Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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Original Article

Sleep quality and mental health in the context of COVID-19 pandemic and lockdown in Morocco

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ABSTRACT

Background: The lockdown of COVID-19 (Coronavirus Disease 2019) is associated with several stressful factors that can negatively affect peoples' sleep quality and mental health. Objectives: We conducted this study to evaluate sleep disorders and psychological impact associated with the spread of the COVID-19 and the lockdown on the Moroccan population. We also aimed to study the effects of respondents' beliefs and attitudes about sleep on sleep disorders, anxiety-related symptoms, and depressive symptoms.
Material and Methods: We used a questionnaire enclosing respondents' sociodemographic information, five psychological and behavioral tests including Dysfunctional Beliefs and Attitudes about Sleep (DBAS-16), Athens Insomnia Scale (AIS), Epworth Sleepiness Scale (ESS), Hamilton Anxiety Rating Scale (HARS) and Beck Depression Inventory (BDI) test.
Results: Our results highlighted widespread false beliefs about sleep and the prevalence of sleep disorders, anxiety, and depression-related symptoms within the Moroccan population. Nearly 82.3% of respondents revealed false beliefs about sleep. Furthermore, we confirmed a strong positive correlation between knowledge and attitudes about sleep and the prevalence of sleep disorders, anxiety, and depression-related symptoms. However, we found no significant difference in the prevalence of sleep and psychological disorders, between healthcare workers and other professions workers.
Conclusion: Our study revealed a high prevalence of sleep disorders, anxiety, and depressive symptoms in the Moroccan population during the COVID-19 lockdown period. Moreover, false beliefs on sleep understanding were prevalent and were presenting a risk factor leading to sleep disorders, anxiety, and depressive symptoms.

1. Introduction

The COVID-19 is a pandemic that affected Morocco. The first case of the country was reported on March 3, 2020, [1]. Eight days later, health authorities have reported the first fatal case of COVID-19 [2]. Local virus transmission was revealed on March 12, 2020

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[3]. Besides, on April 1, corresponding to the start of our study, the total number of confirmed cases was 638, with 36 deaths [4].

Demographically, according to the population clock of the High Commission for Planning in Morocco on June 16, 2020, at GMT 13:43:56, the legal population was 35 937 612 inhabitants. The 2014 official Moroccan authorities' census reported an urbanization population rate of 60.3% [5]. Besides, in 2018, the female to male ratio was 1.03 [6]. On the other hand, according to the World Health Organization (WHO) 2019 report on human development, Morocco was classified among the medium human development countries with a Human Development Index of 0.676 [6].

The lockdown is a hard psychological and social experience for most people; it requires physical and social distancing, including being separated from family and friends, as well as the frustration resulting from the commitment to sit at home. This new life configuration leads to significant consequences on sleep and mental health [7]. Many methods were used to study the harmful effects of the lockdown, including collecting population data using the interview, electronic survey, and phone calls [8]. The literature showed increased mental health disorders such as sleep disorders, anxiety-related symptoms, depressive symptoms, post-traumatic stress, and psychological burn-out symptoms [9,10]. COVID-19 pandemic has dramatically impacted world population life compared to earlier epidemics, such as SARS, H1N1, and horse flu [11,12]. Indeed COVID-19 impact might be higher on healthcare workers [8,13].

Throughout this study, we aimed to study sleep disorders and psychological impact associated with the spread of the COVID-19 and the lockdown on the Moroccan population. We intended to correlate the respondents' beliefs and attitudes about sleep with sleep disorders, anxiety-related symptoms, and depressive symptoms in our population. We used the DBAS-16 scale.

2. Material and methods

2.1. Study population and data collection

A descriptive cross-sectional study was conducted from April 1, 2020, to May 1, 2020, in Morocco. We collected data using a questionnaire, including seven sections. The first one contains sociodemographic information such as the age and gender of participants, their education levels, and their professional profile, besides information on their sleeping routines and activities practiced at homes during this lockdown stage. The five remaining sections consisted of a brief version of the Dysfunctional Beliefs and Attitudes about Sleep (DBAS-16), Athens Insomnia Scale (AIS), Epworth Sleepiness Scale (ESS), Hamilton Anxiety Rating Scale (HARS) and Beck Depression Inventory (BDI) test.

We conducted and transferred the electronic version of the questionnaire to the Moroccan population. The survey was self-applied, considering the pandemic conditions requiring physical and social distancing, and lockdown. The survey was addressed to the targeted population through social media and groups. We achieved a primary pilot and feasibility investigation to assess any constraint that might occur during the survey. Hereafter, we conducted a preliminary evaluation of 10 respondents to ensure the clarity of questions and fluency. The mean duration of the self-applied survey was 11.8 ± 2.1 min.

2.2. Tests and scoring

2.2.1. DBAS-16 test

DBAS-16 test consists of 16 statements that estimate the respondents' beliefs and attitudes about sleep. Each statement was scored according to a scale ranging from 1 (strongly disagree) to 10 (strongly agree). We asked respondents to express and estimate their degree of agreement with each statement by choosing the number that outfits their state. The test was subdivided into four sub-scales: consequences of insomnia (statement 5, 7, 9, 12 and 16), worry about sleep (statement 3, 4, 8, 10, 11, 14), sleep expectation (statement 1and 2) and assignment of drug (statement 6, 13 and 15) [14].

We calculated the total score by summing the four subscales scores. Finally, the totals score over/equal to 4 refers to false beliefs about sleep, whereas scores less than 4 refers to the right or accurate beliefs about sleep.

2.2.2. Athens Insomnia Scale (AIS)

AIS scale aimed to assess any sleep troubles that are experienced by respondents during the COVID-19 lockdown stage. AIS included eight statements that assess the onset of sleep (the time it takes to sleep after turning off the light) and the wake up during the night and in the morning. AIS test evaluates the full duration and quality of sleep (no matter how long they slept). Besides, AIS test statements allow estimating stress caused by insomnia experience and the desire to sleep during the day and their interference with routine daily activities. The respondents describe each sleep difficulty by choosing an expression that best describes their states, provided they have experienced this condition at least three times a week during the last month [15].

We calculated AIS scores by summing the scores obtained for each statement. Scores over or equal to 6 indicate the presence of insomnia, while scores less than 6 show the absence of insomnia.

2.2.3. Epworth Sleepiness Scale (ESS)

We have used the Epworth Sleepiness Scale as a subjective measure of respondents' sleepiness. The test consists of a list of eight situations that allow evaluating the tendency to become drowsy on a scale ranging from 0 (chance of falling asleep) to 3 (a strong chance to fall asleep). To score the ESS test, we add the value of respondents' answers on a scale ranging from 0 to 24. The scale estimates whether respondents are suffering from excessive drowsiness that might require medical consideration. The scores ranged from 0 to 10, referring to a healthy subject, the scores ranging from 11 to 15 refers to moderate daytime sleepiness, and a score between 16 and 24 reflects that respondent suffers from severe daytime sleepiness [16].

2.2.4. Hamilton Anxiety Rating Scale (HARS)

HARS test measures the severity of anxiety symptoms. It consists of 14 assessments; a series of symptoms defined each one. These assertions are mixed and take into account the psychic (mental agitation and psychological distress) and somatic (physical complaints related to anxiety) aspects of anxiety.

Each item is scored on a scale ranging from 0, reflecting no presence of symptom to 4, reflecting the highest severity of symptoms; the total score ranges between 0 and 56. Scores less than 14 are considered normal, while scores ranged between 14 and 17 is reflecting a subject with mild anxiety. Also, a score ranging between 18 and 24 refers to moderate anxiety, and scores over 25 indicate severe anxiety [17].

2.2.5. Beck depression inventory (BDI)

We used the BDI test to screen depression and measure the behavioral manifestations and severity of depression. It consists of eight statements; each one contains four choices. Respondents choose the suggestion that best describes their situation; if more than a single choice was suitable to describe the subject situation, they should choose the highest number for that group. Choices

were scored respectively 0 for the first choice, 1 for the second choice, 2 for the third choice, and 3 for the fourth choice. Scores ranging from 4 to 7 do indicate mild depression, 8 to 15 are assigned to moderate depression, 16 and over are indicating severe depression [18].

2.3. Statistical analysis

The descriptive statistics approach was used to describe the demographic variables such as gender, age, localization of residence, education level, and profession. The mean age of our sample was 35 years old. Hence, we considered two subgroups: a first group below the average age and a second group above the average age. The prevalence of depressive symptoms, anxiety, and sleep quality were reported. Variables with $p \leq 0.20$ on univariate analysis were taken into account in the multivariate logistic regression model to assess the potential factors influencing depressive symptoms, anxiety, and sleep quality during the COVID-19 lockdown stage. Odds ratio (OR), adjusted odds ratio (AOR), and 95% confidence interval (95% CI) were obtained from logistic regression models. The p-value of equal or less than 0.05 was considered significant. The statistical analysis of the data was performed using the statistical software package SPSS 17.0 (Statistical Package for the Social Sciences).

3. Results

Table 1 summarized the distribution respondents' data, including sociodemographic characteristics and their attitudes towards the COVID-19 pandemic. We have collected 827 responses with a male to female ratio of 0.91 (52.2% are women). We received responses from all regions of Morocco.

Table 1
Demographic characteristics of the study sample (N = 846).

Variables	Number (%)
Gender (n = 827)	
Male	395 (47.8)
Female	432 (52.2)
Age (Mean ± SD) (n = 825)	35.9 ± 12.5
< 35 years	451 (54.7)
≥ 35 years	374 (45.3)
Profession (n = 814)	
Healthcare workers[a]	282 (34.6)
Enterprise or institution workers[b]	112 (13.8)
Teachers or students[c]	305 (37.5)
Others[d]	115 (14.1)
Education level (n = 827)	
Baccalaureates (B)	106 (12.8)
Doctorate (D)	258 (31.2)
Bachelor degree (L)	268 (32.4)
Masters' degree (M)	185 (22.4)
Primary (P)	10 (1.2)
Chronic disease (n = 827)	
Yes	132 (16.0)
No	695 (84.0)
COVID-19 medical team workers	
Yes	80 (9.7)
No	744 (90.3)
Following COVID-19 related news	
Yes	522 (63.3)
No	303 (36.7)

Abbreviations: n, number; SD, Standard deviation.
[a] Doctors, nurses, and health administrators.
[b] Enterprise employees, national/provincial/municipal institution workers, and other relevant staff.
[c] Teachers and students from universities, middle schools, or elementary schools.
[d] Include freelancers, retirees, social worker, and other relevant staff.

The results revealed a high prevalence of sleep disorder, especially insomnia (56.0%) and daytime sleepiness (9.9%). Also, 29.5% of respondents had anxiety. Besides, the results of the beck depression inventory revealed that 35.6% of respondents suffered from depressive symptoms.

Table 2 summarized the results from this univariate and multivariate logistic regression. The analysis revealed that insomnia was significantly predicted by area and chronic disease, the insomnia score was higher within urban respondents [OR = 2.09 (1.21–3.62); $p < 0.05$] and people with chronic diseases [OR = 2.14 (1.42–3.22); $p < 0.05$] compared respectively with rural and respondents' without chronic disease. Furthermore, gender and age constitute significant predictors of depressive symptoms. Women's depressive symptoms score [OR = 0.53 (0.40–0.71); $p < 0.05$] and age less than 35 years-old [OR = 0.42 (0.32–0.57) $p < 0.05$] were superior to scores of males and people of 35 years-old or older. Additionally, area, gender, and chronic disease were the man predictors of anxiety; people with chronic disease [OR = 1.49 (1.0–2.11); $p < 0.05$], rural [OR = 2.08 (1.15–3.77); $p < 0.05$], and being women [OR = 0.35 (0.26–0.46); $p < 0.05$] were more likely to develop anxiety than people without chronic disease, urban, and being male, respectively.

Table 3 summarized the prevalence of anxiety, depressive symptoms, insomnia, and daytime sleepiness during the COVID-19 lockdown period according to beliefs about sleep. Accurate beliefs about sleep prevent respondents from insomnia ($p < 0.001$), daytime sleepiness ($p < 0.001$), anxiety ($p < 0.001$), and depressive symptoms ($p < 0.001$) (Table 3).

The study of the association between respondents' sleep knowledge using the DBAS-16 score, AIS, and ESS scores were performed by correlation analysis. This analysis showed that the correlation between DBAS and AIS yielded an $r = 0.546$ with $p < 0.001$, the correlation between DBAS and ESS yielded an $r = 0.294$ with $p < 0.001$, the scores were significant. AIS and ESS scores increase with the DBAS-16 score.

A correlation analysis showed that the association between AIS on one hand and anxiety ($r = 0.670$; $p < 0.001$) and depressive symptoms ($r = 0.516$; $p < 0.001$), on the other hand, was significant. These associations were positive; the increase of the AIS score leads to an increase of depressive symptoms and anxiety scores.

The correlation analysis shows that the relationship between ESS on one hand and anxiety ($r = 0.325$; $p < 0.001$) and Depressive symptoms ($r = 0.209$; $p < 0.001$), on the other hand, was significant, the increase of ESS score leads to increased scores of anxiety and depressive symptoms.

4. Discussion

We conducted this study to evaluate the weight of COVID-19 infection lockdown on the sleep and psychological state of the Moroccan population and to find the causes underlying the anxiety and depression-related symptoms. Our questionnaires were sent to the Moroccan population through emails and social networks. Thus, people with good internet access and medium to high education levels valuing their mental health might have reacted to our requests to participate in this study. Indeed this constitutes a bias since omitting a significant fraction of the population that does not access to the internet.

Our results confirmed the widespread false beliefs about sleep within the Moroccan population regardless of their level of education. Nearly 82.3% of respondents revealed false beliefs about sleep. Additionally, we confirmed a strong correlation between knowledge and attitudes about sleep and the prevalence of sleep disorders (insomnia and daytime sleepiness), anxiety, and depression-related symptoms. Indeed, false beliefs about sleep

Table 2
Prevalence of anxiety, depressive symptoms, and sleep quality during the COVID-19 outbreak period. Results of univariate and multivariate logistic regression analyses.

Variables	Insomnia		Depressive symptoms		Anxiety	
	OR (95% CI)	AOR (95% CI)	OR (95% CI)	AOR (95% CI)	OR (95% CI)	AOR (95% CI)
Area						
Rural	1	1	1	–	1	–
Urban	2.09 (1.21–3.62)*	1.78 (1.01–3.12)	0.72 (0.42–1.23)	–	2.08 (1.15–3.77)*	–
Gender						
Male	0.41 (0.31–0.54)	0.43 (0.32–0.57)	0.53 (0.40–0.71)*	0.59 (0.44–0.79)*	0.35 (0.26–0.46)*	0.35 (0.26–0.46)*
Female	1	1	1	1	1	1
Age						
<35 years	1	–	1	1	1	–
≥35 years	0.89 (0.67–1.17)	–	0.42 (0.32–0.57)*	0.45 (0.34–0.62)*	0.82 (0.62–1.08)	–
Occupation						
Healthcare workers[a]	1	–	1	–	1	–
Enterprise or institution workers[b]	0.63 (0.41–0.98)	–	0.96 (0.61–1.51)	–	0.71 (0.45–1.11)	–
Teachers or students[c]	0.66 (0.47–0.91)	–	0.96 (0.69–1.35)	–	0.86 (0.62–1.19)	–
Others[d]	0.47 (0.47–1.15)	–	0.82 (0.52–1.29)	–	0.87 (0.57–1.35)	–
Education level						
Primary	1		1	–	1	–
Secondary	1.04 (0.28–3.79)	–	2.06 (0.49–8.18)	–	2.08 (0.51–8.49)	–
Universitaire	1.40 (0.40–4.89)	–	1.25 (0.32–4.91)	–	1.78 (0.45–6.95)	–
Chronic diseases						
Yes	2.14 (1.42–3.22)*	2.04 (1.35–3.10)	1.08 (0.74–1.58)	–	1.49 (1.0–2.11)*	–
No	1	1	1	–	1	–

Abbreviations: OR, odds ratio; AOR, adjusted odds ratio; 95% CI, 95% confidence interval *P < 0.05.
[a] Doctors, nurses, and health administrators.
[b] Enterprise employees, national/provincial/municipal institution workers, and other relevant staff.
[c] Teachers and students from universities, middle schools, or elementary schools.
[d] Include freelancers, retirees, social worker, and other relevant staff.

Table 3
Prevalence of anxiety, depressive symptoms, and sleep quality during the COVID-19 outbreak according to respondents' beliefs about sleep.

Variable	Accurate beliefs about sleep n (%)	False beliefs about sleep n (%)	P
Anxiety			
Yes	17 (11.3)	344 (49.4)	<0.001
No	133 (88.7)	352 (50.6)	
Depression			
Yes	12 (8.0)	289 (41.5)	<0.001
No	138 (92.0)	407 (58.5)	
Insomnia			
Yes	29 (19.3)	445 (63.9)	<0.001
No	121 (80.7)	251 (36.1)	
Daytime sleepiness			
Normal subject	121 (80.7)	442 (63.5)	<0.001
Moderate daytime sleepiness	22 (14.7)	117 (25.4)	
Severe daytime sleepiness	7 (4.7)	77 (11.1)	

increase the risk of developed sleep disorders, anxiety, and depression-related symptoms.

Recent studies showed that adverse psychological effects had been reported during the lockdown period of the COVID-19 outbreak [8,9]; these psychological effects included post-traumatic stress symptoms, confusion, anger, and psychological burn-out symptoms. Our study disclosed a high prevalence of sleep disorder, especially insomnia (56.0%) and daytime sleepiness severe (9.9%). Additionally, 17.1% of the studied sample has developed severe anxiety, moderate anxiety (12.4%). The results of the beck depression inventory revealed that 35.6% of respondents suffered from depressive symptoms (mild depression: 21.5%, moderate depression: 12.4%, and severe depression: 1.6%). Before the COVID-19 pandemic and lockdown, the prevalence of sleep disorders, anxiety, and depression in Morocco was 18.6%, 4.5%, and 4.5%, respectively [19–21]. It seems that during this period of the lockdown, the prevalence of sleep disturbances has increased. In China, the overall prevalence of anxiety disorders, depressive symptoms, and sleep quality of the public during the lockdown period were 35.1%, 20.1%, and 18.2%, respectively [22]. The increase of such disorders was associated with several stressors. During the outbreak, there was a high risk of infection, a longer quarantine duration, infection fears, frustration, boredom, inadequate supplies, and inadequate information, financial loss, stigma overwork, frustration, discrimination, isolation, patients with negative emotions, a lack of contact with their families, and the excess information from mass media [8,13,22,23].

Additionally, there was a strong correlation between the prevalence of sleep disorder, anxiety, and depressive symptoms. Our results confirmed that insomnia and daytime sleepiness were predicted by anxiety and depressive symptoms. Sleep disorders were associated with anxiety [24]. A close relationship between the occurrence of sleep disorders and anxiety disorders in the general population has been demonstrated [25–28]. Furthermore, sleep deficiency during stress states increases exposure to anxiety [29]. In humans, acute and chronic stress has been shown to have harmful effects on sleep that are released through activation of the sympathetic system [30]. The association between sleep problems and depressive symptoms had been reported in low and middle-income countries [31]. Besides, this study confirmed that the coexistence of sleep problems and depressive symptoms increased the risk for the expansion of anxiety and stress among these populations [31].

People with chronic diseases were more likely to develop insomnia and anxiety. Sleep disorders are pervasive in people with cancer and chronic medical conditions [32–36]. Furthermore, respondents from the urban area with chronic diseases were more likely to experience anxiety-related symptoms than those from rural areas and those without chronic diseases. Also, the anxiety symptoms were more frequent within women compared to men. People living in an urban area would spend much time to follow COVID-19 news.

Moreover, COVID-19 cases were more frequent in urban areas and cities compared to rural areas. Almost 20% of the respondents developed symptoms of depression of type mild to moderate, while

1.6% of our sample expressed a severe depression. Furthermore, women and respondents, aged less than 35 years old, were more exposed to depressive symptoms than men and people aged 35 years or older. Recent COVID-19 related research showed that age less than <35 years-old and time spent focusing on the COVID-19 news along 3 h or more per day were associated with a generalized anxiety disorder. However, the prevalence of women's depressive symptoms and anxiety-related symptoms was different from other research that demonstrated that women and men were similarly affected [12].

5. Conclusion and perspectives

We recommend fighting against false sleep beliefs, and we must provide adequate psychiatric and psychological support to those people suffering from insomnia, anxiety and depression related to fear and anxiety developed in an environment of COVID-19 outbreak.

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Declarations

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All authors have read and approved the final manuscript.

CRediT authorship contribution statement

Abdelkrim Janati Idrissi: Practical design, Methodology, Data collection, Interpretation of the data, Writing - original draft, First drafting, Final manuscript approval, Manuscript submission processing. **Abdelaziz Lamkaddem:** Practical design, Methodology, Data collection, Interpretation of the data, Writing - original draft, First drafting, Final manuscript approval. **Abdelilalh Benouajjit:** Practical design, Methodology, Data collection, Final manuscript approval. **Manar El Bouaazzaoui:** Practical design, Methodology, Data collection, Final manuscript approval. **Farah El Houari:** Practical design, Methodology, Data collection, Final manuscript approval. **Mohammed Alami:** Practical design, Methodology, Data collection, Final manuscript approval. **Sanae Labyad:** Practical design, Methodology, Data collection, Final manuscript approval. **Abderrahman Chahidi:** Practical design, Methodology, Data collection, Final manuscript approval. **Meryem Benjelloun:** Practical design, Methodology, Data collection, Final manuscript approval. **Samira Rabhi:** Practical design, Methodology, Data collection, Final manuscript approval. **Najib Kissani:** Practical design, Methodology, Data collection, Final manuscript approval. **Benaissa Zarhbouch:** Practical design, Methodology, Data collection, Final manuscript approval. **Reda Ouazzani:** Practical design, Methodology, Data collection, Interpretation of the data, Writing - review & editing, Manuscript editing, Final manuscript approval. **Fouzia Kadiri:** Practical design, Methodology, Data collection, Final manuscript approval. **Rachid Alouan:** Practical design, Methodology, Data collection, Final manuscript approval. **Mohamed Elbiaze:** Practical design, Methodology, Data collection, Final manuscript approval. **Said Boujraf:** Early concept and design, Data collection, Writing - original draft, Writing - review & editing, Final draft reviewing, Editing and approving. **Samira El Fakir:** Practical design, Methodology, Statistical analysis and data interpretation, Final manuscript approval. **Zouhayr Souirti:** Principal Investigator, Writing - original draft, Original drafting, Validation, Formal analysis, Project administration, Conceptualization, Methodology, data collection, interpretation of the data, final manuscript approval.

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Conflict of interest

The authors declared no conflict of interest.

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Abbreviations

AIS	Athens Insomnia Scale
AOR	Adjusted Odds Ratio
BDI	Beck Depression Inventory
CI	Confidence Interval
COVID	Coronavirus Disease
DBAS	Dysfunctional Beliefs and Attitudes about Sleep
ESS	Epworth Sleepiness Scale
HARS	Hamilton Anxiety Rating Scale
MERS	Middle East Respiratory Syndrome
OR	Odds Ratio
SARS	Severe Acute Respiratory Syndrome
SPSS	Statistical Package for the Social Sciences
SD	Standard Deviation
WHO	World Health Organization

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