Original Paper

In-Depth Characterization of Sleep Patterns Among People with Insomnia During the Pandemic of COVID-19

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ABSTRACT: Background. The effects of the COVID-19 pandemic on sleep duration and insomnia have been well studied in different studies. However, there is no study available on the characteristics of insomnia during the pandemic. This study aimed to evaluate the characteristics of insomnia experienced by the general Iranian population during the COVID-19 pandemic. Methods. A cross-sectional community-based study was designed. We designed an online questionnaire and sent it to Iranian people via available social platforms. The questionnaire contained questions on the socio-demographic characteristics of the participants. We used Fear of COVID-19 scale (FCV-19), Insomnia Severity Index (ISI), Patient Health Questionnaire-2 (PHQ-2), and Generalized Anxiety Disorder Scale-2 (GAD-2) for detailed characterization of insomnia and its symptoms. Results. In total, 675 people with insomnia with the mean age of 40.28 years (SD=11.15) participated in our study. Prevalence of difficulty initiating sleep (DIS), difficulty maintaining sleep (DMS), and early morning awakening (EMA) were 91.4%, 86.7%, and 77%, respectively. DIS, DMS, and EMA were more common in people with depression and anxiety. FCV-19 score was higher in those with more severe types of DIS, DMS, and EMA (P<0.001). FCV-19 was a risk factor for all patterns of insomnia (OR=1.19, 1.12, 1.02 for DIS, DMS, and EMA, respectively). Conclusion. Fear of COVID-19 is a major contributing factor to insomnia patterns. Investigation of COVID-19 fear in people with insomnia and the addition of attributed relieving or management strategies to conventional management of insomnia are reasonable approaches to improve the sleep condition of people in the pandemic.

KEYWORDS: *Insomnia, Pandemic, Sleep, Early morning awakening, Difficulty intiating sleep, Difficulty maintaining sleep.*

Introduction

In December 2019, the emergence of a cluster of patients with pneumonia-like symptoms in China led to the diagnosis of a novel coronavirus, which was later named severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) [1].

Since then, the virus has spread rapidly throughout the world and is responsible for millions of cases of Coronavirus disease (COVID-19). On March 11, 2020, the World Health Organization (WHO) declared the global pandemic [2].

According to WHO reports, about 14.5 million people have been affected by COVID-19, and about 600000 people have lost their lives because of it [3].

COVID-19 pandemic not only puts people's lives at risk, but it also affects people's sleep and psychological health. Sleep and psychological issues among different groups of people have been well studied during the COVID-19 pandemic. The prevalence of sleep and psychological disorders has increased since the start of the pandemic [4,5].

The prevalence of stress, anxiety, and depression in the general population during the COVID-19 pandemic has been 29.6%, 31.9%, and 33.7%, respectively[6]. Insomnia has associations with psychological issues such as depression and anxiety [7,8].

In a study on the Greek population, the prevalence of insomnia has risen significantly during the pandemic [9].

In addition to sleep duration, people's sleep quality has also been affected in the current pandemic situation. In a study in China, 18.2% of the general population had poor sleep quality during the COVID-19 pandemic [10].

Insomnia may have several patterns, such as difficulty initiating sleep (DIS), difficulty maintaining sleep (DMS), and early morning awakening (EMA) according to the diagnostic

10.12865/CHSJ.47.02.02

and statistical manual of mental disorders 5 (DSM-5), which are experienced separately or concurrently in patients who have insomnia. Although the effects of the COVID-19 pandemic on the prevalence of insomnia and sleep quality have been well studied in several nations, there is no study available on the effects of the pandemic on the insomnia symptoms and characteristics. The current study aimed to evaluate the subtle impact of the COVID-19 pandemic on insomnia symptoms and determine whether there are relations between psychometric parameters, fear of COVID-19, and different patterns of insomnia experienced by Iranian people during this pandemic.

Materials and Methods

Procedure

We designed a cross-sectional study. The first patients with COVID-19 in Iran were diagnosed in February 2020. We conducted this study in April 2020, in the first wave of COVID-19 in Iran. As officials had recommended people stay home and avoid close contact with other people, we conducted this study via online forms. We designed an online questionnaire using the www.epoll.pro website and sent it to people across the country using available social platforms. A message containing the study goals and objectives was sent to people via social platforms, and we invited those interested in participating in our study. It was mentioned in the message that the form is being filled anonymously, and participation in the study is voluntary, and those who were not interested in participating in the study could ignore the message.

The Research Deputy of Tehran University of Medical Sciences approved the study design (ethical code: IR.TUMS.VCR.REC.1399.233).

Measurements

The questionnaire consisted of questions on socio-demographic characteristics of the participants, including age, gender, marital status, educational level, and employment status. To evaluate the relation between insomnia and fear of COVID-19, we used the Insomnia Severity Index (ISI) and Fear of COVID-19 scale (FCV-19), respectively.

ISI and its Persian version are reliable and valid tools for evaluating insomnia [11,12].

It consists of 7 questions on individuals' current insomnia symptoms, the impact of insomnia on their lives, and their feeling toward their sleep patterns. The first three items evaluate DMS, DIS, and EMA, respectively. Each item can be answered from 0 to 4 on a Likert scale, and higher scores indicate a more severe problem. The total score is the sum of all items scores and ranges between 0 to 28. Total scores between 0 to 7 interpret as no clinically significant insomnia, 8 to 14 as subthreshold insomnia, 15 to 21 as moderate insomnia, and 22 to 28 as severe insomnia [11]. As we wanted to evaluate clinically relevant insomnia symptoms, we excluded those with no clinically significant insomnia (ISI score of less than 8) from the study (548 participants).

FCV-19 is a reliable and valid tool to evaluate fear of COVID-19 and consists of 7 items. Each item can be answered from 1 (strongly disagree) to 5 (strongly agree) on a Likert scale. The total score is the sum of all items score and ranges from 7 to 35, and higher scores indicate more fear of COVID-19 [13].

As depression and anxiety have associations with insomnia and fear and may act as confounding factors, we screened participants for depression and anxiety using Patient Health Questionnaire-2 (PHQ-2) and Generalized Anxiety Disorder Scale-2 (GAD-2), respectively. PHQ-2 and GAD-2 have two items on recent depression and anxiety symptoms, respectively, and each item can be answered on a Likert scale from 0 to 3, and higher scores indicate a more severe symptom. The total scores of these questionnaires are the sum of all items scores and are calculated from 6 [14,15].

PHQ-2 and GAD-2 total scores of 3 or more indicate positive screening for depression and anxiety, respectively [15,16].

These questionnaires are translated to Persian and proved to be reliable and valid tools for evaluating depression and anxiety in Iranian people[17,18].

Statistical analysis

The number and percentage of participants in different socio-demographic groups were calculated. We also calculated the prevalence of depression, anxiety, and insomnia among our participants with descriptive statistics. The number and percentage of people with different severities of DMS, DIS, and EMA were calculated separately and in each socio-demographic group. The mean and SD of participants' age and FCV-19 scores were calculated separately. We also calculated the mean and SD of the participant's age and FCV-19 scores based on the severity of DMS, DIS, and EMA. A Chi-square test was used to evaluate the differences between the categorical

 10.12865/CHSJ.47.02.02

variables in terms of DMS, DIS, and EMA. Kolmogorov Smirnov (KS) analysis was used to see whether the participants' age and FCV-19 scores were distributed normally or not. As they were not distributed normally (P<0.05), the Mann-Whitney U test was used to see whether age and FCV-19 scores differ significantly in different severities of DMS, DIS, and EMA or not. Multiple ordinal logistic regressions were used to determine which variables independently affect the severity of DMS, DIS, and EMA. SPSS software (version 16 for windows, SPSS inc, Chicago, Illinois) was used for analyses.

Results

In total, 675 people with a mean age of 40.28 years (SD=11.15) participated in the study. One-hundred and ninety-six (29%) were male, and 479 (71%) were female. Eighty-six participants (12.7%) were illiterate or had an educational level lower than a diploma, 164 (24.3%) had a diploma, and 425 (63%) had an educational level higher than a diploma. One-hundred and fifty-seven participants were unemployed, 282 (41.8%) were employees, and 236 (35%) were self-employed. Four-hundred and fifty-nine participants (68%) were married, and 216 participants (32%) were divorced or had never married.

Three hundred and forty-two participants (50.7%) had subthreshold insomnia, 275 (40.7%) participants had moderate insomnia, and 58 participants (8.6%) had severe insomnia. Six-hundred and seventeen participants (91.4%) had DIS, 585 participants (86.7%) had DMS, and 520 participants (77%) suffered from EMA. The prevalence of these disorders was significantly different from each other (P<0.05), and DIS was the most common insomnia pattern.

DIS, DMS, and EMA in different demographic groups and people with psychological issues are shown in Tables 1, 2, and 3, respectively. DIS, DMS, and EMA were more common in people with depression or anxiety (P<0.001). The mean FCV-19 score was significantly higher in those with more difficulty initiating and maintaining sleep and those who suffered more from EMA (P<0.001). The severity of EMA increased significantly with age (P<0.001).

Table 1. DIS in different demographic groups and people with psychological issues.

		Difficulty initiating sleep					
		None	Mild	Moderate	Severe	Very severe	P-value
Gender	Male (N=196)	20 (10.2%)	51 (26%)	77 (39.3%)	30 (15.3%)	18 (9.2%)	0.051
	Female (N=479)	38 (7.9%)	91 (19%)	180 (37.6%)	104 (21.7%)	66 (13.8%)	
Educational level	Lower than diploma (N=86)	14 (16.3%)	23 (26.7%)	29 (33.7%)	11 (12.8%)	9 (10.5%)	0.06
	Diploma (N=164)	15 (9.1%)	31 (18.9%)	66 (40.2%)	28 (17.1%)	24 (14.6%)	
	Higher than diploma (N=425)	29 (6.8%)	88 (20.7%)	162 (38.1%)	95 (22.4%)	51 (12%)	
Marital status	Single (N=216)	16 (7.4%)	50 (23.1%)	80 (37%)	43 (19.9%)	27 (12.5%)	0.864
	Married (N=459)	42 (9.2%)	92 (20%)	177 (38.6%)	91 (19.8%)	57 (12.4%)	
Occupational status	Unemployed (N=157)	12 (7.6%)	36 (22.9%)	58 (36.9%)	32 (20.4%)	19 (12.1%)	0.118
	Employee (N=236)	25 (10.6%)	59 (25%)	82 (34.7%)	49 (20.8%)	21 (8.9%)	
	Self-employed (N=282)	21 (7.4%)	47 (16.7%)	117 (41.5%)	53 (18.8%)	44 (15.6%)	
Age (years)		41.03 (9.96)	40.49 (11.84)	40.66 (10.67)	40.62 (11.29)	37.71 (11.85)	0.0302
Anxiety	Yes (N=438)	27 (6.2%)	67 (15.3%)	163 (37.2%)	108 (24.7%)	73 (16.7%)	**<0.001**
	No (N=237)	31 (13.1%)	75 (31.6%)	94 (39.7%)	26 (11%)	11 (4.6%)	
Depression	Yes (N=496)	31 (6.3%)	92 (18.5%)	190 (38.3%)	109 (22%)	74 (14.9%)	**<0.001**
	No (N=179)	27 (15.1%)	50 (27.9%)	67 (37.4%)	25 (14%)	10 (5.6%)	
FCV-19 score		17.79 (5.19)	18.87 (4.38)	21.28 (4.59)	23.64 (3.78)	24.42 (5.51)	**<0.001**

All values reported as number (percent) except the values for FCV-19 score and age, which were reported as mean (SD).
DIS: Difficulty initiating sleep, FCV-19: Fear of COVID-19

Table 2. DMS in different demographic groups and people with psychological issues.

		Difficulty maintaining sleep					
		None	Mild	Moderate	Severe	Very severe	P-value
Gender	Male (N=196)	28 (14.3%)	51 (26%)	55 (28.1%)	31 (15.8%)	31 (15.8%)	0.317
	Female (N=479)	62 (12.9%)	99 (20.7%)	135 (28.2%)	106 (22.1%)	77 (16.1%)	
Educational level	Lower than diploma (N=86)	17 (19.8%)	18 (20.9%)	25 (29.1%)	19 (22.1%)	7 (8.1%)	0.177
	Diploma (N=164)	19 (11.6%)	30 (18.3%)	44 (26.8%)	39 (23.8%)	32 (19.5%)	
	Higher than diploma (N=425)	54 (12.7%)	102 (24%)	121 (28.5%)	79 (18.6%)	69 (16.2%)	
Marital status	Single (N=216)	34 (15.7%)	45 (30%)	68 (31.5%)	40 (18.5%)	29 (13.4%)	0.317
	Married (N=459)	56 (12.2%)	105 (22.9%)	122 (26.6%)	97 (21.1%)	79 (17.2%)	
Occupational status	Unemployed (N=157)	23 (14.6%)	34 (21.7%)	48 (30.6%)	32 (20.4%)	20 (12.7%)	0.125
	Employee (N=236)	36 (15.3%)	57 (24.2%)	70 (29.7%)	45 (19.1%)	28 (11.9%)	
	Self-employed (N=282)	31 (11%)	59 (20.9%)	72 (25.5%)	60 (21.3%)	60 (21.3%)	
Age (years)		37.68 (10.89)	40.2 (11.33)	40.48 (10.9)	41.38 (11.33)	40.81 (11.22)	0.122
Anxiety	Yes (N=438)	48 (11%)	82 (18.7%)	117 (26.7%)	103 (23.5%)	88 (20.1%)	**<0.001**
	No (N=237)	42 (17.7%)	68 (28.7%)	73 (30.8%)	34 (14.3%)	20 (8.4%)	
Depression	Yes (N=496)	54 (10.9%)	105 (21.2%)	136 (27.4%)	109 (22%)	92 (18.5%)	**0.001**
	No (N=179)	36 (20.1%)	45 (25.1%)	54 (30.2%)	28 (15.6%)	16 (8.9%)	
FCV-19 score		19.12 (4.69)	20.08 (4.69)	21.11 (4.61)	22.27 (4.74)	24.12 (5.47)	**<0.001**

All values reported as number (percent) except the values for FCV-19 score and age, which were reported as mean (SD).
DMS: Difficulty maintaining sleep, FCV-19: Fear of COVID-19

Table 3. EMA in different demographic groups and people with psychological issues.

		Early morning awakening					
		None	Mild	Moderate	Severe	Very severe	P-value
Gender	Male (N=196)	39 (19.9%)	41 (20.9%)	48 (24.5%)	36 (18.4%)	32 (16.3%)	0.582
	Female (N=479)	116 (24.2%)	84 (17.5%)	112 (23.4%)	99 (20.7%)	68 (14.2%)	
Educational level	Lower than diploma (N=86)	23 (26.7%)	17 (19.8%)	17 (19.8%)	17 (19.8%)	12 (14%)	0.518
	Diploma (N=164)	31 (18.9%)	39 (23.8%)	42 (25.6%)	29 (17.7%)	23 (14%)	
	Higher than diploma (N=425)	101 (23.8%)	69 (16.2%)	101 (23.8%)	89 (20.9%)	65 (15.3%)	
Marital status	Single (N=216)	57 (26.4%)	37 (17.1%)	45 (20.8%)	47 (21.8%)	30 (13.9%)	0.443
	Married (N=459)	98 (21.4%)	88 (19.2%)	115 (25.1%)	88 (19.2%)	70 (15.3%)	
Occupational status	Unemployed (N=157)	48 (30.6%)	24 (15.3%)	31 (19.7%)	27 (17.2%)	27 (17.2%)	**0.039**
	Employee (N=236)	44 (18.6%)	46 (19.5%)	71 (30.1%)	46 (19.5%)	29 (12.3%)	
	Self-employed (N=282)	63 (22.3%)	55 (19.5%)	58 (20.6%)	62 (22%)	44 (15.6%)	
Age (years)		36.15 (10.06)	41.14 (11.32)	40.57 (10.61)	43.41 (10.96)	40.92 (12)	**<0.001**
Anxiety	Yes (N=438)	90 (20.5%)	72 (16.4%)	93 (21.2%)	110 (25.1%)	73 (16.7%)	**<0.001**
	No (N=237)	65 (27.4%)	53 (22.4%)	67 (28.3%)	25 (10.5%)	27 (11.4%)	
Depression	Yes (N=496)	114 (23%)	81 (16.3%)	111 (22.4%)	115 (23.2%)	75 (15.1%)	**0.003**
	No (N=179)	41 (22.9%)	44 (24.6%)	49 (27.4%)	20 (11.2%)	25 (14%)	
FCV-19 score		20.21 (5.16)	20 (5.1)	20.63 (4.71)	23.42 (3.69)	23.05 (5.58)	**<0.001**

All values reported as number (percent) except the values for FCV-19 score and age, which were reported as mean (SD).
EMA: Early morning awakening, FCV-19: Fear of COVID-19

The prevalence of depression and anxiety was 73.5% and 64.9%, respectively. Participants' mean FCV-19 score was 21.33 (SD=33). The prevalence of anxiety was 26.8%, 58.2%, 90.3%, and 98% in the first, second, third, and fourth quartile of FCV-19 scores, respectively. The prevalence of depression was 45.4%, 78.8%, and 92% in the first, second, third, and fourth quartile of FCV-19 scores, respectively. In the first, second, third, and fourth quartile of FCV-19 scores, 48.6%, 13%,

 10.12865/CHSJ.47.02.02

1.5%, and 1.3% of people neither had anxiety nor depression.

Multiple ordinal logistic regressions of the factors affecting different insomnia patterns are shown in Table 4. FCV-19 was a risk factor for all patterns of insomnia (OR=1.19, 1.12, 1.02 for DMS, DIS, and EMA, respectively). Age was a risk factor for EMA (OR= 1.09), but it was a protective factor for DMS (OR=0.98). Self-employment was a risk factor for DMS (OR=1.61) and DIS (OR=1.59).

Table 4. Results of the multiple ordinal logistic regressions of the factors affecting insomnia symptoms.

			OR	95% CI	SE	P-Value
Difficulty initiating sleep	FCV-19 score		1.19	1.16-1.23	0.015	<0.001
	Age		0.98	0.96-0.99	0.007	0.005
	Occupational status	Unemployed	1.15	0.78-1.69	0.195	0.459
		Self-employed	1.61	1.16-2.21	0.163	0.004
		Employee*	-	-	-	-
Difficulty maintaining sleep	FCV-19 score		1.12	1.09-1.15	0.014	<0.001
	Occupational status	Unemployed	1.1	0.77-1.58	0.184	0.581
		Self-employed	1.59	1.16-2.17	0.158	0.003
		Employee*	-	-	-	-
Early morning awakening	FCV-19 score		1.02	1.01-1.03	0.014	<0.001
	Age		1.09	1.06-1.12	0.006	<0.001

Discussion

Up to our knowledge, this is the first study on the impacts of the COVID-19 pandemic on the characteristics and patterns of insomnia in the general population. DIS was more common among our participants compared to DMS and EMA. Fear of COVID-19 was a risk factor for all insomnia patterns, but it affects DIS (OR=1.19) more than DMS and EMA. EMA takes less effect of fear of COVID-19 compared to other symptoms. Age was a protective factor for DIS but a risk factor for EMA in insomniac participants.

DIS was the most prevalent insomnia symptom during the COVID-19 pandemic. There is no study available on the characteristics of insomnia in the Iranian population before the COVID-19 pandemic. However, Aslan et al. found DIS as the most prevalent symptom among the Turkish population [19].

DIS has remained the most prevalent in the pandemic situation. As the fear of COVID-19 affects DIS more than other insomnia symptoms, DIS may be more susceptible to external threats than other insomnia symptoms and is affected before other symptoms. Negative emotions can lead to more difficulty in sleep initiation, reduced sleep duration, and poor sleep quality [20].

Negative emotions affect sleep, but inadequate sleep may, in turn, lead to negative emotions such as stress, anxiety, and worries [21].

As adequate high-quality sleep is one simple way to prevent the consequences of negative emotions on physical health, lack of enough sleep besides negative emotions may put people at higher risk of physical health problems at the time of the pandemic.

More prevalence of DIS among the insomniac population of the current study may not apply to other countries, especially developed countries, as the prevalence of DIS, DMS, and EMA is different in those countries. For example, DMS is more prevalent in the United States (US) [22], and studies are needed to evaluate the effects of the COVID-19 pandemic on insomnia characteristics in developed countries to have a more comprehensive global picture of insomnia patterns in the COVID-19 pandemic.

Previous studies in China [10], Italy [23,24], France [25], and Greece [26] did not evaluate the effects of the COVID-19 pandemic on insomnia patterns and only focused on insomnia itself. Only Yu et al. evaluated DIS in an urban population in China [27].

In Yu et al. study, insufficient store of masks, being worried about family members being infected, stress, interfered daily life because of COVID-19, lack of trust toward government to control the epidemic, and female gender were all related to the higher risk of DIS [27].

Fear of COVID-19, younger ages, and being self-employed were related to a higher risk of DIS in our study. Different variables entered the model for logistic regression analysis in two

studies, but there are similarities between them. For example, wearing masks is one of the main strategies for people to protect themselves against COVID-19, and they may feel safe when wearing a mask. Limited access to protective equipment in the early days of the COVID-19 pandemic may lead to fear in them, which can cause DIS. People who are self-employed have more troubles compared to those who are employed as they are responsible for their own business and health measures, and lockdown because of health measures may affect their business more. Such interference to people's daily life is recognized by Yu et al. as one of the risk factors for DIS [27].

Considering what was mentioned above, it seems that being scared, worried, and uncertain about the future of the pandemic are risk factors for DIS during the COVID-19 pandemic.

We found age as a protective factor for DIS (OR=0.98, 95% CI=0.96-0.99), but in contrast, it was a risk factor for EMA. There was no significant association between age and insomnia in previous studies [23,24]; neither was there an association between age and sleep quality [10].

In Rossi et al. study, the mean age of those with insomnia was lower compared to those without insomnia ($P<0.001$), but age was not an independent predictor of insomnia (Adjusted OR=0.99, 95% CI=0.98-1). Previous studies in the non-pandemic situation indicated that DIS and DMS were more common among adults aged 45 and over [22].

As we found age as a protective factor for DIS and a risk factor for EMA, eventually, age is responsible for the change in the sleep pattern during the pandemic and not for clinical insomnia. Because of changes in the circadian rhythm, older adults tend to wake up earlier than middle-aged and young adults [28], and EMA is more common in aged people [29].

EMA during the pandemic may be attributable to normal changes in older adults, and these changes are still the most crucial factor leading to EMA.

Participants who experienced more severe DIS, DMS, and EMA patterns had more frequency of anxiety and depression. However, none of these psychiatric diseases affected insomnia patterns independently. As there are relations between insomnia, depression, and anxiety [30], anxiety and depression may mediate the observed significant association between fear of COVID-19 and different patterns of insomnia. In this regard, fear may lead to anxiety and depression, leading to different patterns of insomnia.

Limitations

First, as the region did not undergo complete lockdown during the COVID-19 pandemic, we did not evaluate the effects of quarantine on participants' insomnia. As loneliness and being quarantined have impacts on insomnia patterns due to changing exposure to environmental cues of the circadian system and sleep-wake phase cycle. Thus, future studies evaluating the effect of these factors are necessary for a better understanding of the insomnia patterns during the pandemic, as it may have different management approaches. Second, differences exist between developed and developing countries in terms of sleep patterns and prevalence of insomnia patterns; therefore, our results may not apply to developed countries, and studies are needed to evaluate insomnia characteristics in developed countries.

Conclusions

Patterns of insomnia (DIS, DMS, and EMA) are all affected by fear of COVID-19, and among these, DIS is the most common pattern among the population of insomniac patients during the pandemic.

Insomnia attenuates immune function towards infectious diseases.

Thus the further investigation of COVID-19 fear in people with insomnia and the addition of attributed relieving or management strategies to conventional management of insomnia are reasonable approaches to improving people's sleep condition in the pandemic.

Moreover, in-depth characterization of sleep patterns among insomniac patients and the related interactions with COVID19 would provide novel and in-depth knowledge regarding interactions of special subtypes of insomnia and COVID-19; these novel pearls would be beneficial in the development of updated management plans for insomnia.

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Conflict of interests

Authors have no conflict of interest to declare.

References

1. Zhu N, Zhang D, Wang W, Li X, Yang B, Song J, Zhao X, Huang B, Shi W, Lu R. A novel coronavirus from patients with pneumonia in China, 2019. NEW ENGL J MED, 2020, 382(8):727-733.

2. Cucinotta D, Vanelli M. WHO declares COVID-19 a pandemic. Acta bio-medica: Atenei Parmensis, 2020, 91(1):157-160.
3. World Health Organization. Coronavirus disease 2019 (COVID-19): situation report[online], Available at „https://cdn.who.int/media/docs/default-source/wha-70-and-phe/20200721-covid-19-sitrep-183.pdf?sfvrsn=b3869b3_2" [Accessed 21.07. 2020]
4. Choi EPH, Hui BPH, Wan EYF. Depression and Anxiety in Hong Kong during COVID-19. Int J Environ Res Public Health, 2020, 17(10):3740.
5. Torales J, O'Higgins M, Castaldelli-Maia JM, Ventriglio A. The outbreak of COVID-19 coronavirus and its impact on global mental health. Int J Soc Psychiatry, 2020, 66(4):317-320.
6. Salari N, Mohammadi M, Vaisi-Raygani A, Abdi A, Shohaimi S, Khaledipaveh B, Daneshkhah A, Jalali R. The prevalence of severe depression in Iranian older adult: a meta-analysis and meta-regression. BMC Geriatr, 2020, 20(1):39.
7. Hertenstein E, Feige B, Gmeiner T, Kienzler C, Spiegelhalder K, Johann A, Jansson-Frojmark M, Palagini L, Rucker G, Riemann D, Baglioni C. Insomnia as a predictor of mental disorders: A systematic review and meta-analysis. Sleep Med Rev, 2019, 43:96-105.
8. Neckelmann D, Mykletun A, Dahl AA. Chronic insomnia as a risk factor for developing anxiety and depression. Sleep, 2007, 30(7):873-880.
9. Voitsidis P, Gliatas I, Bairachtari V, Papadopoulou K, Papageorgiou G, Parlapani E, Syngelakis M, Holeva V, Diakogiannis I. Insomnia during the COVID-19 pandemic in a Greek population. Psychiatry Res, 2020, 289:113076.
10. Huang Y, Zhao N. Generalized anxiety disorder, depressive symptoms and sleep quality during COVID-19 outbreak in China: a web-based cross-sectional survey. Psychiatry Res, 2020, 288:112954.
11. Bastien CH, Vallières A, Morin CM. Validation of the Insomnia Severity Index as an outcome measure for insomnia research. Sleep medicine, 2001, 2(4):297-307.
12. Yazdi Z, Sadeghniiat-Haghighi K, Zohal MA, Elmizadeh K. Validity and reliability of the Iranian version of the insomnia severity index. Malays J Med Sci, 2012, 19(4):31-36.
13. Ahorsu DK, Lin C-Y, Imani V, Saffari M, Griffiths MD, Pakpour AH. The fear of COVID-19 scale: development and initial validation. INT J MENT HEALTH AD, 2020, 0(0):0.
14. Kroenke K, Spitzer RL, Williams JB. The Patient Health Questionnaire-2: validity of a two-item depression screener. MED CARE, 2003, 41(11):1284-1292.
15. Kroenke K, Spitzer RL, Williams JB, Monahan PO, Löwe B. Anxiety disorders in primary care: prevalence, impairment, comorbidity, and detection. Annals of internal medicine, 2007, 146(5):317-325.
16. Löwe B, Kroenke K, Gräfe K. Detecting and monitoring depression with a two-item questionnaire (PHQ-2). Journal of psychosomatic research, 2005, 58(2):163-171.
17. Dadfar M, Lester D. Psychometric characteristics of Patient Health Questionnaire-2 (PHQ-2) in Iranian psychiatric outpatients. Austin J Psychiatry Behav Sci, 2017, 4(1):1059.
18. Ahmadi SM, Masjedi Arani A, Bakhtiari M, Davazdah Emamy MH. Psychometric Properties of Persian Version of Patient Health Questionnaires-4 (PHQ-4) in Coronary Heart Disease Patients. Iranian Journal of Psychiatry and Behavioral Sciences, 2019, 13(4):e85820.
19. Aslan S, Gulcat Z, Selda Albayrak F, Maral I, Yetkin S, Sutcigil L, Aycan S, Isik E, Aydin H. Prevalence of insomnia symptoms: results from an urban district in Ankara, Turkey. International journal of psychiatry in clinical practice, 2006, 10(1):52-58.
20. Kalmbach DA, Pillai V, Roth T, Drake CL. The interplay between daily affect and sleep: A 2-week study of young women. Journal of Sleep Research, 2014, 23(6):636-645.
21. Baglioni C, Spiegelhalder K, Lombardo C, Riemann D. Sleep and emotions: a focus on insomnia. Sleep medicine reviews, 2010, 14(4):227-238.
22. Ohayon MM, Roth T. What are the contributing factors for insomnia in the general population? Journal of psychosomatic research, 2001, 51(6):745-755.
23. Gualano MR, Lo Moro G, Voglino G, Bert F, Siliquini R. Effects of COVID-19 lockdown on mental health and sleep disturbances in Italy. International Journal of Environmental Research and Public Health, 2020, 17(13):4779.
24. Rossi R, Socci V, Talevi D, Mensi S, Niolu C, Pacitti F, Di Marco A, Rossi A, Siracusano A, Di Lorenzo G. COVID-19 pandemic and lockdown measures impact on mental health among the general population in Italy. An N= 18147 web-based survey. Frontiers in psychiatry, 2020, 11:790.
25. Kokou-Kpolou CK, Megalakaki O, Laimou D, Kousouri M. Insomnia during COVID-19 pandemic and lockdown: Prevalence, severity, and associated risk factors in France population. Psychiatry Research, 2020, 290:113128.
26. Voitsidis P, Gliatas I, Bairachtari V, Papadopoulou K, Papageorgiou G, Parlapani E, Syngelakis M, Holeva V, Diakogiannis I. Insomnia during the COVID-19 pandemic in a Greek population. Psychiatry Research, 2020, 289:113076.
27. Yu BY-M, Yeung W-F, Lam JC-S, Yuen SC-S, Lam SC, Chung VC-H, Chung K-F, Lee PH, Ho FY-Y, Ho JY-S. Prevalence of Sleep Disturbances during COVID-19 Outbreak in an Urban Chinese Population: A Cross-Sectional Study. Sleep Medicine, 2020, 74:18-24
28. Li J, Vitiello MV, Gooneratne NS. Sleep in Normal Aging. Sleep Med Clin, 2018, 13(1):1-11.
29. Neubauer DN. Sleep problems in the elderly. American family physician, 1999, 59(9):2551.
30. Ypsilanti A, Lazuras L, Robson A, Akram U. Anxiety and depression mediate the relationship between self-disgust and insomnia disorder. Sleep Health, 2018, 4(4):349-351.

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