Sleep disorders in university students during COVID-19: United States of America, Mexico and El Salvador

Trastornos del sueño en universitarios durante el COVID-19: Estados Unidos, México y El Salvador

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Abstract

Objective: The purpose of this cross-sectional study was to measure students' sleep disorders 12 months after the start of the COVID-19 pandemic.

Materials and Methods: Data were collected from 693 students from three universities in El Salvador, Mexico, and the United States using the Student Health Behavior Inventory.

Results: Sleep disorders were identified in the sample with those in the US reporting higher levels of sleep disorders and those in El Salvador reported the least. Differences were also observed by gender with females reporting more sleep disorders one year into the pandemic than males.

Conclusions: The global pandemic related to COVID-19 has had a profound impact on the mental and physical wellbeing of students. Sudden changes in learning modalities, modifications to work schedules, and potential loss of loved ones have contributed to sleep disorders in this population group. Universities need to take steps to address the evolving needs of college students as they cope with this pandemic.

Keywords: Sleep; Coronavirus; Students; Cross-cultural comparison

Resumen

Objetivo: El propósito de este estudio transversal fue medir los trastornos de sueño de los estudiantes, 12 meses después del principio de la pandemia de COVID.

Materiales y Métodos: Se recolectaron datos de 693 estudiantes de tres universidades en El Salvador, México y los Estados Unidos, utilizando el Inventario de Conducta de Salud del Estudiante.

Resultados: Se identificaron síntomas de trastornos del sueño; los universitarios de EUA informaron niveles más altos de trastornos del sueño y los de El Salvador menos. También, se observaron diferencias por género, ya que las mujeres reportaron más trastornos del sueño un año después de la pandemia que los hombres.

Conclusiones: La pandemia relacionada con COVID-19 ha tenido un profundo impacto en el bienestar mental y físico de los estudiantes. Los cambios repentinos en las modalidades de aprendizaje, las modificaciones en los horarios de trabajo y la posible pérdida de seres queridos han contribuido a los trastornos del sueño en este grupo poblacional. Las universidades deben tomar medidas para abordar las necesidades cambiantes de los estudiantes universitarios a raíz de la pandemia.

Palabras Clave: Sueño; Coronavirus; Estudiantes; Comparación transcultural

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Introduction

Sleep is essential for the preservation of the health, wellbeing and quality of human life. During sleep, the physiological functions that allow mental and physical balance take place and it has been proposed that human beings cannot live without it; therefore the concept of sleep health has been proposed and investigated in recent years[1] with studies showing that during sleep, the rejuvenation of mental processes take place[2]; the immunological system is activated[3] and other vital functions necessary to keep an active life are completed. Sleep is controlled by the circadian rhythm which is responsible for regulating the sleep-wake cycle in periods of approximately 24 hours. At night, the secretion of melatonin -- a hormone that is involved in the sleep process – increases[4] and it leads to more restful sleep.

The National Sleep Foundation recommends seven to nine hours[5] of sleep for young adults 13-18 and eight or more for older people. There is, however, evidence that six hours of sleep may be enough[6]. Different studies have demonstrated a negative impact on a person's physical and mental health based on the number of sleeping hours[7,8,9,10]. Studies have shown that low quality sleep or lack of sleep affects the cardiovascular system[11,12,13] and increases stress levles[14]. Other studies have shown a negative correlation with eating disorders[15,16]. Other health issues related to poor sleep include depression, anxiety, and cognitive changes. It is essential to point out that persistent sleeping alterations represent risk factors in developing future mental illnesses and substance use disorders[17].

Regular sleep consists of two types of stages: Rapid Eye Movement (REM) sleep and Non-Rapid Eye Movement (NREM) sleep. High neuronal activity is produced during REM and dreams occur. During NREM, brain activity is reduced up to 50% and is divided into three phases. The first one, or light sleep, is the shortest. The second one takes place during more than 50% of sleeping time. Finally, the third one is called Slow-Wave Sleep or Delta Sleep, the deepest and most restoring sleep[6,11].

According to the Diagnostic and Statistical Manual of Mental Disorders V (DSM–V), sleep disorders are classified into ten disorders (Table 1). Sleep disorders are also described in the International Classification of Diseases 10 (ICD-10), specifically in the point G47 and the section F51, where the non-organic sleep disorders are mentioned[18].

Sleep disorders affect the academic performance of university students. Studies have shown that college students do not always exhibit the most appropriate sleep patterns. Since sleep influences human cognition, it is not surprising that students with inadequate sleep have low academic performance[19,20,21,22].

alterations in 67% of the sample[26]. Similarly, another study involving 3011 students in Colombia, during the third phase of the COVID-19 pandemic, found that 17% of study

Table 1. Sleeping disorders and their symptoms according to the Diagnostic and Statistical Manual of Mental Disorders (DSM–V)

Disorder	Symptoms
Insomnia	Difficulty initiating sleep, staying asleep, on other occasions waking up early in the morning with inability to fall asleep.
Hypersomnolence	Recurrent feeling of sleep need during the day, nonrestorative sleep, difficulty for staying full awake.
Narcolepsy	Recurrent episodes of irresistible sleeping or daytime napping occur.
Breathing-related sleep disorders	The three types are: a) Obstructive sleep apnea hypopnea, b) Central Sleep Apnea, and c) Sleep-Related Hypoventilation. For diagnosis evidence by polysomnography of apneas (a & b) or decreased respiration (c) is needed.
Circadian rhythm sleep-wake disorders	Interruptions during sleep due to alteration of circadian rhythm causing excessive sleepiness or insomnia and in other cases both.
Non-rapid eye movement (NREM) sleep arousal disorders	Sleepwalking or sleep terrors, with little recall of dreams.
Nightmare disorder	Well-remembered dreams usually involving danger or survival situations.
Rapid eye movement (REM) sleep behavior disorder	Sleep with episodes of vocalization or motor behaviors, usually during REM.
Restless legs syndrome	Urge to move the legs during inactivity, or at night before sleep.
Substance/ medication-induced sleep disorder	Significant and severe sleep disturbances related to substance or medication.

Source: Autors based on DSM-5 information

Therefore, the quality of sleep that students show requires attention[23].

Research during COVID-19 pandemic evidenced sleep disorders in university students. One research involving 637 university students from Oman showed the most common sleep disorders are narcolepsy (88%), Restless Legs Syndrome (41%), insomnia (36%), obstructive sleep apnea (22%)[24]. Another study among students in Lima, Peru, demonstrated the presence of insomnia in 37.2% and hypersomnia in 2.3% of the sample[14]. Another research study also conducted in Peru during SARS-COV-2 found that 46.75% of sample respondents reported insomnia[25]. A survey of 295 Colombian medical students in 2019 showed the presence of sleep

respondents reported moderate insomnia and an additional 2% reported severe insomnia. Thirty-six percent of study respondents reported depression and 32% reported anxiety[27].

In research study conducted early in the pandemic among 644 Mexican university students, it was found that 36.3% of the sample presented insomnia[28]. A study in El Salvador, found that approximately 50% of the sample respondents reported experiencing insomnia related to the pandemic which included difficulty falling sleep, night awakenings, final awakening earlier than desired, and somnolence during the day[29].

Materials and Methodology

The purpose of this study was to evaluate sleep disorders among a sample of college students in three different countries 12 months after the onset of COVID-19. The study population consisted of 693 university students in El Salvador (52.1%,) United States (20.2%), and Mexico (27.7%). The vast majority (75%) was female and 1% preferred not having their gender identified. The reported age range was between 17 and 60 years old, which a mean of 23.76 (SD = 5.99).

Data were collected using the Student Health Behavior Inventory which was based on scales designed to evaluate sleep disorders[30,31]. Researchers developed questions that included aspects necessary for the research project; specifically, responses indicated if these symptoms were derived from the COVID-19 pandemic. The preliminary version of this instrument was composed of nine items. However, two questions were removed after confirmatory factor analysis since they did not fit statistically to the evaluated variable. The final instruments consisted of seven questions, which evaluate sleep patterns during the previous seven days (e.g. During the pandemic, How many days a week have you had trouble falling asleep?). The scale response was the Likert 5-points scale, where 1 = Not any day at all, 2 = One or two days, 3 = Three days, 4 = Four or five days, and 5 = Six or seven days.

Institutional review boards at the participating institutions approved the study. Data were collected using the Qualtrics platform over an eight-week period (February and March 2021). All students provided informed consent by acknowledging the purpose of the study, electronically signing and informed consent form, and completing the instrument. Data analysis was performed in SPSS (v26) for reliability analysis and descriptive statistics. A confirmatory factor analysis took place using AMOS; taking into consideration the goodness-of-fit indicators recommended by Valdes[32]: Chi-square with associated probability (p <, 001), Root Mean Square Deviation (RMSD < .05), Goodness-of-Fit Indicators

(GFI > .90), Comparative Fit Index (CFI < .95) and Root Mean Square Error of Approximation (RMSEA <. 07).

Reliability was obtained through Cronbachs' alpha; subsequently, an index was calculated using the means of the seven reactive from the final scale. Later, an analysis of Variance (ANOVA) was performed to compare the means according to the country, and a *Student t-test* was performed to analyze statistical differences based on participants' gender. It is essential to highlight that only eight people decided not to specify their gender, so they were not considered in this analysis, but included in all others.

Results

The Confirmatory Factor Analysis (CFA) obtained acceptable goodness-of-fit indicators: $X2 = 28.29$ (df = 10; = p =. 002), RMSR = .029, GFI = .99, CFI = .99. RMSEA = .051 (90%; IC = .030 - .074). Factor weight oscillated between .30 and .82 (Figure 1). Reliability analysis revealed a Cronbach´s Alpha of .85 for the final version of seven items.

Figure 1. Confirmatory Factor Analysis model.
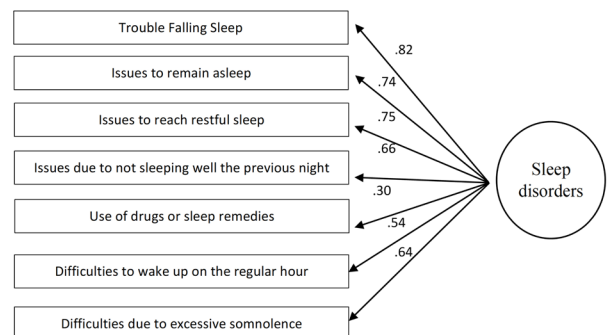
Source: Authors

An Analysis of Variance (ANOVA) was performed to determine differences between the three countries. Differences were found in the sleep disorders reported by students in El Salvador, United States, and Mexico [$F = 23.79$ (df = 2, 690), $p = .000$] as shown in Table 2. Further comparisons pointed out statistical differences among groups with probability values oscillating between .000 and .020.

Finally, a means comparison to explore sleep disorders by gender was conducted using a student t-test for independent samples. Findings suggest differences between men and women in all three countries (see Table 3). Women reported more frequency of sleep disorders during the pandemic [Mean = 2.39 (SD = .88), $t = 3.45$ (df = 682), $p = .001$].

Table 2. Descriptive statistics from sleep patterns by country and ANOVA results.

Country	N	Range	Mean	SD	ANOVA		
					F	df	p
El Salvador	361	1 to 5	2.13	0.87			
United States	140	1 to 5	2.69	0.81	23.79	Inter = 2 Intra = 690	.000
Mexico	192	1 to 5	2.44	0.85			

Source: Authors

Table 3. Descriptive statistics from sleep patterns by gender and student t-test results

Gender	N	Range	Average	SD	Student t-test		
					t	Df	p
Male	172	1 to 5	2.13	0.84	3.45	682	.001
Female	512	1 to 5	2.39	0.88			

Source: Authors

Discussion

The COVID-19 pandemic brought along multiple psychological affections worldwide[33]. Among university students, these effects included lifestyle adjustments including attending classes through technology, performing activities, studying extra time, and in some cases, working and studying simultaneously. Given the uncertainty related to COVID -19, university students are more likely to develop sleep disorders, specifically, in the American continent. The Confirmatory Factor Analysis indicates that the scale has an acceptable validity to evaluate sleep disorders due to the COVID-19 pandemic in university students. Also, it has an acceptable reliability index.

It is interesting that while sleep disorders were found in all three countries differences were present in a north-south direction with students in the US reporting higher levels of sleep disorders while students in El Salvador reported the lowest levels. Social isolation affected all countries, but the response seems to be of increased anxiety represented as sleeping disorders among North American students. These differences may be related to social support networks available to students in Mexico and in El Salvador which are not available to students in the United States. It has been suggested that the ravages of COVID-19 are presented differently in the countries, especially due to the different forms of action each society takes around this situation[34].

Gender differences were not totally unexpected. Latin American females reported higher levels of sleep disorders. Results suggest that female's mental health tends to be more affected, probably due to the responsibility of house chores being assigned to this gender[35], joining to the fact that the more time people are at home, these types of activities increase. It seems fair to conclude that female's responsibilities increased as a result of spending more time at home with other relatives while leaving less time to focus on their studies or other activities.

There are some limitations inherent in this study. The first is the self-reported nature of the data. Social desirability could be present in some responses from participants; however, in the obtained results, data support reliability and validity of the instrument. Another constraint is the cross-sectional nature of the study. There is no baseline data to compare the sleep disorders in students before and after one year of social isolation; however, despite the limitations, it is considered that the information provided by this research can be useful in providing resources to students who may be experiencing sleep disorders.

Conclusion

Research suggests social isolation related to COVID 19 has resulted in sleeping disorders among college students. In our study, statistical differences were found by gender and country of origin; however, this is a snapshot of students after one year of virtual education derived from COVID-19 pandemic, with no baseline data for comparison. Future research could replicate this study, taking into account more countries from the American continent to make wider contrasts. Lastly, it is recommended that educational institutions perform research periodically, evaluating sleep disorders and other psychological alterations that are developing in this pandemic period.

Conflict of interest

Authors confirm there is no any conflict of interest.

Authors' Contribution

Conceptualization and design: MP, EC, and MD; Literature review: MP, EC, MD, ML and AF; Methods: MP, EC, and MD; Data collection: MP, EC, MD; Data analysis: MD, MP Principal Investigator: MP, MD, and EC; Manuscript preparation: ML and AF; Manuscript revision and editing: MD, MP, and EC.

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