



Research Article

Impact of Stressors on The Mental and Physical Health of Professionals Working in Intensive Care Units During The COVID-19 Pandemic

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Abstract

Stress-inducing factors experienced by professionals working in intensive care units (ICUs) during the COVID-19 pandemic have detrimental effects on their mental and physical well-being. The COVID-19 outbreak led to a surge in the number of patients requiring critical care, necessitating the dedicated efforts of ICU workers. However, the introduction of COVID-19 posed significant threats to their health and safety. To investigate the impact of these stressors, researchers employed a comprehensive questionnaire consisting of 75 questions covering personal aspects, job satisfaction, salary, working hours, impact on family activities, and emotional and psychological balance. The results indicated that the model used in the study was statistically adequate according to the Hosmer & Lemeshow test ($p = 0.58$). Furthermore, the Omnibus Tests demonstrated an improved equation with the model, as indicated by a Chi-square value of 36.372, 8 degrees of freedom, and $p < .000$. Nargle Kerke's R2 coefficient suggested that the model accounted for 37% of the variance associated with exhaustion. Importantly, a positive association was observed between exhaustion and job satisfaction (24.92). In conclusion, the study revealed higher levels of exhaustion among nurses, females, professionals using controlled medication, those who did not rest after work, and those juggling multiple jobs. These findings underscore the need for a more comprehensive analysis of the identified attributes within the context of care provision, particularly as the pandemic evolves.

Keywords: COVID-19; SARS-COV-2; ICU; Stressor elements

Introduction

The COVID-19 pandemic, since its inception in December 2019, has been associated with infections and patient deaths, as well as other harmful collateral damage to patients and society. This has exacerbated stress levels among professionals working in Intensive Care Units (ICUs) who care for these patients [1].

The virus responsible for COVID-19 is called Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) and has high transmissibility and lethality [2]. It has been recognized as a severe public health problem in Brazil and worldwide [3,4].

The numbers of COVID-19 cases and deaths have been significant since the start of its spread. As of December 29, 2021, there have been 281,808,270 confirmed cases and 5,411,759 deaths worldwide [5]. These numbers highlight the magnitude of the medical and social impact of the disease, affecting both public and private hospitals and having economic consequences, particularly in less developed regions [6,7].

Vaccination efforts are underway worldwide, but there have been challenges in terms of logistics and the number of vaccines administered. Disparities in vaccination rates have been observed, with poorer and remote regions facing difficulties in access and distribution [7].

The COVID-19 pandemic represents not only a health challenge but also a sociological phenomenon that potentially affects the performance and satisfaction of healthcare professionals caring for hospitalized patients, many of whom have severe morbidity. Various external factors can influence the course and prognosis of the epidemic, including competition for vaccine acquisition, distribution logistics, vaccine acceptance by populations, economic consequences, and societal responses to preventive measures [9,10].

It is important to recognize and address the stressors faced by ICU professionals during this pandemic to achieve a desired balance between their health and satisfaction in delivering competent and quality care. Understanding and managing negative stress levels will have a positive impact on the work environment and administrative management during the pandemic. This knowledge can also contribute to future healthcare situations of similar importance. The aim of this study is to evaluate stress levels and exhaustion among professionals working in ICUs during the COVID-19 pandemic.

Materials and Methods

This cross-sectional study was conducted from August through September 2020, during the COVID-19 pandemic, in five ICUs

from public and private hospitals in the State of Bahia, Brazil. The procedures were approved by the Research Ethics Committee of the Professor Edgard Santos University Hospital (HUPES) and by the National Research Ethics Committee (CONEP), being registered on the Plataforma Brasil-CAAE (Certificate of Presentation for Ethics Appreciation) n° 30447520.3.0000.5577. Hospital institutions with public and private profiles were randomly chosen, considering restrictions resulting from the pandemic.

The census sampling included 192 healthcare professionals. The questionnaire methodology was a census with the main focus on a population census in ICUs to take stock and produce a total population count without omission or duplication. Another key focus was the ability to provide accurate demographic and socioeconomic characteristics pertaining to each enumerated individual. All teams composed of physicians, nurses, and physiotherapists from the studied intensive care units were surveyed.

The instrument sought to verify the experiences and perceptions of physicians, nurses, and physiotherapists through 75 questions presented in a script of qualitative questions on the various aspects that could reveal the most striking stressor elements that can raise exhaustion levels in the ICU during the COVID-19 pandemic. In this study, a question that included work-related mental and physical fatigue defined exhaustion.

The instrument included various demographic and work-related questions such as name, gender, date of birth, profession, exhaustion, use of controlled medication, living arrangements, marital status, physical activity, alcohol consumption, chronic tobacco use, having children, monthly income, decision-making in services, ICU protection measures, professional relationships, conflicts at work, professional vacations, training time, experiences with deceased COVID patients, previous COVID infection, use of Personal Protective Equipment (PPE), after-service rest, empowerment for pandemic care, shift duration, feeling safe with the team, multiple jobs, patient load, work hours, stress moments, professional discouragement, difficulty relaxing, tiredness, work overload, stress perception, satisfaction with the chosen profession, work irritation, fear of COVID, ICU pressure, concerns in the ICU, feeling isolated, overload of responsibilities, feeling like a professional hero, thoughts of death, fear of dying from COVID, and handling patient suffering.

In the bivariate analysis for exhaustion, sociodemographic and work-related variables with a p-value less than 0.20 were included in a binary logistic regression model. The parameters used to assess the quality of the logistic regression were the Hosmer & Lemeshow tests (goodness of fit) to determine the adequacy of the model (p-value > 0.5), the Omnibus Tests (p-value < 0.05) to assess the improvement of the data in the equation with the model,

and Nargle Kerke's R^2 . A network analysis was performed to evaluate the psychological aspects associated with exhaustion, using the InSigSampler estimator with bivariate regression analysis and Bootstrap 500 of the non-parametric type.

This research applied the discourse analysis method as a qualitative approach to describe the ergonomic aspects of the stressor elements commonly observed in the ICU, according to the literature. Therefore, the scientific concept of discourse analysis and the critical points of using the theoretical tendency are presented.

Results

In 2020, a total of 192 professionals from five ICUs were invited to answer an electronic questionnaire. Out of the 192 participants, 115 ICU workers (60%) participated. Of the study participants, 30.4% were male and 69.6% were female. In the population, 34.8% were physicians, 30.4% were nurses, and 34.8% were physiotherapists. In the present work, the results of the questions, all conducted in ICU environments, were extracted descriptively. The response rate described in the article was 60%. Generally, response rates for online surveys are less than 20%. Table 1 shows exhaustion according to sociodemographic characteristics of ICU workers. Among ICU workers, exhaustion was 68% higher (PR=1.68; $p<0.001$) in nurses, 48% higher in professionals using controlled medication (PR=1.48; $p=0.042$), and 75% higher in females (PR=1.75; $p<0.001$).

Sociodemographic characteristics		With exhaustion		No exhaustion		PR	CI	P
		n	%	n	%			
Profession	Nurse	28	80,0	7	20,0	1.68	1.169-2.427	<0.001
	Physiotherapist	19	47,5	21	52,5	1		
	Physician	28	70,0	12	30,0	1.47	1.004-2.163	0.04
Use of controlled medication	Yes	11	91,7	1	8,30	1.48	1.175-1.852	0.042
	No	64	62,1	39	37,9	1		
Live alone	Yes	19	76,0	6	24,0	1.22	0.929-1.605	0.201
	No	56	62,2	34	37,8	1		
Marital Status	With relationship	36	64,3	20	35,7	1		
	No relationship	39	66,1	20	33,9	1.02	0.787-1.343	0.838
Physical Activity	Yes	29	59,2	20	40,8	1		
	No	46	69,7	20	30,3	1.17	0.888-1.561	0.242
Drink Alcohol	Yes	22	68,8	10	31,2	1.07	0.810-1.431	0.621
	No	53	63,9	30	36,1	1		0.846
Chronic Tobacco Use	Yes	2	100,0	0	0,0	1.54	1.350-1.774	
	No	73	64,6	40	35,4	1		
Children	Yes	32	66,7	16	33,3	1.03	0.794-1.358	0.782
	No	43	64,2	24	35,8	1		
Monthly Income in Reais	Up to 5 000	25	65,8	13	34,2	0.94	0.701-1.275	0.712
	5 – 7 000	18	58,1	13	41,9	0.83	0.585-1.190	0.301
	> 7 000	32	69,6	14	30,4	1		
Gender	Female	57	71,2	17	21,2	1.75	1.215-2.534	<0.001
	Male	18	51,4	23	37,1	1		
Sociodemographic characteristics		With exhaustion		No exhaustion		PR	CI	P
		n	%	n	%			

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	No	73	64,6	40	35,4	1		
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	5 – 7 000	18	58,1	13	41,9	0.83	0.585-1.190	0.301
	> 7 000	32	69,6	14	30,4	1		
Gender	Female	57	71,2	17	21,2	1.75	1.215-2.534	<0.001

Table 1: Exhaustion according to sociodemographic variables of ICU workers, Bahia, Brazil, 2020.

Table 2 presents the analysis of exhaustion based on factors related to the work of ICU professionals. The use of ICU protection resulted in a 38% reduction in exhaustion (PR=0.62; p<0.001), while working shifts lasting more than 12 hours led to a 48% reduction in exhaustion (PR=0.52; p<0.001) among ICU workers. Additionally, feeling unsafe during work contributed to a 49% reduction in exhaustion (PR=0.51; p=0.033) among professionals. On the other hand, not resting after work and having more than one job increased exhaustion by 44% (PR=1.44; p=0.04) and 61% (PR=1.61; p=0.009), respectively.

Work-related aspects		With exhaustion		No exhaustion		PR	CI	P
		n	%	n	%			
Decisions Services	Yes	70	64,8	38	35,2	0.91	0.556-1.479	>0.999
	No	5	71,4	2	28,6	1		
ICU Protection	Yes	24	92,3	2	7,7	1		
	No	51	57,3	38	42,7	0.62	0.502-0.766	<0.001
Professional Relationship	Yes	72	64,3	40	35,7	1		
	No	3	100,0	0	0,0	1.56	1.355-1.786	0.547
Conflicts at work	Yes	40	74,1	14	25,9	1.29	0.987-1.687	0.06
	No	35	57,4	26	42,6	1		

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Professional Vacations	Yes	40	59,7	27	40,3	1		
	No	35	72,9	13	27,1	1.22	0.940-1.586	0.142
Training Time	<5 years	17	56,7	13	43,3	0.86	0.600-1.245	0.416
	5 to 10 years	20	74,1	7	25,9	1.13	0.845-1.512	0.43
	>10 years	38	65,5	20	34,5	1		
Dead Patient COVID	Yes	68	66,0	35	34,0	1.13	0.687-1.862	0.815
	No	7	58,3	5	41,7	1		
Already been infected with COVID	Yes	30	73,2	11	26,8	1.2	0.927-1.561	0.182
	No	45	60,8	29	39,2	1		
Use of some PPE	Yes	30	56,6	23	43,4	1		
	No	45	72,6	17	27,4	1.28	0.968-1.698	0.072
After-service rest	Yes	22	51,2	21	48,8	1		
	No	53	73,6	19	26,4	1.44	1.042-1.987	0.014
Empowered for Pandemic Care	Yes	65	63,1	38	36,9	1		
	No	10	83,3	2	16,7	1.32	0.985-1.770	0.281
Appropriate Duration of the Shift	4 -6 hours	32	80,0	8	20,0	1		
	Up to 8 h	24	80,0	6	20,0	1	0.789-1.267	>0.999
	Up to 12 h	19	42,2	26	57,8	0.52	0.362-0.768	<0.001
Feel safe at same team	Yes	70	69,3	31	30,7	1		
	No	5	35,7	9	64,3	0.51	0.252-1.053	0.033
More than one job	Yes	63	71,6	25	28,4	1.61	1.026-2.505	0.009
	No	12	44,4	15	55,6	1		
Patients on duty	3 to 8 patients	17	58,6	12	41,4	1		
	9 to 12 patients	52	69,3	23	30,7	1.18	0.841-1.663	0.301
	More than 13 patients	6	54,5	5	45,5	0.93	0.500-1.730	>0.999
Work time	Up to 6 years	46	68,7	21	31,3	1		
	More than 6 years	29	60,4	19	37,6	1.13	0.858-1.504	0.36
ICU Shift Hours	Up to 47hours	35	56,5	27	43,5	1		
	48 hours or more	40	75,5	13	24,5	1.33	1.024-1.746	0.032
Stress moments	Admission	16	72,7	6	27,3	1		
	Intubation	41	62,1	25	37,9	0.85	0.626-1.174	0.367
	Pronation	18	66,7	9	33,3	0.91	0.633-1.327	0.647

Table 2: Exhaustion according to the aspects related to work in the ICU, Bahia, Brazil, 2020.

The collinearity evaluation parameters, Tolerance index (>0.2), and VIF (<10), showed that the data fulfill the prerequisites for regression with the absence of multicollinearity. In logistic regression (Table 3), “ICU protection” (OR: 7.8) and “Appropriate Duration of the Shift” (OR: 0.5) were directly and inversely associated with exhaustion. The Hosmer & Lemeshow test (the goodness of fit) suggested the adequacy of the model (p = 0.58). Omnibus Tests (Chi-square = 36.372, df = 8, p < 0.000) showed the improvement of the equation with the model, and Nagelkerke’s R² suggests that the model explains 37% of the variance in exhaustion.

Variable	Exp(B)	EXP(B)		Sig.
		95% CI		
		Lower	Upper	
Gender	1948	0,691	5488	0,207
Profession	0,763	0,400	1455	0,412
Use of controlled medication	6868	0,641	73586	0,111
ICU Protection	7806	1606	37933	0,011
After-service rest	0,403	0,145	1117	0,081
Appropriate Duration of the Shift	0,550	0,311	0,974	0,040
Feel safe at same team	2424	0,564	10415	0,234
More than one job	1251	0,378	4135	0,714
Constant	1163			0,878

Table 3: Logistic regression equation coefficients having Exhaustion as dependent variable among 115 ICU workers, Bahia, Brazil, 2020.

Table 3 explains that exhaustion was the dependent variable, and according to the method, the variables with significant values in the bivariate analysis of Tables 1 and 2 were included in the analysis model, as described in the method below.

In the bivariate analysis for exhaustion, sociodemographic and work-related variables with p-values < 0.20 were included in a binary logistic regression model. The parameters used to assess the quality of the logistic regression included the Hosmer & Lemeshow tests (for goodness of fit) to determine the adequacy of the model (p > 0.5), Omnibus Tests (p < 0.05) to assess the improvement of the model’s fit with the data, and Nagelkerke’s R².

The network analysis revealed stronger and inversely proportional relationships with the phenomenon of exhaustion, including feeling suffocated with responsibilities (-27.87), difficulties relaxing (-24.52), and irritability with the service (-24). There was a positive association between exhaustion and job satisfaction (24.92) (Figure 1). Detailed associations are described in Table 4.

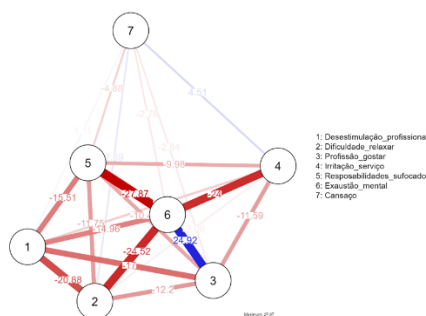


Figure 1: Network analyses.

Variable	Network						
	Professional discouragement	Hard to relax	Profession Like	Service Irritation	Responsibilities suffocated	Mental exhaustion	Tiredness
Professional discouragement	0	-20.877	-16.996	-5.599	-15.51	-14.963	1.115
Hard to relax	-20.877	0	-12.203	-2.062	-11.746	-24.52	2.888
Profession Like	-16.996	-12.203	0	-11.586	-10.493	24.92	-2.637
Service Irritation	-5.599	-2.062	-11.586	0	-9.981	-23.995	4.508
Responsibilities suffocated	-15.51	-11.746	-10.493	-9.981	0	-27.869	-4.884
Mental exhaustion	-14.963	-24.52	24.92	-23.995	-27.869	0	-2.782
Tiredness	1.115	2.888	-2.637	4.508	-4.884	-2.782	0

Table 4: Network analysis / weight matrix.

As showed in Table 4 there is a positive association between exhaustion and job satisfaction with a weight matrix value of 24.92. It was hard for health care workers to relax during covid-19 pandemic. The analysis also indicates that even nursing with a lower shift load than physiotherapy, it is the most affected by the multitude of procedures performed in the ICU.

Exhaustion was remarkable not only in admission but also in intubation, and pronation procedures, which involved dealing with families and performing complex procedures requiring different team competencies. These variables may be better measured in the future, with a methodology for acquiring and validating competences, in reducing the teams' stress levels [23].

Discussion

COVID-19 is a disease that triggers a cytokine storm, leading to inflammation, fibrosis, and cell death [13,14]. These factors directly affect the morphology and functionality of various organs in the human body, including the brain, heart, and others [15-18]. In this context, ICU workers live in constant fear and insecurity, resulting in elevated levels of emotional stress, anxiety, and depression [19]. As shown in this study, occupational stress among medical workers in the post-COVID period it is a very common [20]. The impact of stress on healthcare practice has been emphasized in the description of Burnout syndrome [21] since its initial report by psychologist Freudenberg in 1974. It is characterized as a chronic and inadequate response to work, caused by stress factors, and affects professionals at various levels of healthcare service delivery. The Maslach Burnout Inventory (MBI) is the most widely used instrument to assess and systematize the approach to this syndrome in related research [22].

Surprisingly, we found in logistic regression, ICU protection (OR: 7.8) and shift duration (OR: 0.5) were found to be directly and inversely associated with exhaustion. There is a significant consensus regarding the perception of moderate stress among physicians, physiotherapists, and nurses who do not engage in regular physical activity [23]. The relationship between a lack of physical conditioning and increased exhaustion may be a key area for future research. Exhaustion, characterized by a combination of mental and physical fatigue, is an important risk factor and may be recognized as a concern in the ICU workplace [24]. It can have adverse effects on the overall well-being of ICU staff, and professionals often express concerns about their physical fitness and accumulated occupational stress, which has been observed in other studies [25].

The ergonomic aspects presented in Table 1 were identified based on the self-perception of fatigue among ICU workers. Furthermore, there is a clear correlation between an unhealthy lifestyle and a decrease in physical and mental capabilities for job tasks [25,36]. Lifestyle and healthy habits, including regular physical exercise, are crucial factors in reducing fatigue and enhancing occupational quality among ICUs workers [23].

Regarding the relationship between profession and mental overload in the ICU, nurses appear to experience the highest levels of mental strain, followed by physicians and physiotherapists ref. The findings from the network analysis (Table 4) and (Figure-1) indicate a positive association between exhaustion and job satisfaction. Additionally, the analysis suggests that despite nursing having fewer shift hours than physiotherapy, it is more affected by the multitude of procedures performed in the ICU.

Exhaustion is particularly noticeable not only during patient admission but also during intubation and pronation procedures, which involve interactions with families and the execution of complex procedures requiring various team competencies. These variables may benefit from better measurement methods in the future, along with the development of methodologies for assessing and validating competencies to reduce stress levels among healthcare teams [26].

We conducted measurements of exhaustion and identified stressor factors associated with ICU work. However, it's important to note that the scales and "cutoff points" for diagnosing burnout syndrome still lack robust scientific evidence. Their application is primarily based on clinical observations and exploratory studies [24]. The literature shows variations in results related to stressor measurements, mainly due to the heterogeneity of psychometric properties within different samples [27,28]. The adaptation of inventories or questionnaires for a more consistent description of burnout syndrome remains an ongoing area of specialized research and publication.

Conclusion

Among the professionals evaluated in ICU environments, nurses were the most heavily impacted during the Covid-19 pandemic. Future studies in this area should delve deeper into exploring the relationship between fatigue, exhaustion, and levels of physical fitness. Among the various psychological aspects linked to exhaustion in ICU workers, tiredness was over seven times more prevalent than in those without exhaustion. Logistic regression analysis revealed that having access to ICU protection and working fewer hours on duty were associated with lower levels of exhaustion. Interestingly, higher levels of exhaustion were correlated with increased job satisfaction. In conclusion, this study suggests a need for a more comprehensive analysis of the attributes identified in the healthcare context, with a focus on examining the strength of correlations among variables, especially in the context of professional practice during the evolution of a pandemic.

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References

- Holshue ML, DeBolt C, Lindquist S, Lofy KH, Wiesman J, et al. (2020) First Case of 2019 Novel Coronavirus in the United States. *N Engl J Med* [Internet]. 382: 929-936.
- Pohl MO, Busnadiego I, Kufner V, Glas I, Karakus U, et al. (2021) SARS-CoV-2 variants reveal features critical for replication in primary human cells. *PLoS Biol* [Internet]. 19: e3001006.
- Tsai J, Wilson M (2020) COVID-19: a potential public health problem for homeless populations. *Lancet Public Heal* [Internet]. 5: e186-7.
- Paakkari L, Okan O (2020) COVID-19: health literacy is an underestimated problem. *Lancet Public Heal* [Internet]. 5: e249-e250.
- Danet Danet A (2021) Psychological impact of COVID-19 pandemic in Western frontline healthcare professionals. A systematic review. *Med Clin (English ed)* [Internet]. 156: 449-458.
- (2021) Vulnerabilidade e Déficit de Profissionais de Saúde no Enfrentamento da COVID-19 – IEPS [Internet].
- Padma TV (2021) COVID vaccines to reach poorest countries in 2023 - despite recent pledges. *Nature*. 595: 342-343.
- Wouters OJ, Shadlen KC, Salcher-Konrad M, Pollard AJ, Larson HJ, et al. (2021) Challenges in ensuring global access to COVID-19 vaccines: production, affordability, allocation, and deployment. *Lancet (London, England)* [Internet]. 397: 1023-1034.
- Lazarus JV, Ratzan SC, Palayew A, Gostin LO, Larson HJ, et al. (2020) A global survey of potential acceptance of a COVID-19 vaccine. *Nat Med* 2020 272 [Internet]. 27: 225-228.
- Xiao WS (2021) The Role of Collectivism–Individualism in Attitudes Toward Compliance and Psychological Responses During the COVID-19 Pandemic. *Front Psychol* [Internet]. 12: 600826.
- Ragab D, Salah Eldin H, Taeimah M, Khattab R, Salem R (2020) The COVID-19 Cytokine Storm; What We Know So Far. *Front Immunol*. 11: 1446.
- Merad M, Martin JC (2020) Author Correction: Pathological inflammation in patients with COVID-19: a key role for monocytes and macrophages. *Nature Reviews Immunology*. 20: 355-362.
- Garcia-Revilla J, Deierborg T, Venero JL, Boza-Serrano A (2020) Hyperinflammation and Fibrosis in Severe COVID-19 Patients: Galectin-3, a Target Molecule to Consider. *Front Immunol* 11:2069.
- da Silva KN, Gobatto ALN, Costa-Ferro ZSM, Cavalcante BRR, Caria ACI, et al. (2021) Is there a place for mesenchymal stromal cell-based therapies in the therapeutic armamentarium against COVID-19? *Stem Cell Res Ther* 12:425.
- De Sousa RAL, Improta-Caria AC, Aras-Júnior R, de Oliveira EM, Soci ÚPR, et al. (2021) Physical exercise effects on the brain during COVID-19 pandemic: links between mental and cardiovascular health [Internet]. *Neurological Sciences*. 42: 1325-1334.
- Júnior RA, Durães A, Roever L, Macedo C, Aras MG, et al. (2021) The impact of COVID-19 on the cardiovascular system. *Rev Assoc Med Bras* 67:163-167.
- Villapol S (2020) Gastrointestinal symptoms associated with COVID-19: impact on the gut microbiome. *Transl Res* [Internet]. 226: 57-69.
- Legrand M, Bell S, Forni L, Joannidis M, Koyner JL, et al. (2021) Pathophysiology of COVID-19-associated acute kidney injury. *Nat Rev Nephrol* 2021 1711 [Internet]. 17: 751-764.
- Peng X, Meng X, Li L, Hu C, Liu W, et al. (2021) Depressive and Anxiety Symptoms of Healthcare Workers in Intensive Care Unit Under the COVID-19 Epidemic: An Online Cross-Sectional Study in China. *Front Public Heal*. 9: 603273.
- Bonkalo TI, Polyakova OB (2023) Specifics of professional stress of medical workers in the post-COVID period. *Probl Sotsialnoi Gig Zdravookhraneniia Istor Med* 31:1197-1201.

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21. Freudenberger HJ (1974) Staff Burn-Out. *J Soc Issues* [Internet]. 30: 159-165.
22. Obregon M, Luo J, Shelton J, Blevins T, MacDowell M (2020) Assessment of burnout in medical students using the Maslach Burnout Inventory-Student Survey: a cross-sectional data analysis. *BMC Med Educ* 20: 376.
23. Arsenkova OY, Aksenova EI, Vorobeva AV (2023) Characteristics of the value-based attitude of medical workers to healthy lifestyle. *Probl Sotsialnoi Gig Zdravookhranennii Istor Med* 31:1092-1096.
24. Musker M, Othman S (2024) Effective interventions to reduce burnout in nurses: A meta-analysis. *Complement Ther Clin Pract* 54:101827.
25. Pinho CS, Cleber A, Caria I, Aras Júnior R, Gondim Pitanga FJ, et al. (2020) The effects of the COVID-19 pandemic on levels of physical fitness. *Rev Assoc Med Bras* [Internet]. 66: 34-37.
26. Ruotsalainen J, Serra C, Marine A, Verbeek J (2008) Systematic review of interventions for reducing occupational stress in health care workers. *Scand J Work Environ Health* [Internet] 34:169-178.
27. Perniciotti P, Serrano Júnior CV, Guarita RV, Morales RJ, Romano BW (2020) Síndrome de Burnout nos profissionais de saúde: atualização sobre definições, fatores de risco e estratégias de prevenção. *Rev da SBPH* [Internet]. 23: 35-52.
28. Montero-Marín J, García-Campayo J (2010) A newer and broader definition of burnout: Validation of the "burnout clinical subtype questionnaire (BCSQ-36)." *BMC Public Health* [Internet]. 10: 1-9.