships with health professionals and educational institutions were of paramount importance, enabling decision-making based on sound epidemiological data[17].

Initiatives outside the SUS, such as the Oswaldo Cruz Foundation's MonitoraCOVID-19[19] and press consortium provided unified and reliable information on COVID-19 trends. Case and death surveillance indicators were created and revised; however, difficulties tracking cases, particularly asymptomatic cases, undermined contingency planning[20].

In 2022, Brizzi et al.[21] analyzed COVID-19 hospital mortality rates in 14 capital cities during the second wave of the pandemic, revealing regional, socioeconomic and health resource disparities before and during the pandemic. Deaths were lower in capitals with more well-structured hospital systems and higher bed availability, rein-

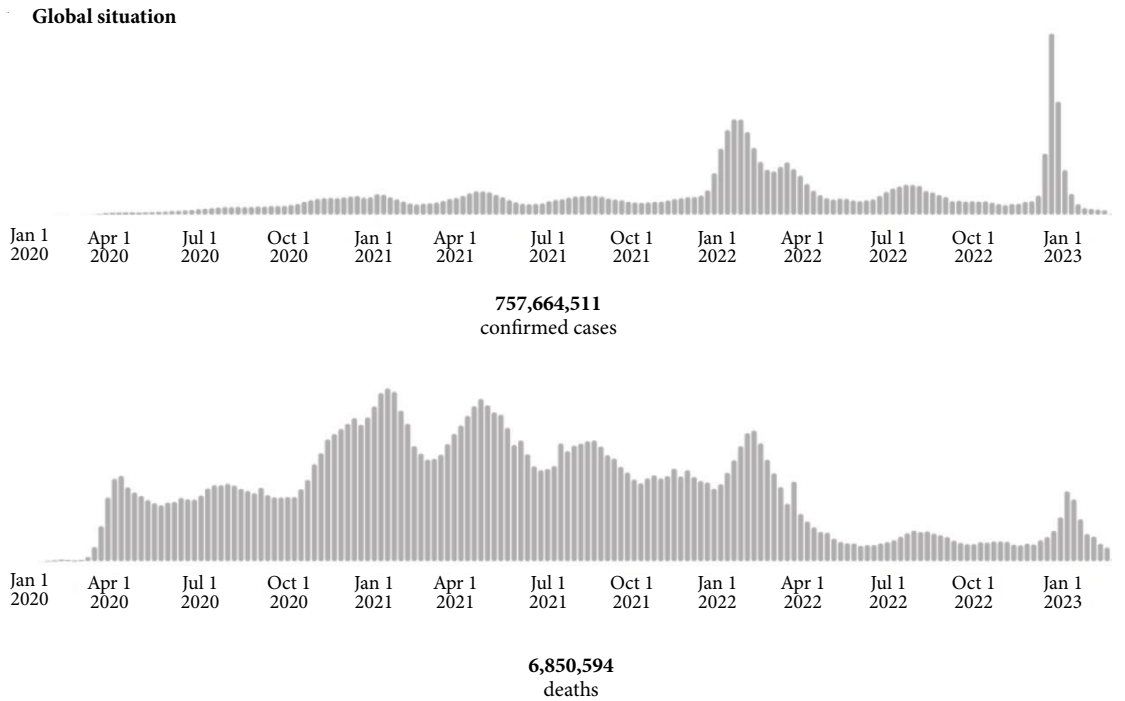


Figure 2. WHO Global Health Emergency Dashboard.

Source: World Health Organization – 10/02/2023 (https://COVID19.who.int/).

forcing the importance of health care and crisis preparedness. The study estimated that approximately half of hospital deaths due to COVID-19 could have been avoided if the country had had an even response structure, without pre-pandemic regional inequities and pandemic healthcare pressure, and with continued structuring of the SUS across all levels of health care and strong regulation and management.

Social distancing required the reorganization of health care, including point of entry, rearguard and emergency services. With regard to face-to-face services, the largely precarious physical spaces of the country's more than 40,000 primary health care centers had to be redesigned to prevent transmission, separating COVID and "non-COVID" patients[22]. Within this context, the relationship of trust between family health teams and the community was an important ally in the dissemination of correct information and adherence to preventions measures. Data on health regions enabled the identification of individuals from vulnerable groups and with comorbidities, facilitating the planning of treatment and even social isolation. However, inadequate infrastructure and facilities and the poor quality of the information available during this phase presented significant barriers to health care.

Virtual consultation and *remote* diagnosis technologies such as telehealth were adopted, improving screening of mild cases and health worker and patient safety[23]. However, this process was hampered by poor organizational culture, lack of training, legal uncertainties and limited access to technology[20]. In view of these difficulties, the pandemic response reinforced the need for coordination across all levels of care to strengthen the SUS.

In January 2020, the Public Health Emergency Operations Center for the new Coronavirus (COE-nCoV) was created and real-time PCR testing was standardized in accordance with WHO protocols[15]. Initially tests were offered by a limited number of laboratories through public-private partnerships, prioritizing hospital patients[16] and later individuals with flu-like signs and symptoms[22,24].

The COVID-19 pandemic placed unprecedented pressure and stress on the health system.

The number of hospitals with intensive care units (ICUs), ventilators and qualified professionals was insufficient to meet patient demand across all regions, especially in the North and Northeast[25,26].

The beginning of the pandemic saw the spread of treatments without evidence and not approved or recommended by government and international health bodies. The Federal Medical Council (Consultation CFM 8/2020, report CFM 4/2020) authorized the prescription of hydroxychloroquine for mild cases of COVID-19 with patient consent in April 2020[27], despite the lack of scientific evidence to support its effectiveness.

Various studies highlighted that there was no evidence supporting the effectiveness of the medicines that made up the "COVID kit", either individually or in combination[28-31]. The excessive use of certain medications can even increase the incidence of adverse effects, some of which can be fatal[30,32].

In November 2021, under significant pressure from scientific organizations and media bodies, the National Commission for the Incorporation of Technologies into the Unified Health System (CONITEC) belatedly issued a public statement confirming that it did not recommend the use of the "COVID kit"[33]. The damage was already done from a public health point of view. The consequences are difficult to measure, including medicine shortages and treatment interruptions[20].

Vaccination is one of the most effective ways of preventing the spread of the diseases and mitigating the effects of the pandemic. Brazil's National Immunization Program (PNI) is one of the world's largest and complete vaccination programs[34,35]. The Brazilian government's initial hesitation in acquiring vaccines authorized in other countries and the poor organization of and delays in vaccine distribution prolonged high hospitalization rates and contributed to deaths during pandemic[34,35].

In 2020, a study with health professionals working in public services in Brazil showed that only 69.5% of nurses, 64.1% of doctors and 34.1% of community health workers had received personal protective equipment (PPE) on a continuous basis during the pandemic. Only 65% of invisible health workers (IHWs) were provided with PPE and received training in the proper use of equipment[36,37] (Chart 1).

Guidance saying that only individuals with more severe symptoms should seek health services had an effect on the treatment of other chronic conditions[20]. Services for other types of conditions had already been limited before the pandemic due to a reduction in the number of available medical appointments in primary care, home visits and vaccination coverage[38].

Effects on the working conditions of health workers

The essence of health work is to care for life, human beings and society. To develop and deliver care for life, health systems need a huge and complex health work force (HWF) made up of a diverse range of professionals and specialists who require continuous training and development, and specific professional regulation. According to Machado, health care is currently in the "pre -professional citizenship stage"[36,37].

There are deep inequalities between professionals: those with higher education, the visible; and the large contingent of professionals with technical qualifications, who are invisible and peripheral to the eyes of directors, managers and service users. IHWs generally work in unstable, low-paid outsourced jobs[36,37], providing support for care activities. Different and unequal worlds interacting in the same health care setting.

The two studies conducted by FIOCRUZ mentioned above analyzed replies from 15,132 health professionals and 21,480 IHWs to a questionnaire about working conditions and mental health in the context of the COVID-19 pandemic. Most to the respondents were women 77.6% and 72.5% were IHWs (Box 1). Over half of the health professionals (57.7%) were white and 39.9% were brown or black, compared 36.6% and 59% of the IHWs, respectively. The largest numbers of health professionals are concentrated in the Southeast and Northeast and the smallest numbers in the Midwest and North (Chart 1).

The data show that 47.4% of health professionals and 50.9% of IHWs perform physically demanding tasks. Around 43% of health professionals and 53% of IHWs reported that they do not feel protected at work, while 27.6% and 37.3%, respectively, said they had not received training in the use of PPE (Chart 1).

The pandemic had a significant effect on the personal and professional well-being of health workers due to the daily contact with the disease and death, poor working conditions, exhausting workload and changes in work routine. The most common effects on the daily life of the HWF were sleep disturbance, irritability/crying/general disorders, and inability to relax/stress (Chart 1).

In the analysis of the data on mental health, symptoms were divided into two groups: depres-

Ciência & Saúde Coletiva, 28(10):2965-2978, 2023

Chart 1. Health workers and invisible health workers within the context of the COVID-19 pandemic – Brazil (n = 15,132 and n = 21,480).

Variables		Health workers*	Invisible health workers**
Sex	✓ Male	22.1	25.6
	✓ Female	77.6	72.5
	✓ NR	0.2	1.9
Color or race	✓ White	57.7	36.6
	✓ Black + brown	39.9	59.0
	✓ Yellow	2.0	2.0
	✓ Indigenous	0.2	0.5
	✓ NR	0.2	1.9
Place of work (region)	✓ North	12.1	12.1
	✓ Northeast	24.7	31.9
	✓ South	14.9	15.4
	✓ Southeast	38.1	28.9
	✓ Midwest	10.2	8.2
	✓ NR	0.1	3.5
Physically strenuous work	✓ Yes	47.4	50.9
	✓ No	51.4	45.6
	✓ NR	1.2	3.5
Training in proper use of PPE	✓ Yes	53.8	43.0
	✓ Own initiative	17.7	17.1
	✓ No	27.6	37.3
	✓ NR	0.9	2.6
Protection at work	✓ Yes	55.9	44.4
	✓ No	43.2	52.9
	✓ NR	0.9	2.8
Violence and discrimination	✓ Yes	30.4	35.5
	✓ At work	38.7	36.2
	✓ On the way to work/home	27.6	31.5
	✓ From neighbors	33.7	32.4

it continues

sive symptoms and anxiety disorder. Depressive symptoms were indicated by loss of job/life satisfaction (9.1% of health professionals and 7.2% of IHWs) and having a negative feeling about the future/life (8.3% of health professionals and 6.8% of IHWs). Anxiety disorder was indicated by changes in appetite/weight (8.1% of health professionals and 7.2% of IHWs), irritability, frequent crying and general disorders (13.6% of health professionals and 9.8% IHWs), difficulty concentrating or slower thinking (9.2% of health professionals and 7.2% of IHWs), inability to relax/stress (11.7% of health professionals and 9.7% of IHWs), anxiety, headaches and general pain (0.5% of health professionals and 9.7% of IHWs).

Sleep disturbance, understood as insomnia and hypersomnia, was the most common problem (15.8% of health professionals and 13% of IHWs). Respondents also reported a significant increase in the consumption of medicines, alcohol, energy drinks and cigarettes during the pandemic (6% of health professionals and 3.6% of IHWs), which can affect the health of these workers.

With regard to feelings in relation to professional life during the pandemic, 30.4% of health professionals and 35.5% of IHWs reported experiencing violence/discrimination. The latter was experienced at work (38.7% of health professionals and 36.2% of IHWs), on the way to work/home (27.6% of health professionals and 31.5% of IHWs), or from neighbors (33.7% of health professionals and 32.4% of IHWs).

With regard to professional appreciation, 16.7% of health professionals and 23.8% of IHWs

Chart 1. Health workers and invisible health workers within the context of the COVID-19 pandemic – Brazil (n = 15,132 and n = 21,480)

Variables		Health workers*	Invisible health workers**
Effects on daily life	✓ Sleep disturbance	15.8	13.0
	✓ Irritability/crying/disorder	13.6	9.8
	✓ Inability to relax/stress	11.7	9.7
	✓ Difficulty concentrating	9.2	7.2
	✓ Loss of job/life satisfaction	9.1	7.2
	✓ Negative feeling about the future/ life	8.3	6.8
	✓ Change in appetite/weight	8.1	7.2
Professional appreciation	✓ More appreciated by the public	24.3	22.0
	✓ More respected by colleagues	11.2	7.1
	✓ Better team relations	15.8	13.6
	✓ More welcomed by directors/ management	10.9	8.0
	✓ Less appreciated by the public	16.7	23.8
	✓ Less welcomed by directors/ management	21.0	25.6
Fake news during the pandemic			
"Fake health news is an obstacle to tackling the novel coronavirus."			
(Agree - 91.6%)	(Disagree/indifferent - 6.9%)		
"I treated patients who believed in fake news about COVID-19."			
(Agree - 76.1%)	(Disagree/indifferent - 21.0%)		
"The positions taken by health authorities on COVID-19 have been consistent and enlightening."			
(Agree - 29.3%)	(Disagree/indifferent - 68.5%)		

*Doctor, nurse, physiotherapist/occupational therapist, dentist, biomedical professional, pharmacist/biochemist, psychologist, social worker, nutritionist, speech therapist, biologist, veterinarian, hospital administrator, physical educator, engineer/occupational safety/ sanitary specialist, undergraduate student (medicine, nursing, etc.). **Technician: nursing; oral health; pharmacy/hemotherapy/ hematology/clinical analysis; radiology; orthopedic immobilizations/plaster; workplace safety; health surveillance, community health worker, indigenous health worker, stretcher bearer, ambulance driver, mortician, hospital kitchen staff; administrative staff; receptionist/telephone operator/security guard; cleaning and maintenance.

Source: "Working Conditions of Health Professionals in Brazil within the Context of COVID-19" – ENSP - CEE- FIOCRUZ, 2020/2021 and "Invisible Health Workers: Working Conditions and Mental Health in Brazil in the Context of COVID-19" – ENSP – CEE/FIOCRUZ, 2021/2022.

felt less appreciated by the public and 21% of health professionals and 25.6% of IHWs felt less welcomed by directors/managers. Around 22% of health professionals and IHWs reported feeling more welcomed by health service users, 10% of health professionals and 8% of IHWs felt more welcomed by directors/managers, and 10% of health professionals and 7.1% of IHWs felt more respected by colleagues.

Around 43% of health professionals and 53% of IHWs felt unprotected, unsafe, fear of dying, and exposed to long and exhausting working hours and a hostile organizational climate (Chart 1).

The COVID-19 pandemic threatened people's lives and imposed changes to the world of work in general. It had a particularly large impact on health work, changing the health care process, workers' lives and well-being, and health and safety at work.

Saragih et al. (2021)[39] conducted a systematic literature review to analyze the prevalence of mental health problems among healthcare workers during the COVID-19 pandemic. The distribution of workers included 27.9% doctors, 43.7% nurses and 7.0% allied health workers. The pooled prevalence of post-traumatic stress disor-

Ciência & Saúde Coletiva, 28(10):2965-2978, 2023

der, anxiety, depression, and distress was 49%, 40%, 37% and 37%, respectively.

A systematic review of 65 studies by Li et al. (2021)[40] found that pooled prevalence of depression, anxiety and posttraumatic stress disorder was 21.7%, 22.1% and 21.5%, respectively.

The COVID-19 HEalth caRe wOrkErs Study (HEROES) conducted interviews with 14,502 health care workers from 11 Latin American countries. The findings show that the pandemic increased rates of stress, anxiety, depression, suicidal ideation and psychological distress among health workers and clearly showed the lack of specific policies to protect the mental health of these professionals[41].

The Director of the WHO Health Workforce Department, James Campbell, said that "COVID-19 has exposed the cost of this systemic lack of safeguards for the health, safety and wellbeing of health workers", when revealing that about 115,500 health workers died from COVID-19 in the first 18 months of the pandemic. In the same vein, the Director of the International Labor Organization's Sectoral Policies Department, Alerte van Ler, declared that "Health workers, like all other workers, should enjoy their right to decent work, safe and healthy working environments and social protection for healthcare, sickness absence and occupational diseases and injuries"[42].

On 22/10/2021, the WHO estimated that between 80,000 and 180,000 health and care workers could have died from COVID-19 between January 2020 and May 2021, not to mention the burnout, stress, anxiety, fatigue and poor working conditions experienced by these professionals. Proportionally, Brazil recorded the highest rate of death among this group.

According to Public Services International, more than 4,500 health professionals died in Brazil during the pandemic[43]. Machado et al (2022)[44] analyzed data from the period March 2020-March 2021, reporting high COVID-19 mortality rates among doctors, nurses, and auxiliary nurses in Brazil. According to the Federal Medical Council and Federal Nursing Council, 622 doctors, 100 nurses and 470 auxiliary nurses died up to March 2023. Most of the doctors (87.6%) were male, while most of the auxiliary nurses (69.1%) were female. Rates among nurses were similar between genders: 59.5% women and 40.5% men (Table 1).

The words of WHO Director-General Dr Tedros Adhanom Ghebreyesus are emblematic: "No country, hospital or clinic can keep its patients safe unless it keeps its health workers safe. WHO's Health Worker Safety Charter is a step towards ensuring that health workers have the safe working conditions, the training, the pay and the respect they deserve". The protection of health professionals is essential to ensure the functioning of health systems and society[45]. Health systems are threatened by the shortage and exodus of experienced health professionals.

Infodemic and dissemination of fake news

The WHO coined the term infodemic in parallel with the COVID-19 pandemic to refer to an overabundance of information, including false or misleading information, during a disease outbreak.

Fake health news can be characterized as conspiracy theories, false cures, miracle foods and other dubious news that aggravate the spread of SARS-CoV-2, confusing citizens and encouraging them to ignore evidence-based treatments recommended by official health agencies.

Propagated by social media and messaging apps (Twitter, WhatsApp, Telegram, Facebook, YouTube, TikTok, LinkedIn, Viber, VK, Kwai), this phenomenon has called for an integrated and coordinated global response from governments, organizations and specialists.

Combating fake news is key to reducing the damage that the infodemic continues to cause, undermining confidence in health systems, health workers, treatment, diagnoses and vaccines.

The response lies in infodemiology[46], a branch of communications dedicated to delving deep into the internet in search of public health content posted by common users with the aim of monitoring information, improving news, translating scientific knowledge and carrying out systematic checks.

In response to this global problem, the WHO today recommends 5 ways to combat the stigma[47] caused by the infodemic: 1) use social media listening to analyze what is being said, who is saying it and how it affects you; 2) use language carefully to avoid stigmatizing specific groups and perpetuating social or health inequalities; 3) involve members of communities at risk of being stigmatized in designing interventions aimed at them; 4) provide free content that promotes health equity; and 5) promote ways through which individuals and communities experiencing stigma, harassment and abuse can protect themselves online and report misinformation.

Keys to infodemic management[48] include training health workers, as trusted sources of

Table 1. Deaths of doctors, nurses and auxiliary nurses due to COVID-19 by sex – Brazil.

Profession	Male		Female		Total	
	N	%	N	%	N	%
Doctor	545	87.6	77	12.4	622	100.0
Nurse	81	40.5	119	59.5	200	100.0
Auxiliary nurse	145	30.9	325	69.1	470	100.0

Source: Machado MH, Teixeira EG, Freire NP, Pereira EJ, Minayo MCS. 2023. p. 411 Special tabulation (COFEN, March 2021). Inventory of Deaths of Health Professionals Due to COVID-19 in Brazil (Fiocruz, 2021).

health information, to identify and address misinformation, tailoring health, information and digital literacy initiatives to specific populations, and debunking misinformation before it is widely disseminated.

An important initiative developed by FIOCRUZ to tackle the dissemination of fake news, misinformation and malicious manipulation of information was a workshop for journalists aimed at providing high-quality information about the health emergency to representatives of the country's main media outlets[49].

The two studies conducted by FIOCRUZ showed that 91.6% of the HWF agreed that fake health news was an obstacle to tackling the novel coronavirus. Around 76% of health professionals treated patients who believed fake news about COVID-19 and 68.5% disagreed with the positions taken by the country's health authorities[36,37].

Final considerations

The impact of the COVID-19 pandemic was greater in low-income countries and among marginalized groups. The pandemic underscored weaknesses in the funding, management and structure of the country's health services. The interruption of essential health services, such as consultations and non-emergency surgeries, aggravated comorbidities and preventable deaths and led to a reduction in infectious disease testing. It is essential to promote actions to protect the health, safety and well-being of health workers, who are all too often exposed to poor working conditions and risk their own lives to save the lives of others. The infodemic, fake news and vaccine refusal should be effectively addressed in a systematic manner and access to correct true information should be improved.

The correlation between the factors mentioned above show that several variables can lead to burnout, chronic stress, anxiety disorders and depression among health workers. It is therefore crucial to ensure safe and healthy working conditions and emotional support to protect the mental health of workers during health crises. Other pandemics will come, and preparation should be ongoing.

Collaborations

AV Machado, WE Ferreira, MAA Vitoria, HM Magalhães Júnior, LL Jardim, MAC Carneiro, POR Santos, FL Vargas and EJ Pereira participated in study conception and design, drafting the article and revising it critically for important intellectual content, and in approving the final version to be published.

Acknowledgements

We are grateful to the Lucas Machado Educational Foundation (FELUMA) for their support and incentive during the study and to Geralda Oliveira for her support.

References

1. Wu F, Zhao S, Yu B, Chen YM, Wang W, Song ZG, Hu Y, Tao ZW, Tian JH, Pei YY, Yuan ML, Zhang YL, Dai FH, Liu Y, Wang QM, Zheng JJ, Xu L, Holmes EC, Zhang YZ. A new coronavirus associated with human respiratory disease in China. *Nature* 2020; 579(7798):265-269.
2. Brasil. Ministério da Saúde (MS). Portaria nº 188, de 3 de fevereiro de 2020. Declara Emergência em Saúde Pública de importância Nacional (ESPIN) em decorrência da Infecção Humana pelo novo Coronavírus (2019-nCoV). *Saúde Legis* 2020; 3 fev.
3. Brasil. Lei 13.979, de 6 de fevereiro de 2020. Dispõe sobre as medidas para enfrentamento da emergência de saúde pública de importância internacional decorrente do coronavírus responsável pelo surto de 2019. *Diário Oficial da União* 2020; 6 fev.
4. Genoma do SARS-CoV-2 do primeiro caso de COVID-19 da América Latina sequenciado em 48 horas no Instituto Adolfo Lutz [Internet]. *Faculdade de Medicina da USP* 2020. [acessado 2022 fev 8]. Disponível em: https://www.fm.usp.br/fmusp/noticias/-genoma-do-sars-cov-2-do-primeiro-caso-de-covid-19-da-america-latina-sequenciado-em-48-horas-no-instituto-adolfo-lutz
5. COVID-19 Excess Mortality Collaborators. Estimating excess mortality due to the COVID-19 pandemic: a systematic analysis of COVID-19-related mortality, 2020-21. *Lancet* 2022; 399(10334):1513-1536.
6. Gill I, Schellekens P. COVID-19 is a developing country pandemic [Internet]. 2021. [cited 2022 maio 27]. Available from: https://pandem-ic.com/blog-covid-19-is-a-developing-country-pandemic/
7. Schellekens P. The demographics of excess mortality [Internet]. 2022. [cited 2022 ago 9]. Available at: https://pandem-ic.com/the-demographics-of-excess-mortality/
8. Crook H, Raza S, Nowell J, Young M, Edison P. Long covid-mechanisms, risk factors, and management *BMJ* 2021; 374:n1648.
9. Desai AD, Lavelle M, Boursiquot BC, Wan EY. Long-term complications of COVID-19. *Am J Physiol Cell Physiol* 2022; 322(1):C1-C11.
10. Davis HE, Assaf GS, McCorkell L, Wei H, Baixo RJ, Re'em Y, Redfield S, Austin JP, Akrami A. Characterizing long COVID in an international cohort: 7 months of symptoms and their impact. *E Clinical Medicine* 2021; 38:101019.
11. Johnson AG, Amin AB, Ali AR, Hoots B, Cadwell BL, Arora S, Avoundjian T, Awofeso AO, Barnes J, Bayoumi NS, Busen K, Chang C, Cima M, Crockett M, Cronquist A, Davidson S, Davis E, Delgadillo J, Dorabawila V, Drenzek C, Eisenstein L, Fast HE, Gent A, Hand J, Hoefer D, Holtzman C, Jara A, Jones A, Kamal-Ahmed I, Kangas S, Kanishka F, Kaur R, Khan S, King J, Kirkendall S, Kliqueva A, Kocharian A, Kwon FY, Logan J, Lyons BC, Lyons S, May A, McCormick D; MSHI; Mendoza E, Milroy L, O'Donnell A, Pike M, Pogosjans S, Saupe A, Sell J, Smith E, Sosin DM, Stanislawski E, Steele MK, Stephenson M, Stout A, Strand K, Tilakaratne BP, Turner K, Vest H, Warner S, Wiedeman C, Zaldivar A, Silk BJ, Scobie HM. COVID-19 incidence and death rates among unvaccinated and fully vaccinated adults with and without booster doses during periods of delta and omicron variant emergence – 25 U.S. jurisdictions April 4-December 25, 2021. *MMWR Morb Mortal Wkly Rep* 2022; 71(4):132-138.
12. Watson OJ, Barnsley G, Toor J, Hogan AB, Wisnkill P, Ghani AC. Global impact of the first year of COVID-19 vaccination: a mathematical modelling study. *Lancet Inf Dis* 2022; 22(9):1293-302.
13. Moore S, Hill EM, Dyson L, Tildesley M.J, Keeling MJ. Retrospectively modeling the effects of increased global vaccine sharing on the COVID-19 pandemic. *Nature Med* 2022; 28(11):2416-2423.
14. Omboni S, Padwal RS, Alessa T, Benczúr B, Green BB, Hubbard I, Kario K, Khan NA, Konradi A, Logan AG, Lu Y, Mars M, McManus RJ, Melville S, Neumann CL, Parati G, Renna NF, Ryvlin P, Saner H, Schutte AE, Wang J. *Connect Health* 2022; 1:7-35.
15. United Nations Children's Fund (UNICEF), United Nations Educational, Scientific and Cultural Organization (UNESCO), World Bank. *Where are we on education recovery?* New York: UNICEF; 2022.
16. Croda J, Oliveira WK, Frutuoso RL, Mandetta LH, Silva DCB, Sousa JDB, Monteiro WM, Lacerda MVG. COVID-19 in Brazil: advantages of a socialized unified health systemand preparation to contain cases. *Rev Soc Bras de Med Trop* 2020; 53: e20200167.
17. Wakimoto MD, Menezes RC, Pereira SA, Nery T, Castro-Alves J, Penetra SLS, Ruckert A, Labonté R, Veloso VG. COVID-19 and zoonoses in Brazil: environmental scan of one health preparedness and response. *One Health* 2022; 14:100400.
18. Tasca R, Carrera MBM, Malik AM, Schiesari LMC, Bigoni A, Costa CF, Massuda A. Gerenciando o SUS no nível municipal ante a COVID-19: uma análise preliminar. *Saude Debate* 2022; 46(esp. 1):15-32.
19. Fundação Oswaldo Cruz (Fiocruz). Instituto de Comunicação e Informação Científica e Tecnológica em Saúde (ICICT) [Internet]. *MonitoraCovid-19*. 2020. [acessado 2023 jan 26] Disponível em: https://bigdata- covid19.icict.fiocruz.br/
20. Massuda A, Malik AM, Vecina G, Tasca R, Ferreira-Júnior WC. A resiliência do Sistema Único de Saúde frente à COVID-19. *Cad EBAPE.BR* 2021; 19(esp.):735-744.

21. Brizzi A, Whittaker C, Servo LMS, Hawryluk I, Prete Jr CA, Souza WM, Aguiar RS, Araujo LJT, Bastos LS, Blenkinsop A, Buss LF, Candido D, Castro MC, Costa SF, Croda J, de Souza Santos AA, Dye C, Flaxman S, Fonseca PLC, Geddes VEV, Gutierrez B, Lemey P, Levin AS, Mellan T, Bonfim DM, Miscouridou X, Mishra S, Monod M, Moreira FRR, Nelson B, Pereira RHM, Ranzani O, Schnekenberg RP, Semenova E, Sonabend R, Souza RP, Xi X, Sabino EC, Faria NR, Bhatt S, Ratmann O. Spatial and temporal fluctuations in COVID-19 fatality rates in Brazilian hospitals. *Nat Med* 2022; 28(7):1476-1485.
22. Lavras C. Atuação das equipes de APS durante o período de enfrentamento da COVID-19. In: Conselho Nacional de Secretários de Saúde (CONASS). *Profissionais de saúde e cuidados primários*. Brasília: CONASS; p. 13-24
23. Caetano R, Silva AB, Guedes ACCM, Paiva CCN, Ribeiro GR, Santos DL, Silva RM. Desafios e oportunidades para telessaúde em tempos da pandemia pela COVID-19: uma reflexão sobre os espaços e iniciativas no contexto brasileiro. *Cad Saude Publica* 2020; 36(5):e00088920.
24. Kameda K, Barbeitas MM, Caetano R, Löwy I, Oliveira ACD, Corrêa MCDV, Cassier M. Testing COVID-19 in Brazil: fragmented efforts and challenges to expand diagnostic capacity at the Brazilian Unified National Health System. *Cad Saude Publica* 2021; 37(3):e00277420.
25. Cotrim Júnior DF, Cabral LMS. Crescimento dos leitos de UTI no país durante a pandemia de COVID-19: desigualdades entre o público X privado e iniquidades regionais. *Physis* 2020; 30(3):e300317.
26. Passos VMA, Brant LCC, Pinheiro PC, Correa PRL, Machado IE, Santos MR, et al. Higher mortality during COVID-19 pandemic in socially vulnerable areas in Belo Horizonte: implications for vaccination priority. *Rev Bras Epidemiol* 2021; 24:e210025.
27. Conselho Federal de Medicina (CFM). Processo-consulta CFM nº 8/2020 – Parecer CFM nº 4/2020. Considerar o uso da cloroquina e hidroxicloroquina, em condições excepcionais, para o tratamento da COVID-19 [Internet]. 2020. Disponível em: https://saude.mppr.mp.br/arquivos/File/Corona/CFM/6.pdf
28. Cavalcanti AB, Zampieri FG, Rosa RG, Azevedo LCP, Veiga VC, Avezum A, Damiani LP, Marcadenti A, Kawano-Dourado L, Lisboa T, Junqueira DLM, de Barros E Silva PGM, Tramujas L, Abreu-Silva EO, Laranjeira LN, Soares AT, Echenique LS, Pereira AJ, Freitas FGR, Gebara OCE, Dantas VCS, Furtado RHM, Milan EP, Golin NA, Cardoso FF, Maia IS, Hoffmann Filho CR, Kormann APM, Amazonas RB, Bocchi de Oliveira MF, Serpa-Neto A, Falavigna M, Lopes RD, Machado FR, Berwanger O; Coalition Covid-19 Brazil I Investigators. Hydroxychloroquine with or without Azithromycin in Mild-to-Moderate COVID-19. *N Engl J Med* 2020; 383(21):2042-2052.
29. Horby P, Mafham M, Linsell L, Bell JL, Staplin N, Emberson JR, Wiselka M, Ustianowski A, Elmahi E, Prudon B, Whitehouse T, Felton T, Williams J, Faccenda J, Underwood J, Baillie JK, Chappell LC, Faust SN, Jaki T, Jeffery K, Lim WS, Montgomery A, Rowan K, Tarning J, Watson JA, White NJ, Juszczak E, Haynes R, Landray MJ. Effect of hydroxychloroquine in hospitalized patients with Covid-19. *N Engl J Med* 2020; 383(21):2030-2040.
30. Siemieniuk RA, Bartoszko JJ, Zeraatkar D, Kum E, Qasim A, Martinez JPD, Izcovich A, Lamontagne F, Han MA, Agarwal A, Agoritsas T, Azab M, Bravo G, Chu DK, Couban R, Devji T, Escamilla Z, Foroutan F, Gao Y, Ge L, Ghadimi M, Heels-Ansdell D, Honarmand K, Hou L, Ibrahim Q, Khamis A, Lam B, Mansilla C, Loeb M, Miroshnychenko A, Marcucci M, McLeod SL, Motaghi S, Murthy S, Mustafa RA, Pardo-Hernandez H, Rada G, Rizwan Y, Saadat P, Switzer C, Thabane L, Tomlinson G, Vandvik PO, Vernooij RW, Viteri-García A, Wang Y, Yao L, Zhao Y, Guyatt GH, Brignardello-Petersen R. Drug treatments for covid-19 living systematic review and metanalysis. *BMJ* 2020; 370:m2980.
31. Furtado RHM, Berwanger O, Fonseca HA, Corrêa TD, Ferraz LR, Lapa MG, Zampieri FG, Veiga VC, Azevedo LCP, Rosa RG, Lopes RD, Avezum A, Manoel ALO, Piza FMT, Martins PA, Lisboa TC, Pereira AJ, Olivato GB, Dantas VCS, Milan EP, Gebara OCE, Amazonas RB, Oliveira MB, Soares RVP, Moia DDF, Piano LPA, Castilho K, Momesso RGRAP, Schettino GPP, Rizzo LV, Neto AS, Machado FR, Cavalcanti AB; COALITION COVID-19 Brazil II Investigators. Azithromycin in addition to standard of care versus standard of care alone in the treatment of patients admitted to the hospital with severe COVID-19 in Brazil (COALITION II): a randomized clinical trial. *Lancet* 2020; 396(10256):959-967.
32. Mitjà O, Corbacho-Monné M, Ubals M, Alemany A, Suñer C, Tebé C, Tobias A, Peñafiel J, Ballana E, Pérez CA, Admella P, Riera-Martí N, Laporte P, Mitjà J, Clua M, Bertran L, Sarquella M, Gavilán S, Ara J, Argimon JM, Cuatrecasas G, Cañadas P, Elizalde-Torrent A, Fabregat R, Farré M, Forcada A, Flores-Mateo G, López C, Muntada E, Nadal N, Narejos S, Nieto A, Prat N, Puig J, Quiñones C, Ramírez-Viaplana F, Reyes-Urueña J, Riveira-Muñoz E, Ruiz L, Sanz S, Sentís A, Sierra A, Velasco C, Vivanco-Hidalgo RM, Zamora J, Casabona J, Vall-Mayans M, González-Beiras C, Clotet B; BCN-PEP-CoV2 Research Group. A cluster-randomized trial of hydroxychloroquine for prevention of Covid-19. *N Engl J Med* 2021; 384(5):417-427.
33. Comissão Nacional de Incorporação de Tecnologias no Sistema Único de Saúde. Relatório de recomendação: protocolos clínicos e diretrizes terapêuticas [Internet]. 2021. [acessado 2022 set 29]. Disponível em: https://www.gov.br/conitec/pt-br/midias/relatorios/diretrizesbrasileiras_tratamentohospitalarpaciente_capii.pdf.

34. Cruz A. A queda da Imunização no Brasil [Internet]. 2017. [acessado 2022 mar 3] Disponível em: https://portal.fiocruz.br/sites/portal.fiocruz.br/files/documentos/revistaconsensus_25_a_ queda_da_imunizacao.pdf
35. Sato APS. Qual a importância da hesitação vacinal na queda das coberturas vacinais no Brasil? *Rev de Saude Publica* 2018; 52:96.
36. Machado, MH, coordenadora. *Pesquisa: condições de trabalho dos profissionais de saúde no contexto da covid-19 no Brasil*. Rio de Janeiro: ENSP/CEE-Fiocruz; 2020/2021.
37. Machado, MH, coordenadora. *Pesquisa: os trabalhadores invisíveis da saúde: condições de trabalho e saúde mental no contexto da covid-19 no Brasil*. Rio de Janeiro: ENSP/CEE-Fiocruz; 2021/2022.
38. Oliveira MLA, Abreu AL, Siqueira MM. A organização da vigilância laboratorial e a rede de laboratórios de Saúde Pública no contexto da pandemia de COVID-19. In: *Profissionais de saúde e cuidados primários*. Brasília: CONASS; 2021. [acessado 2022 ago 3]. Disponível em: https:// www.conass.org.br/biblioteca/volume-4-profissionais-de-saude-e-cuidados-primarios/
39. Saragih ID, Tonapa SI, Saragih IS, Advani S, Batubara SO, Suarilah I, Lin CJ. 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.
40. Li Y, Scherer N, Felix L, Kupe H. Prevalence of depression, anxiety and posttraumatic stress disorder in health care workers during the COVID-19 pandemic: a systematic review and meta-analysis. *PLoS One* 2021; 16(3):e0246454.
41. Organização Panamericana da Saúde (OPAS). O Covid-19 Health Care Workers Study (HEROES): Relatório Regional das Américas [Internet]. 2022. [acessado 2022 maio 9]. Disponível em: https://iris.paho.org/handle/10665.2/55972
42. Organização Mundia da Saúde (OMS), Organização Internacional do Trabalho (OIT). *Guia de orientações para garantir a segurança no trabalho para os profissionais de saúde da OMS e da OIT*. Lisboa: OMS/OIT; 2020.
43. Organização Mundial da Saúde (OMS). Ano Internacional dos Trabalhadores de Saúde e Cuidadores [Internet]. 2020. [acessado 2022 jul 23]. Disponível em: https://www.paho.org/pt/campanhas/ano-internacional-dos-trabalhadores-saude-e-cuidadores2021#:~:text=2021%20foi%20designado%20como%20o,na%20 capacidade%20da%20s ociedade%20de
44. Machado MH, Teixeira EG, Freire NP, Pereira EJ, Minayo MCS. Óbitos de médicos e da equipe de enfermagem por COVID-19 no Brasil: uma abordagem sociológica. *Cien Saude Colet* 2023; 28(2):405-419.
45. Organização Mundial da Saúde (OMS). Até 180 mil profissionais de saúde morreram de Covid-19, informa OMS [Internet]. 2021. [acessado 2022 out 7]. Disponível em: https://brasil.un.org/pt- br/152760-ate-180-mil-profissionais-de-saude-morreram-de-covid-19-informa-oms
46. Freire NP, Cunha ICKO, Ximenes Neto FRG, Machado MH, Minayo CS. A infodemia transcende a pandemia. *Cien Saude Colet* 2021; 26(09):4065-4068.
47. World Health Organization (WHO). How to report misinformation online [Internet]. 2022. [cited 2023 jan 7]. Available from: https://www.who.int/campaigns/connecting-the-world-to-combat-coronavirus/how-to-report-misinformation-online
48. World Health Organization (WHO). WHO policy brief: COVID-19 infodemic management [Internet]. 2022. [cited 2022 set 14]. Available from: WHO/2019-nCoV/Policy_Brief/Infodemic/2022.1
49. Valverde R. Oficina sobre coronavírus para jornalistas [Internet]. 2020. [acessado ano mês dia]. Disponível em: https://portal.fiocruz.br/noticia/fiocruz-oferece-oficina-sobre-coronavirus-para-jornalistas

Article presented 20/10/2022
Aprroved 01/06/2023
Final version submitted 28/06/2023

Chief editors: Romeu Gomes, Antônio Augusto Moura da Silva