

Impact of COVID-19 Pandemic On Sleep Quality in Students and Employees: Web-Based Survey

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Research

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Abstract

Background

Facing the COVID-19 pandemic, individuals are experiencing severe mental distress. Thus, during the last year, drastic changes occurred in everyday life of every human being. Following social distancing and economic insecurity, significant increases in mental health concerns (loneliness, anxiety, depression, or insomnia) have developed.

Methods

Following social distancing and economic insecurity, significant increases in mental health concerns (loneliness, anxiety, depression, or insomnia) have developed. The objective of this study was to explore the sleep quality in students and employees, during the COVID-19 pandemic. 620 responses were validated.

Results

In this study, more than 20% of the participants scored above the cut-off score for insomnia and almost 40% screened positive for mild problems with sleep. All these results are indicating an exacerbation of sleep disturbances. Although there is an increased prevalence of sleep disorders among respondents, these changes were not directly associated with the presence of the infection or its severity, but rather with various demographic, socio-economic variables and finally with the presence of a pre-existing psychiatric disorder.

Conclusions

In conclusion, sleep disorders among students and employees are a major health issue associated with great psychological burden. Up to date, research of insomnia during a pandemic crisis is limited. To the best of our knowledge, this was the first study to explore sleep difficulties during the COVID-19 pandemic in students and employees in Romania. This study uncovered a high-level of insomnia during the COVID-19 pandemic. Women, single people, or presence of psychiatric disorders were more susceptible to sleep difficulties.

Background

On 31 December 2019, the Wuhan Municipal Health Commission, from China, reported a cluster of pneumonia cases, and following that, the coronavirus disease 2019 (COVID-19) outbreak occurred and aroused global attention [1] In March 2020, the World Health Organization officially declared that COVID-19 was a pandemic and called on the whole world to collaborate in this large-scale infectious disease

challenge [2]. The COVID-19 global health pandemic underlined the importance of all communities having access to the highest quality physical and mental health services. With its impact reaching across individuals, social relationships, environment and financial security, COVID-19, as a public crisis from the global perspective, draws attention to policy development for management, specifically under the public sector. In this period of physical distancing and self-imposed isolation, risk to develop acute stress disorders is growing, therefore mental health services are particularly critical in ensuring the overall well-being [3, 4].

Previous studies showed that acute infectious disease, like severe acute respiratory syndrome (SARS), can cause significant distress, anxiety, depression, and even posttraumatic stress disorders both in survivors and non-infected people [5–7]. Furthermore, a negative impact on the mental health of people that face sudden events was identified [8]. In contrast to previous epidemics, such as severe acute respiratory syndrome and Middle East respiratory syndrome, COVID-19 spreads faster and is more contagious [9]. Traumatic events, such as those caused by COVID-19 outbreak, can produce psychological distress and anxiety symptoms which negatively impact sleep quality [10].

Facing this pandemic public health concern and these enormous disturbances to routine life, individuals are under a unique pressure and are experiencing severe mental distress [11]. Thus, during the last year, the COVID-19 pandemic has changed the everyday life drastically for much of the world's population, and Romania is no exception. Following social distancing and economic insecurity, significant increases in mental health concerns arose, including loneliness, anxiety, depression, insomnia and even suicidal risk [12–15]. However, people differ widely in how they respond to challenges and difficulties that appear in a pandemic crisis [16].

The long-term mental health effects are anticipated to be intensified due to the pandemic affecting people worldwide [17]. When cope with the COVID-19 pandemic, sleep quality becomes crucial due to its many benefits for physical and mental health [13, 18]. Sleep disorders can impair decision making and psychologic functioning, expose the immune system, lead to mood changes, increase the risk of accidents, increase medical expenditures, and render individuals more susceptible to contracting the virus because of concentration deficit [19].

Methods

The primary objective of this study was to explore the prevalence of sleep difficulties in a sample of students and employed population, during the COVID-19 pandemic.

Participants

An anonymous web-based survey included questions about demographic and socio-economics characteristics, contact with COVID-19, as well as the Athens Insomnia Scale (AIS). Participants completed the questionnaire after agreeing to an electronic informed consent requested for each participant. The survey took approximately 15 min to be completed. Chain-referral sampling was used to

recruit participants. Inclusion in the study group was based on the status of student or worker. 620 responses were validated (331 students and 289 workers).

The study was accepted by the ethics committee under the Bacau College of Physicians number 46/18.2021. The study was developed in accordance with the World Health Organization (WHO) and the Declaration of Helsinki.

Measures

Demographic variables like gender, age, marital status, living location, household size and socioeconomic status (which combines information on education, employment status, weekly working hours and monthly income) were evaluated. The respondents were also asked if they have any underlying condition (somatic or psychiatric).

Contact with COVID-19. Given the possible implications of the pandemic context, participants were asked if they had been confirmed with SARS-CoV2 virus infection and what the symptoms were. They were also asked if they had loved ones who had been diagnosed with COVID-19 or died of it.

Sleep questionnaire. AIS consists of eight questions concerning sleep quality and duration. The questionnaire was created by a group of Greek scientists in 2000 [20]. The first five items pertain to sleep induction, awakenings during the night, final awakening, total sleep duration, and sleep quality, while the last three refer to well-being, functional capacity, and sleepiness during the day. Each item is scored on a scale ranging from 0 to 3 (with 0 corresponding to "no problem at all" and 3 to a "very serious problem"). The respondents were required to provide a positive rating if they experienced a sleep difficulty described by each item at least three times a week during the last month. A score from 0 to 5 indicates normal sleep, from 6 to 10, mild problems with sleep, and a score of 11 and above corresponds to insomnia. When diagnosing individuals with a score of 6 or higher as insomniacs, the scale presents with 93% sensitivity and 85% specificity (90% overall correct case identification). For this cut-off score, in the general population, the scale has a positive predictive value (PPV) of 41% and a negative predictive value (NPV) of 99% [21].

Descriptive statistics and significance tests were performed. The Chi-Square test, the corresponding corrections when the criteria were not met (Likelihood ratio, Fisher test) and the Phi and Cramer V parameters were used to verify the interval combinations; the t-independent test with the reporting of the degrees of freedom, the difference of means, the Levene's test for the homogeneity test, the Kolmogorov-Smirnov and Shapiro-Wilk normality tests for the subgroups under 30 respondents were utilized and the confidence interval was set at 95%. For the situation where the conditions of the normality tests were not met, the non-parametric Mann-Whitney U test was used. The ANOVA test, the Levene's and Welch tests were also used. All analyses were carried with SPSS Statistics.

Results

The questioner was completed by 622 persons and 620 responses were validated (331 students and 289 workers). The majority of the respondents were female ($N = 464$) and 4 out of 5 were young adults aged between 18 and 35 years. Regarding the level of education, 57.1% of the respondents have an academic degree (bachelor, master, doctoral). Regarding marital status 65.8% were in a relationship (cohabitating couple, married), the rest of them were not in a relationship (single, divorced, widowed). All demographic, socio-economic characteristics, as well as any underlying conditions are presented in Table 1.

Table 1
Sample demographics (N = 620)

Lot Characteristics	Answers - Lot (N) – 620 people / %	
Demographics Characteristics		
Occupational status	Student – 331 (53.4%)	
	Employees – 289 (46.6%)	
Gender	Male – 156 (25.2%)	
	Female – 464 (74.8%)	
Age	18 to 24 years – 374 (60.3%)	
	25 to 34 years – 137 (22.1%)	
	35 to 44 years – 44 (7.1%)	
	45 to 54 years – 35 (5.6%)	
	55 years and over – 30 (4.9%)	
Marital status	No relationship 212 (34.2%)	Divorced – 11 (1.8%) Widowed – 3 (0.5%) Single – 198 (31.9%)
	In a relationship 408 (65.8%)	Cohabitating couple – 293 (47.3%) Married – 115 (18.5%)
Living location	Urban – 569 (91.8%)	
	Rural – 51 (8.2%)	
Do you take care of an older person?	Yes – 585 (94.4%)	
	No – 46 (7.4%)	
Pet owner	Yes – 250 (40.3%)	
	No – 370 (59.7%)	
Socioeconomic status		
Level of education	High school graduation	266 (42.9%)

Lot Characteristics	Answers - Lot (N) – 620 people / %	
	Academic degree	Bachelor's Degree Certificate 229 (36.9%)
		Master's Degree Certificate 117 (18.9%)
		Doctoral Degree Certificate and Postdoctoral studies 8 (1.3%)
Household size and composition	Living alone 99 (15.8%)	
	Living with somebody else 558 (90%)	Partner – 249 (47.8%) Children – 82 (15.7%) Parents – 236 (45.3%) Grandparents – 36 (6.9%) Siblings – 92 (17.7%) Friends/ Flat mates – 41 (7.9%) Others – 7 (1.3%)
Family/personal income N = 586 (36 respondents chose not to respond)	0-€ 99 / person – 20 (3.4%) € 100-€ 199 / person – 54 (9.2%) € 200-€ 399 / person – 104 (17.7%) € 400-€ 799 / person – 216 (36.9%) € 800-€ 1599 / person – 136 (23.2%) € 1600 or more / person – 56 (9.6%)	
Number of hours of weekly work	Under 10 hours / week – 119 (19.2%) 10 to 20 hours / week – 66 (10.6%) 20 to 40 hours / week – 204 (32.9%) 40 to 60 hours / week – 195 (31.5%) Over 60 hours / week – 36 (5.8%)	
Underlying health conditions (somatic and psychiatric)		

Lot Characteristics	Answers - Lot (N) – 620 people / %
Do you have any comorbidities?	Yes – 62 (10%) No – 558 (90%)
Have you ever been diagnosed with any psychiatric disorders?	Yes – 35 (5.6%) No – 585 (94.4%)
If so, please mention the diagnosis and treatment followed.	Major depressive disorder – 18 (51.4%) General anxiety disorder – 13 (37.1%) Mixed anxiety depressive disorder – 3 (8.6%) Obsessive-compulsive disorder – 4 (11.4%) Bipolar affective disorder – 2 (5.7%) Borderline personality disorder – 1 (2.9%) Insomnia – 1 (2.9%)
N = 35 (diagnosis)	Antipsychotics 4 (26.7%) Antidepressants 11 (73.3%) Benzodiazepine 6 (40%)
N = 15(treatment)	

Regarding COVID-19 disease, 16% tested positive for SARS-Cov2, of which 65% had a mild form. A great number of individuals had close people detected with COVID-19 and 7.1% had close people who died of COVID-19 (Table 2).

Table 2
COVID-19 status

COVID-19 status	Answers - Lot (N) – 620 people / %
Were you infected with SARS-Cov-2 (confirmed by a test)?	Yes, I am positive now – 28 (4.5%) Yes, I was infected last month – 39 (6.3%) Yes, I was infected in the last 6 months – 27 (4.4%) Yes, I was infected more than 6 months ago – 5 (0.8%) No – 520 (84%)
If the answer to the previous question is "yes", what was /is the severity of symptoms?	Asymptomatic – 10 (10%) Few symptoms – 65 (65%) Moderate symptoms – 25 (25%) Severe symptoms – 0 (0%)
N = 100	
Has someone close to you been infected with SARS-Cov-2?	Yes – 439 (70.8%) No – 181 (29.2%)
Has someone close to you died of COVID-19 infection?	Yes – 44 (7.1%) No – 576 (92.9%)

Using the predefined cut-offs of the AIS scoring system to screen for sleep disturbances, we found that every second participant in the survey (374, 60.32%) had impaired sleep quality. With scores between 6 and 10, more than one third of the respondents ($n = 242$, 39.03%) screened positive for mild sleep problems, while 132 (21.29%) of them screened positive for insomnia (score ≥ 11).

In the student population, sleep induction was more affected comparing to employees' group ($p = 0.013$, $df = 3$, Phi = 0.132, moderate association). Also, the perception of physical and mental functioning during the day ($p < 0.001$, $df = 3$, Phi = 0.206, strong association) and sleepiness during daytime ($p < 0.001$, $df = 3$, Phi = 0.189, strong association) are more prevalent among students. In contrast, awakenings during the night are more prevalent among employees ($p < 0.001$, $df = 3$, Phi = 0.185, strong association) and the final awakening also was found to be earlier than desired ($p = 0.002$, $df = 3$, Phi = 0.155, strong association). Overall, the AIS results are not significantly different between students and employees ($p = 0.140$, $df = 1$).

Women reported more frequently by impairment of total sleep duration ($p = 0.032$, $df = 3$, Phi = 0.119, moderate correlation); and overall poorer quality of sleep regardless of the total duration of sleep ($p = 0.042$, $df = 3$, Phi = 0.115, moderate correlation). Furthermore, AIS scores were significantly higher for

women, (Mean Differences-1,027: women's mean score = 6.39, men's mean score = 5.37), $p = 0.007$, Levene's test = 0.001. The frequency of awakenings during night increase with age ($p < 0.001$, df = 6, Phi = 0.248, strong correlation), as well as awakenings earlier than the desired time ($p = 0.004$, df = 6, Phi = 0.202, strong corelation). Drowsiness during the day is more prevalent at younger ages ($p < 0.001$, df = 6, Phi = 0.251, large association).

Single people (divorced, widowed, single) experienced more often awakenings during the night compared to those who are married or in a relationship ($p < 0.001$, df = 12, Phi = 0.369, strong association). On the other hand, married people have a tendency to wake up in the morning before the setting time more often ($p = 0.040$, df = 12, Phi = 0.184, strong association).

There are no significant differences between respondents from urban areas or countryside related to AIS scale scores ($p = 0.084$, df = 1).

Taking care of an older person is associated with delay in falling asleep ($p = 0.037$, df = 3, Phi = 0.117, moderate association) and waking before the desired time ($p = 0.003$, df = 3, Phi = 0.173, strong association). Participants who care for older people have more often clinically significant scores on AIS scale ($p = 0.024$, df = 3, Phi = 0.091, weak association).

Pet owners have a shorter duration of fall asleep ($p = 0.036$, df = 3, Phi = 0.117, moderate association) however, they experience more sleepiness during the day ($p = 0.028$, df = 3, Phi = 0.121, moderate association). However, in terms of AIS total score there are no differences between pet owners and those who do not own pets.

Lower educational levels associate higher levels of dysfunctionality during the day ($p < 0.001$, df = 2, Phi = 0.199, strong association). Nonetheless, AIS total score is not it is not statistically significant influenced by educational level.

Regarding household size and his composition, participants who live with their partners had a shorter time to fall asleep ($p = 0.008$, df = 3, Phi = 0.150, strong association) and daytime sleepiness was associated less often in this group ($p = 0.019$, df = 3, Phi = 0.139, moderate association). At the same time, the perception of functioning during the day was better for the participants who live with their partner ($p = 0.022$, df = 3, Phi = 0.136, moderate association). Altogether, participants who live with partner had normal scores at AIS test, lower than 5 ($p = 0.024$, df = 1, Phi = 0.099, week association) which also, at quantitative statistical test was equivalent with lower values ($p = 0.017$, Mean Rank for the participants who live with their partner = 244.63, and the mean rank for the participants who don't = 275.99).

Studied participants that are living with their children experienced more frequently awakenings during the night ($p = 0.018$, df = 2, Phi = 0.116, moderate association), but they did not experience daytime sleepiness ($p = 0.001$, df = 1, Phi = 0.146, moderate association) and had a good functioning during the day ($p = 0.001$, df = 3, Phi = 0.176, strong association). In contrast, those who live with their parents experienced less frequently awakenings during the night ($p = 0.047$, df = 2, Phi = 0.108, moderate association), but still

they associated sleepiness during the day more often ($p = 0.022$, $df = 3$, $\Phi = 0.136$, moderate association). Living with grandparents was associated with a longer time to fall asleep ($p < 0.001$, $df = 3$, $\Phi = 0.211$, strong association) and worse quality of sleep ($p = 0.020$, $df = 3$, $\Phi = 0.138$, moderate association). A worse quality of sleep was observed also in the participants who live with a roommate ($p = 0.027$, $df = 3$, $\Phi = 0.133$, moderate association), who also declared a worse state of wellbeing during the day ($p = 0.023$, $df = 3$, $\Phi = 0.135$, moderate association).

Low- and middle-income participants have longer times until they fall asleep ($p = 0.046$, $df = 15$, $\Phi = 0.217$, strong association). Higher income participants present slowness during the day more frequently ($p = 0.014$, $df = 15$, $\Phi = 0.224$, strong association). Despite these particularities, no difference in AIS total score was associated with monthly income ($p = 0.233$). In relation to weekly working hours, people who work more feel more often that sleep duration is not enough ($p = 0.050$, $df = 12$, $\Phi = 0.181$, strong association).

Participants with comorbidities do not exhibit clinically significant scores (over 6) on the AIS more frequently than participants without comorbidities, with the exception of psychiatric disorders, like depression, anxiety, bipolar affective disorder, which are associated in the studied group with awakening during the night ($p = 0.001$, $df = 3$, $\Phi = 0.206$, strong association), awakening before desired time ($p = 0.029$, $df = 3$, $\Phi = 0.146$, moderate association) and unsatisfactory total duration and quality of sleep ($p = 0.035$, $df = 3$, $\Phi = 0.118$, moderate association; $p = 0.003$, $df = 3$, $\Phi = 0.150$, strong association). Additionally, participants with mental disorders presented more frequently the next day consequences of insomnia: less wellbeing ($p < 0.001$), worse functioning ($p < 0.001$) and sleepiness ($p = 0.010$) during the daytime. After all, participants with mental disorders associated higher scores on AIS ($p < 0.001$, $df = 1$, $\Phi = 0.165$, strong association).

Regarding COVID-19 status, there were no significant differences between participants in the study who were infected with SARS-CoV2 and those who were not, and there was no difference on insomnia scale in relation to the time interval elapsed since infection with SARS-CoV2 or the severity of associated symptoms of the infection. Moreover, infection or death due to COVID-19 of loved ones is not a risk factor for sleep disturbances in the studied group.

Discussion

This web-based study revealed numerous interesting aspects related to sleep quality. Insomnia seems to be affecting more individuals during the COVID-19 pandemic. Distress levels rise during an infection outbreak due to worry about health, changes in social life and daily routine and finally, financial concerns.

In this study, more than 20% of the participants scored above the cut-off score for insomnia. This percentage is at the upper limit of the worldwide insomnia prevalence, estimated before the pandemic between 3.9% and 22% [22]. Additionally, almost 40% screened positive for minor problems with sleep. All these results are indicating an exacerbation of sleep disturbances. According to a meta-analysis, the prevalence of sleep problems during the COVID-19 pandemic is high and affects approximately 40% of

people from general population [23]. Although there is an increased prevalence of sleep disorders among respondents, these changes were not directly associated with the presence of the infection or its severity, but rather with various demographic, socio-economic variables and last but not least with the presence of a pre-existing psychiatric disorder.

Students associated more frequently the next day consequences of insomnia (overall functioning and sleepiness during the day), while for workers more prevalent were awakenings during the night and early morning awakening. Regarding sociodemographic factors, insomnia score was significantly higher in women and awakenings during the night was a sleep disturbance associated with ageing. Partnered (married or cohabiting) participants at the time of the sleep study had better sleep quality, although household size and its composition did not influence sleep patterns. Participants who take care of older people have more often sleep disturbance, elderly care being associated with delay in falling asleep and waking before the desired time.

However, there are some limitations to our study that need to be considered. We used a self-reported questionnaire to gather data, which is prone to response (extreme response, social desirability) and recall (inaccurate memory) biases. On the other hand, online surveys suffer from two main methodological limitations: limited access to certain portals, and respondents with biases may select themselves into the sample, thus more robust research on insomnia during a pandemic crisis is necessary.

Conclusion

In conclusion, sleep disorders among students and employees are a major health issue associated with great psychological burden. Up to date, research of insomnia during a pandemic crisis is limited. To the best of our knowledge, this was the first study to explore sleep difficulties during the COVID-19 pandemic in students and employees in Romania. This study uncovered a high-level of insomnia during the COVID-19 pandemic. Women, single people, or presence of psychiatric disorders were more susceptible to sleep difficulties.

Abbreviations

SARS - severe acute respiratory syndrome

AIS - Athens Insomnia Scale

WHO - World Health Organization

PPV - positive predictive value

NPV - negative predictive value

Declarations

Ethics approval and consent to participate: Ethics Committee under the Bacau College of Physicians, number 46/18.2021

Consent for publication: Not applicable

Availability of data and materials: The datasets generated and/or analysed during the current study are not publicly available because of ethical restrictions but are available from the corresponding author on reasonable request.

Competing interests: The authors declare that they have no competing interests

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Authors' contributions: TCI, SZ, EM, BIF, and TC, contributed to the conceptualization and design of the research. SZ and EM designed and planned the method to achieve the results. TCI, BIF and EM contributed to data cleaning, analysis and interpretation. TCI, SZ, EM, BIF, and TC contributed to manuscript development. TCI, SZ and CT took responsibility for the evaluation and conclusion of findings. BIF and CT contributed to the manuscript review. All authors read and approved the final manuscript.

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