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Original Article

Depression as a predictor of sleep quality in health workers who faced the COVID-19 pandemic in Mexico

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ABSTRACT

Introduction: There is a relationship between depression and sleep quality; however, the impact of the COVID-19 pandemic on this association is unknown, especially for those health workers who faced the pandemic. Therefore, we aimed to identify the association between depression and sleep quality in health workers who faced the COVID-19 pandemic.

Methods: A survey was performed on 150 health workers with at least 2 years of working tenure in a public maternal perinatal hospital in Mexico, between September and December 2021. Sociodemographic data, levels of sleep quality, depression, anxiety, and gastrointestinal function were obtained through a self-administered questionnaire. Cardiovascular risk was obtained according to age, lifestyle habits, blood pressure, anthropometry, body composition and biochemical measurements.

Results: Those with depression were 10.3 times more likely to have poor sleep quality compared to those without depression, adjusted for gastrointestinal function (95% CI 2.92 – 36.54, p<0.001). Those with depression were 7.23 times more likely to have poor sleep quality compared to those without depression, adjusted for gastrointestinal function, anxiety, and cardiovascular risk (95% CI 1.85-28.14, p<0.001).

Conclusion: Health workers' depression should be considered a predictor of poor sleep quality, especially in those who faced the COVID-19 pandemic.

Keywords: COVID-19 pandemic; Depression; Health Workers; Sleep Quality

Introduction

The prevalence of depression worldwide ranges from 2 to 6%, which can vary depending on the type of instrument used for its diagnosis.[1] The World Health Organization (WHO) and the Global Burden of Disease, reported a prevalence of depression between 3 to 4%.[1,2] However, this increased 7 times more than previously reported during the COVID-19 pandemic.[3]

This prevalence has been particularly high in health workers; for example, in Latin America, it was observed that 14.7 to 22% presented depressive symptoms and 5 to 15% had suicidal thoughts.[4] Thus, the pandemic evidenced a mental health crisis in health personnel, mainly those responsible for caring for patients with COVID-19.[5–7] Furthermore, the workers' mental health

deterioration also had consequences such as poor quality of care, disability, low productivity, deterioration of work performance, absenteeism and even suicide. Therefore, if the mental health of workers is affected by symptoms such as depression, the healthcare of the population will also be affected.[6]

In Mexico, the mental health of workers was also affected during the pandemic, as depression (45.7%) and anxiety (74.7%) have been recorded at higher levels compared to the general population, as a result of continuous exposure to medical care and mourning of loved ones due to COVID-19.[8]

The effects of COVID-19 on health workers not only include consequences such as depression but also sleep problems during the pandemic since workers had to adapt to new work protocols characterized by a higher-than-usual work intensity.[9] Although poor sleep quality can be the consequence of various sleep disorders, such as insomnia, apnea, etc., it can also be related to symptoms of depression and anxiety.[10] In addition, since sleep is necessary for the homeostasis of the immune system, the decrease in sleep quality of health personnel can negatively alter their emotional and physiological state, allowing in turn the activation of inflammatory processes, the release of cytokines and increased susceptibility to depressive disorders.[11] Although previous studies in health workers have reported depressive symptoms, the results being 36.3% for depressive symptoms and 16% for major depression,[12] the impact of the pandemic on the prevalence of sleep disturbances in health workers due to COVID-19 has not yet been reported.[13]

Despite the relationship between sleep and mental health, other factors can modify this relationship, such as anxiety, gastrointestinal function, and cardiovascular risk. In the case of anxiety, this can generate symptoms of gastrointestinal disorders,[12,14] which in turn produce daytime symptoms, exacerbating insomnia and thereby affecting people's sleep quality.[15] In addition, the presence of intestinal diseases occurs more frequently in people with high rates of anxiety and depression, so individuals who were in confinement during the pandemic, including health personnel, could exacerbate said symptoms.[16]

In the case of cardiovascular risk, depression and anxiety are associated with cardiovascular diseases (CVD),[17] since patients with high rates of psychological disorders, such as stress, sadness, insomnia and confusion, present higher morbidity and mortality rates from CVD. In addition, anxiety disorders are associated with metabolic disturbances, related to the pathogenesis of heart disease.[18] Furthermore, depression and/or anxiety are risk factors in the development of heart failure and heart attack,[17,19] because these types of patients present risk behaviors such as smoking and sedentary lifestyles, which in turn increase the risk of CVD.[20] Furthermore, anxiety levels in patients with CVD represent a higher risk of morbidity and mortality, as physiological changes, associated with psychological distress during the pandemic, may predispose patients to or worsen CVD, including increased oxidative stress, catecholamines, cortisol levels, platelet aggregation, inflammatory cells, endothelial dysfunction, and sympathetic nervous system stimulation.[21] Finally, regarding sleep, poor quality sleep is also related to increased cardiovascular risk, specifically increased risk of developing subclinical atherosclerosis, arterial hypertension and CVD.[21,22]

Thus, it is relevant to identify whether there were alterations in the quality of sleep among health personnel who have faced the pandemic, and to what extent they could be related to mental health. Therefore, the objective of this study was to identify the association between depression and sleep quality in health workers who faced the COVID-19 pandemic. It was considered as a hypothesis that depression is a risk factor for poor quality sleep, which was exacerbated during the COVID-19 pandemic.

Methods

This cross-sectional study was performed between September and December 2021 at the "Hospital Materno Perinatal Mónica Pretelini" in Toluca, Mexico; this facility belongs to the public

assistance service for the uninsured population. The study was approved by the Institutional Ethics Review Board (Ethics Number: 2021-08-768).

Considering a universe of 436 workers in the morning shift, a sample size calculation of 135 participants was obtained (alpha = 0.025, Z alpha = 1.96, and 95% confidence level). The use of a prevalence rate of depression was not considered in our study because we did not find reliable reports of a similar situation among healthcare workers in Mexico. Compensating for possible losses, a total of 152 health workers were included (health professionals, administrative, security, cleaning, and kitchen staff), indifferent of gender, over 18 years old who gave their voluntary consent, and with at least 2 years working tenure. According to exclusion criteria, the final sample for statistical analysis was 150 participants for the principal variables and 137 for the cardiovascular risk score. Based on the exclusion criteria, the sample size for statistical analysis comprised 150 participants. However, to obtain the cardiovascular risk score, we analyzed a sample of 137 participants.

Sociodemographic data, levels of sleep quality, depression, anxiety, and gastrointestinal function were obtained through a self-administered Google Forms questionnaire; blood pressure, anthropometric, body composition and biochemical measurements were made by trained personnel using standardized procedures. Google Forms were used as a digital support tool to automatize the information. Moreover, due to the pandemic, we wanted to avoid face-to-face between the interviewee and the interviewer.

Blood pressure (BP) was measured with an automatic arm digital blood pressure monitor (OMRON®, Hoofddorp, The Netherlands) following the recommendations of the Official Mexican Standard NOM-030-SSA.[23] Weight and height were obtained from a scale with a wall-mounted mechanical stadiometer (SECA®, Hamburg, Germany) and waist and hip circumferences were measured with a metal tape for anthropometric use (Lufkin®; México). Furthermore, body fat percentage was analyzed by electrical bioimpedance using a Biody XpertZM® apparatus (Aminogram SAS, La Ciotat, France) and data was stored in the Biody Manager® software (Aminogram SAS, La Ciotat, France). Blood samples were obtained by chemical laboratory staff from the hospital and the biochemical analysis to measure glucose, total cholesterol (TC) and triacylglycerols (TG) was performed in the Biochemistry Laboratory of the "Universidad de la Salud del Estado de México", with the clinical chemistry analyzer: Spinlab® (Spinreact, Girona, Spain) and the kits: Glucose-LQ®, Cholesterol-LQ® and Triglycerides-LQ® (Spinreact, Girona, Spain).

Sleep quality (SQ) was assessed by the Pittsburgh Sleep Quality Index (PSQI). The PSQI consists of seven components: subjective quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbance, sleep medication use, and daytime dysfunction. The scores for each component have a range from 0 to 3 points, and the sum of the scores of all components indicates the total PSQI score, which ranges from 0 to 21. A global PSQI score >5 points indicates poor sleep quality (BSQ).[24]

Depression symptoms were assessed by the Beck Depression Inventory (BDI-II). The BDI-II comprises 21 Likert-type items about the frequency of symptoms of depression over the last two weeks, the response options were rated in four ordered response categories coded from 0 to 3. The total BDI-II scores range from 0 to 63 points, four groups were established based on the total score (Minimum depression: 0-13; mild depression: 14-19; moderate depression: 20-28; and severe depression: 29-63). This test has internal consistency (Alpha 0.91).[25] The results of depression level were encoded on a dichotomous scale for statistical analysis (depression symptoms: no/yes).[26]

Anxiety level was measured by the Beck Anxiety Inventory (BAI), which asked to rate the frequency of anxiety symptoms over the last week, including the day the questionnaire was answered. The BAI comprises 21 Likert-type items and the response

options were rated in four ordered categories that were coded from 0 to 3. The scores range from 0 to 63 and the interpretation of the sum is based on levels of anxious symptomatology (Minimum anxiety: 0-17; mild anxiety: 8-15; moderate anxiety: 16-25; and severe depression: 26-63). BAI has internal consistency in the Mexican population (Alpha 0.83).[27] The anxiety level results were encoded on a dichotomous scale for statistical analysis (anxiety symptoms: no/yes).[28]

Gastrointestinal Function (GIF) was assessed by the gastrointestinal function assessment scale. The GIF scale consists of nine categories: bloating, GI sounds, abdominal pain, flatulence, rectal discomfort, painful bowel movements; and frequency, consistency, and urgency of bowel movements. The scores for each category range from 0 to 3 points, and the total scores of all components range from 0 to ≥ 21. The interpretation of the sum is based on levels of GI function (Normal function: 0-5; mild dysfunction: 6-11; moderate dysfunction: 12-20; and severe dysfunction: ≥ 21). The results of the level of GI function were encoded on a dichotomous scale for statistical analysis (0 = normal function, 1 = GI dysfunction).[29]

The cardiovascular risk score was classified by using ten components, with the corresponding cut-off points for each one. The components were: Age risk: ≥65 years for women/ ≥55 for men;30 Smoking habit risk: no/yes; Physical activity risk: no/yes;[30] Blood pressure: normal/ high (≥130/≥80 mm/Hg);[30] Waist and hip ratio (WHR): normal/ high (women ≥0.84/ men ≥0.90);[31] Body mass index (BMI): normal/high (≥25 kg/m2);[32] Body fat percentage: normal/ high (women ≥28% / men ≥20%);[33] Glucose: normal/high (≥100 mg/dL);[34] Total Cholesterol (TC): normal/high (≥200 mg/dL) and Triacylglycerols (TGC): normal/high (≥150 mg/dL).[35] The score range was 0 to 10 and the results were recorded on a dichotomous scale for statistics analysis (0 = low cardiovascular risk score; 0-2 points and 1 = high cardiovascular risk score; ≥ 3 points).[36]

Data normality was identified by histograms, normal curves, and descriptive measures. For their description, mean and standard deviation were used for continuous variables, and proportions and percentages for categorical variables. For comparisons between participants with and without depression and sleep quality, a chi-square test for categorical variables and a t-test for continuous variables were used.

To estimate the cross-sectional associations between the exposure (depression) and outcome (sleep quality) variables were assessed with multivariable-adjusted logistic regression models. The inclusion of covariates was based on whether they were statistically significant in the bivariate analysis. Covariates that met this criterion were placed in the model simultaneously, and a backward stepwise regression was done to determine the final model.

ORs and 95% CI were obtained. All associations were assessed using two models. Model 1 was adjusted for gastrointestinal function. Model 2 was further adjusted for anxiety and cardiovascular risk score. The goodness of fitness tests was used in both models. All tests were performed with STATA, version 13 (Stata-Corp, College Station, TX, USA). $p < 0.05$ was considered statistically significant.

Results

A total of 190 active-duty personnel were invited to participate in the study, of which, 150 agreed to participate and therefore were analyzed, 137 of these agreed to undergo biomarker measurements to obtain the cardiovascular risk. Descriptive characteristics of the sample and bivariate analysis are shown in Table 1. The group of poor SQ had the highest frequency of anxiety (29.4%) and depression (18.7%), also, this group presented more GI dysfunction (28.6%) compared to the good SQ group. There was a statistically significant difference between employment categories, level of depression, anxiety and GIF between both groups of sleep quality ($p < 0.05$). According to the cardiovascular risk score, no significant differences were found, however, 81% of health workers have a high cardiovascular risk

Table 1: Characteristics of participants according to Sleep Quality Index (n = 150)

	Good Sleep Quality (n = 72)	Poor Sleep Quality (n = 78)	
Variable	mean (SD)	mean (SD)	*p-v*alue
Age (years)	44.12 (12.24)	41.64 (13.34)	0.239
Sex			
Female	55 (36.7)	67 (44.7)	0.148
Male	17 (11.3)	11 (7.3)	
Marital status			
Single	28 (18.7)	33 (22.0)	0.74
Married	44 (29.3)	45 (30.0)	
Depression			
No	69 (46.0)	50 (33.3)	<0.001*+
Yes	3 (2.0)	28 (18.7)	
Anxiety			
No	51 (34.0)	34 (22.7)	<0.001*
Yes	21 (14.0)	44 (29.4)	
Gastrointestinal Function			
Normal	53 (35.3)	35 (23.3)	0.001*
Dysfunction	19 (12.7)	43 (28.6)	
Cardiovascular risk score (*n* = 137)			
Low	10 (7.3)	16 (11.7)	0.393
High	57 (41.6)	54 (39.4)	

Data: *n* (%), $p < 0.05$ * $X2$ test or + Fisher´s exact test. SQ: Sleep quality

In Table 2, descriptive characteristics of the cardiovascular risk score are observed. Although we did not find statistically significant differences between those with good and poor SQ and cardiovascular risk, some alterations were observed in anthropometric, body composition and biochemical parameters. Health workers who were classified as having poor SQ presented alterations in WHR (40.1%), BMI (35%) and BFP (43.1%), as well as high glucose concentrations (10.2%), TC (19.0%) and TGC (18.2%).

Table 3 shows the results of bivariate analysis and multivariable logistic regression models. In the bivariate analysis, those with depression were 12.88 times more likely to have poor sleep quality compared with those without depression. According to model 1, those with depression were 10.3 times more likely to have poor sleep quality compared with those without depression, adjusted for gastrointestinal function (all variables were statistically significant). In model 2, those with depression were 7.23 times more likely to have poor sleep quality compared with those without depression, adjusted for gastrointestinal function, anxiety, and cardiovascular risk (only gastrointestinal function remained statistically significant). When performing a test of goodness in model 1, a combined sensitivity and specificity of 70% was obtained; however, for model 2, it was less than 70%.

Table 2: Cardiovascular risk parameters by Sleep Quality Index (n = 137)

	Good Sleep Quality (n = 72)	Poor Sleep Quality (n = 78)	
Risk variable	n(%)	n(%)	*p-v*alue
Age			
No	63 (46.0)	67 (48.9)	0.714 +
Yes	4 (2.9)	3 (2.2)	
Smoking habit			
No	46 (33.6)	44 (32.1)	0.475
Yes	21 (15.3)	26 (19.0)	
Physical activity			
No	39 (28.5)	40 (29.2)	0.900
Yes	28 (20.4)	30 (21.9)	
Blood pressure			
Normal	36 (26.3)	44 (32.1)	0.279
High	31 (22.6)	26 (19.0)	
Waist-hip ratio			
Normal	12 (8.8)	19 (13.9)	0.197
High	55 (40.1)	51 (37.2)	
Body mass index			
Normal	19 (13.9)	27 (19.7)	0.206
High	48 (35.0)	43 (31.4)	
Body fat percentage			
Normal	8 (5.8)	16 (11.7)	0.093
High	59 (43.1)	54 (39.4)	
Glucose			
Normal	53 (38.7)	56 (40.9)	0.897
High	14 (10.2)	14 (10.2)	
Total cholesterol			
Normal	41 (29.9)	45 (32.8)	0.708
High	26 (19.0)	25 (18.2)	
Triacylglycerols			
Normal	42 (30.7)	53 (38.7)	0.098
High	25 (18.2)	17 (12.4)	

Data: *n* (%), $p < 0.05$ * $X2$ test or + Fisher´s exact test

Table 3: Bivariate and Multivariable logistic regression models for sleep quality and depression

		Bivariate model		Multivariate model 1		Multivariate model 2	
Exposure	n	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95%CI)	p-value
Depression							
No	119	ref.		ref.		ref.	
Yes	31	12.88 (3.71, 44.73)	<0.001	10.3 (2.92, 36.54)	<0.001	7.23 (1.85, 28.14)	<0.001

CI, confidence interval. Good sleep quality (n=78; 52%) vs poor sleep quality (n=72; 48%)
Model 1 (n=150), adjusted for gastrointestinal function. Model 2 (n=137): model 1 + anxiety + cardiovascular risk score. p-value <0.05 was considered statistically significant.

Discussion

The relationship between depression and sleep quality has been previously studied, however, it has not been explored in healthcare workers, especially those who have faced the COVID-19 pandemic. Therefore, we evaluated the relationship between depression and sleep quality in healthcare workers who faced the pandemic.

The results of this study showed that healthcare workers who had depression were 10.3 times more likely to have poor sleep quality compared to those without depression, adjusted for gastrointestinal function, and 7.23 with additional adjustments for anxiety and cardiovascular risk. Our results agreed with those reported by Nanda Naik Bijaya et al., who carried out a cross-sectional study during the COVID-19 pandemic in an Indian tertiary healthcare institution and found that those health workers who had generalized anxiety disorder, were nearly 6 times more likely to have poor sleep quality, mainly because of the high risk of infection for themselves and their families.[37] However, the probability of having poor sleep quality was higher in our study, which could have been related to the high prevalence of anxiety and depression, which were also higher in our study population. Our results are also consistent with those of other studies[38–40] which report that sleep quality and anxiety levels are major concerns for healthcare professionals, as these issues can affect their performance and lead to poor patient outcomes. On the other hand, in a study carried out in Brazil, the quality of sleep in the population was evaluated during the COVID-19 outbreak, concluding that 70% of the adult sample had poor sleep quality, with higher sleep latency and little efficiency, due to the different factors that can modify the quality of sleep, among them: sleep habits of parents and their children during confinement, stress-work level, higher educational level. This could make it difficult to generalize these findings to populations with a lower educational level, considering that the COVID-19 pandemic could have a different impact on people of different socioeconomic levels.[41]

Even though the work of health workers is characterized by great psychological demands that lead to depressive states and emotional exhaustion,[6] the pandemic evidenced a mental health crisis in health personnel, the result of ethical dilemmas and exhausting workdays that affected mental health,[5–7] in addition to the stress and anxiety that health workers may have experienced for fear of infecting their family members or themselves.[37] In Mexico, the mental health of workers was also affected during the pandemic, significant symptoms related to mental well-being in healthcare workers included the presence of anxiety and insomnia, coupled with concerns about the health status of family members and/or people close to health workers, which could even double the risk of developing depression.[8]

Concerning other factors considered in the analysis of this study, such as gastrointestinal function, it should be considered that inflammatory bowel disease (IBD) is a chronic autoinflammatory condition that is more prevalent in people with high rates of anxiety and depression. In addition, gastrointestinal diseases could have been further exacerbated by confinement as a measure to contain the spread of the virus, with people with IBD being more susceptible to the negative impact on the mental health of the pandemic.[16] Regarding cardiovascular risk, anxiety and fear are psychological disorders that can coexist with heart failure and other cardiovascular diseases, and are even considered important risk factors for CVD.[42] Ferreira de Souza, et al., showed in their systematic review that the sleep quality of patients related to COVID-19 was poor, due to the pro-inflammatory component, a risk factor for developing cardiovascular, metabolic, and neurodegenerative diseases. People with psychological problems are prone to medical comorbidities, since recurrent episodes of insufficient sleep in the long term cause negative emotional repercussions for the organism.[22]

The strength of the study is that it was carried out in a Mexican population where physical health was evaluated, through blood biomarkers, and mental health was evaluated through questionnaires, among health workers in the post-confinement period during the COVID-19 pandemic. Within the limitations of the study, the study design implies that temporality is uncertain and it is not possible to determine causal inference, that is, because the quality of sleep of workers before the pandemic and their state of mental health are not known, the causal effect of sleep on depression cannot be established, or vice versa. Another limitation was the instruments applied, as they were not answered in person due to health security measures and the data was collected through an online survey, which can influence the response rate, specifically when obtaining the cardiovascular risk score. Given the limited scope of the sample size, it is essential to take caution when applying these findings to broader populations. The socio-demographics, geographic

location, and other unique attributes of the selected sample could introduce biases that may not be representative of other groups. Lastly, we evaluated participants' sleep characteristics using self-report questionnaires. Self-report measures are commonly employed to gather data on sleep habits.[9] However, reliance on self-report data may introduce memory bias,[13] where participants may inaccurately recall their sleep patterns, leading to potential underreporting or overreporting of sleep-related variables. The use of self-reported data in sleep research highlights the need for cautious interpretation of results.

Conclusion

This study provides additional evidence of the negative impact of the COVID-19 pandemic on the mental health of healthcare workers. Health Services must evaluate the mental health of their workers and provide the necessary resources and benefits to optimize their mental well-being. They must also detect sleep disorders among health professionals promptly to be better prepared for future challenges in the health area, such as the ones presented by the COVID-19 pandemic.

Conflicts of Interest

The authors declare no conflict of interest to report.

Disclosure statement

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

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