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ARTICLE

Nonorganic sleep disorders and sleep quality among the general population of Mongolia

Enkhnaran Tumurbaatar[1], Gantsetseg Tumur-Ochir[2], Enkhjin Bat-Erdene[1], Tsogt-Itgel Munkhbat[1], Chimeddulam Erdenebaatar[1], Bulgantuya Bumandorj[1], Battuvshin Lkhagvasuren[3] and Tsolmon Jadamba[1]*

[1] Sleep Research Laboratory, Brain and Mind Research Institute, Mongolian Academy of Sciences, Ulaanbaatar, Mongolia
[2] Department of Surveillance and Statistics, National Center for Mental Health, Ulaanbaatar, Mongolia
[3] Department of Psychosomatic Medicine, International University of Health and Welfare Narita Hospital, Narita, Japan

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Abstract: The aim of this study was to determine the prevalence of non-organic sleep disorders and sleep quality, using a structured psychiatric interview following screening through the Pittsburgh Sleep Quality Index (PSQI) among the general population. This nationwide population-based cross-sectional study was carried out between August and October 2020 and involved 964 participants (74% women, mean age: 40.72±14.34) who were randomly selected from 64 clusters in 10 sites of Mongolia. 27.9% of the study participants were evaluated as having non-organic sleep disorders based on the diagnostic guidelines of the International Classification of Diseases, Tenth Edition, Clinical Modification (ICD-10). The prevalence of non-organic sleep disorders differed in age ($p<0.001$). Non-organic sleep disorders were related to age, employment, diastolic blood pressure, sleep quality, and quality of life. The prevalence of non-organic sleep disorders in the general population of Mongolia was calculated as 27.9%, while the prevalence rate of the poor sleep quality was 42.2%.

Keywords: *Non-organic sleep disorders; sleep quality; PSQI; COVID-19; Mongolia;*

INTRODUCTION

Sleep plays an important role in brain functions and is a vital component of a healthy well-being. Sleep problems present a global burden ranging from 23 to 56% in the general population [1]. Sleep problems are associated with various psychiatric disorders, suicidal ideation, mental and physical disability, and poor quality of life [2, 3]. Individuals with sleep problems frequently seek medical help in psychiatric practice. ICD-10 lists sleep problems as independent disorders including non-organic disorders (F51) and other sleep disorders (G47). Non-organic disorders include insomnia (F51.0), sleep-wake schedule disorders (F51.2), sleepwalking or somnambulism, sleep terrors (F51.4), and nightmares (F51.5), whereas other sleep disorders include insomnia due to organic causes, hypersomnia, sleep-wake schedule disorders due to organic causes, sleep apnea, narcolepsy and cataplexy.

***corresponding author: tsolmon@mas.ac.mn** https://orcid.org/0000-0002-7455-9777

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Apnea (R06), restless leg syndrome (G25.81), and stiff-man syndrome (G25.82) are also considered as sleep disorders [4, 5]. Moreover, sleep problems are either included as a symptom of many psychiatric disorders or integrated as part of clinical presentation, i.e. depressive disorders or schizophrenia [2]. Worldwide, the prevalence of sleep disorders in the general population are estimated between 20 and 42% [6]. However, findings from high-income countries may not be generalizable to Mongolia, as sleep disorders and sleep problems were underrecognized in developing countries, such as Mongolia.

Furthermore, the recent outbreak of COVID-19 had negatively impacted sleep quality and increased the prevalence of sleep disorders across the globe [7-10]. The first local case of COVID-19 in Mongolia was detected on 10 November, 2020.

Considering the negative impact of centralized measures by the Mongolian Government, including lockdown, curfew, closures of educational institutions, personal safety protection, international travel restrictions, quarantines of international travelers, and infection surveillance, it is essential to examine the sleep quality of the population at this critical moment [11].

However, so far, there has been no study on the prevalence and characteristics of sleep disorders, both in the general and clinical populations, in Mongolia. Moreover, no testing instruments for an accurate assessment of sleep quality for use in the general population has been rigorously translated and validated. Therefore, we aimed to determine the prevalence of sleep disorders, as well as sleep quality, using globally recognized screening tools, in the general population of Mongolia.

MATERIALS AND METHODS

Study Design and Population

The study was carried out between September and October 2020. People aged between 10 and 80 years living in Mongolia were the targeted populations. The estimated baseline level was 9.3%, as confirmed by a previous study on the prevalence of sleep disturbances [12]. The sample size needed was 1,944, based on calculations with 95% confidence interval, a margin of error of 0.05%, a design effect of 1.50, an anticipated response rate of 80%, and 8 age-sex groups (<18, 18-29, 30-44, 45< years for men and women) by WHO STEPS Surveillance Manual [13].

The cohort was designed using a multi-stage cluster sampling. The current population of Mongolia is 3,296,866 as of 2019, based on the National Statistical Office of Mongolia, of which one half of them live in Ulaanbaatar, the capital city, and the remaining half of them live in 4 rural regions [14]. The area of Mongolia is large, travel costs are high, and the population density is sparse. In the first stage, we randomly selected primary sampling unit based on the regions of the country. There are four geographical regions in Mongolia, which include 5-6 provinces or geopolitical units. 10 sites, including the capital city and 9 provinces were sampled from all four regions (Western, Central, Mountain, and Eastern) in Mongolia. The capital city Ulaanbaatar and the 9 provinces were Gobi-Altai, Khovd (Western region), Uvurkhangai, Arkhangai (Mountain region), Tuv, Dornogobi (Central region), Dornod, Sukhbaatar, and Khentii (Eastern region) (Fig. 1. A.). In the second stage, there were 64 sampling clusters, which included 38 primary health centers of 8 districts in Ulaanbaatar and 26 primary health centers of 4 rural regions of the country. Primary health centers provide health care services to all individuals within certain geopolitical units where the population is registered by name, age, gender, education, employment, and household income. In the final stage, 30 individuals were randomly selected from each center. If the selected participants were not available at the center, they were replaced by the next available participants, regardless of their age and sex.

Participants were interviewed by trained research personnel or medical doctors using a structured questionnaire. Information regarding demographic characteristics, medical history,

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symptoms of sleep problems were collected and vital signs were measured. Of the total 1,976 participants, data from 964 participants were used in the present analysis (Fig. 1. B.).

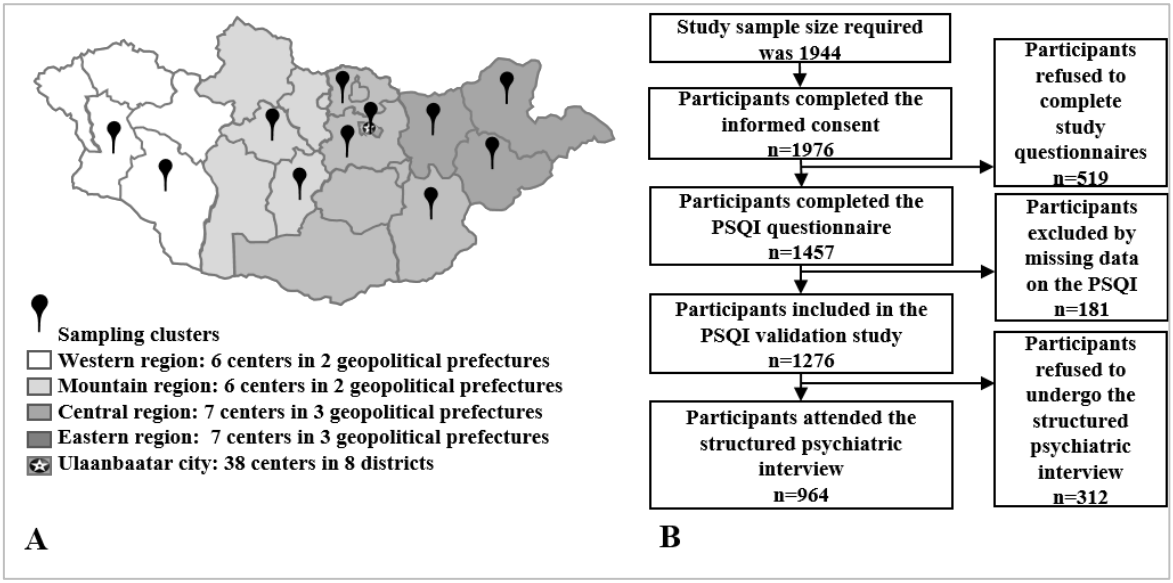

Figure 1. A. Cohort study centers. The cohort consists of 64 sampling centers including 30 primary health centers of 8 districts in Ulaanbaatar and 34 primary health centers of 4 rural regions in Mongolia. B. Study sample inclusion flowchart. A total of 1976 participants were included in analysis from the cohort with completed informed consent. From this cohort, 519 participants refused to complete the study questionnaire, and 181 participants excluded by missing data. The final sample in the present analysis included 1276 patients. 312 participants did not have an available psychiatric interview record to link with administrative data

Written informed consent was obtained from all participants. The institutional review board and Ethics committee of the the Mongolian National University of Medical Sciences approved the study protocol and procedures for informed consent on 5 March 2020.

Questionnaires

PSQI

One widely used self-reported measure of sleep quality, the PSQI, has been established as a valid scale with acceptable psychometric properties when used among clinical and non-clinical population in diverse global settings [15, 16]. The PSQI is a self-report questionnaire containing 19 response items, which are further divided into 7 categories: sleep duration (C1), sleep disturbance (C2), sleep latency (C3), daytime dysfunction due to sleepiness (C4), sleep efficiency (C5), overall sleep quality (C6), and sleep medication use (C7). Each category is given a score from 0 to 3, where a higher value indicates dysfunction. The total score ranges from 0 to 21, with a score above 5 indicating poor sleep quality.

The cut-off value of 5 was chosen by Buysse et al., as the optimal cut-off score based on a receiver operating curve (ROC) comparison to polysomnographic tests with a sensitivity of 89.6%, and a specificity of 86.5 [15].

World Health Organization Quality of Life Assessment (WHOQOL-BREF)

The WHOQOL Group defines quality of life (QoL) as “an individual’s perception of their position in life, in the context of the culture and value systems in which they live, and in relation to their goals, expectations, standards and concerns.” It is a broad ranging concept affected in a complex way by the person's physical health (Domain 1), psychological state (Domain 2), social relationships (Domain 3) and their relationship to salient features of their environment (Domain 4). We used developed short form WHOQOL-BREF to assess the QoL associated with sleep problems among the Mongolian population. It has a number of advantages, as it is one of the most commonly used generic QoL questionnaires developed by the WHOQOL group in 1996.

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The questionnaire has a short completion time and is suitable for large-sample surveys or clinical trials in clinical and non-clinical populations. It is an open source and free to use for non-commercial purposes, and has been translated into about 40 different languages. The Mongolian version of the structured WHOQOL-BREF includes 26 standard items from the original WHOQOL-BREF, including two items on General QoL and General Health questionnaires. The remaining 24 items, on a five-point scale, are classified into four domains. The total score for each domain is converted to a score that ranges either from 4 to 20 or from 0 to 100, with low scores indicating poor QoL [18, 19].

Hospital Anxiety Depeession Scale (HADS)

Psychological symptoms were assessed using the Hospital Anxiety and Depression Scale (HADS). The questionnaire consists of 14 items, seven of them are for anxiety and the remaining seven are for depression. Individuals might feel tested for certain mental disorders; thus, any symptoms of severe psychopathology are not included intending to increase acceptability and preclude. This makes HADS more sensitive to milder psychopathology. The ranges of scores for cases on each subscale are: 0–7 or normal, 8–10 or mild disorder, 11–14 or moderate disorder, and 15–21 or severe disorder [20].

Clinical examination

Vital function indices

To determine the current physical health status and potential associations with mental health characteristics, We measured four primary vital signs including body temperature measured in skin (forehead, wrest) with an electronic infrared thermometer gun (the Tida, TD-133, China), blood pressure and heart rate were measured by an advanced blood pressure monitor (BP A6 PC, Microlife, Switzerland), and oxygen saturation (SpO_2) was measured by a pulse oximetry (PO40, Beurer, Germany). All procedures were non-invasive and have been taken by either nurses or medical doctors.

Structured psychiatric interview

All participants were asked to take an individual structured psychiatric interview. All psychiatrists were licensed and trained in structured interview before the study began. The interviews were conducted in a separate room to provide the individual`s privacy. The ICD-10 is a currently available diagnostic system to classify sleep conditions in Mongolia. This WHO publication groups sleep disorders into global categories of organic and non-organic origin. Organic sleep disorders, which are classified using “G” codes, focus on neurologically-based sleep disorders and diseases of the nervous system. Non-organic sleep disorders, which are classified using “F” codes, focus on mental and behavioral disorders. ICD-10 diagnostic guidelines were used to diagnose insomnia disorder, hyper-somnolence disorder, narcolepsy, and parasomnias. The sleep concerns were assessed with a specially developed structured psychiatric interview that can help clinicians gather important details concerning a patient’s sleep complaint, such as acuity or chronicity, course, factors alleviating or exacerbating the condition, and any previous treatment utilization. To help stablish the etiology of their sleep concerns, it is important to inquire about particular medical or mental health conditions, life even ts, and substance use present at the onset of the sleep problem. All interviews were noted. The average time for each interview was 40 minutes. (See details in Appendix 1)

Statistical Analysis

Data were presented as a mean ± standard deviation. Distributions of continuous variables were tested by the Kolmogorov Smirnov test. Differences between categorical and continuous variables were tested by the Mann Whitney U and Kruskal Wallis tests, where appropriate. Binary logistic and multinomial logistic regression tests were used to determine the effect of risk factors (socio-demographic characteristics) on the prevalence of non-organic sleep disorders. An odds ratio (OR) was used to measure the association between an exposure and an outcome (i.e how risk factors affect non-organic sleep disorders). A 95% confidence interval (CI) was used to estimate the precision of the OR, with statistical significance set at $p<0.05$ (two-sided).

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RESULTS AND DISCUSSION

Prevalence of nonorganic sleep disorders

Demographic characteristics

A total of 1,276 participants completed the survey questionnaire, 948 (74.3%) were women, 357 (28%) held a bachelor's degree or above, 859 (67.3%) were married and registered with the national registering agency and 621 (48.67%) were residents of Ulaanbaatar city. Compared with good sleepers, poor sleepers were less likely to be living in rural areas (p=0.009).

Participants who went through structured psychiatric interview (n=976, mean age=40.7±14.3,) 269 (27.9%) people evaluated as having non-organic sleep disorders based on ICD-10 diagnostic guidelines for mental and behavioral disorders, of these 204 (75.8%) were women. The age-related difference in the prevalence of non-organic sleep disorders was largest in participants, where ages over 30 reached a high prevalence rate of 35.7%-51.3% (vs 3.3%-9.7% for younger ages). The detailed demographic information of the participants is shown in Table 1.

Table 1. Demographic characteristics of participants by PSQI and Psychiatric interview

Selected Variables n(%)	Non-organic sleep disorder (n=964)				P value*	Sleep Quality (n=1276)				P value*
	Yes		No			Poor Sleeper		Poor Sleeper		
	269(27.9)		695(72.1)			538(42.2)		538(42.2)		
Gender										
Male	65	(24.2)	128	128	0.41	128	(24.2)	186	(26.8)	0.182
Female	204	(75.8)	410	410		410	(75.8)	509	(73.2)	
Age										
Years, mean ± SD	44.40	±12.93	40.44	40.44	<0.001	40.44	±12.93	39.29	±14.61	0.312
Age groups by										
< 18	9	(3.3)	43	43	<0.001	43	(3.3)	82	(10.4)	0.158
18–29	26	(9.7)	93	93		93	(9.7)	121	(17.4)	
30–44	96	(35.7)	171	171		171	(35.7)	235	(33.8)	
45<	138	(51.3)	231	231		231	(51.3)	267	(38.4)	
Marital status										
Married	193	(71.7)	357	357	0.191	357	(71.7)	457	(65.8)	0.34
Never married	38	(14.1)	108	108		108	(14.1)	156	(22.4)	
Others#	38	(14.1)	73	73		73	(14.1)	82	(11.8)	
Education										
Below middle school	113	(42.0)	244	244	0.243	244	(42.0)	324	(46.6)	0.581
Associate's degree	74	(27.5)	144	144		144	(27.5)	172	(24.7)	
Bachelor's degree	71	(26.4)	131	131		131	(26.4)	178	(25.6)	
Above Master's degree	11	(4.1)	19	19		19	(4.1)	21	(3.0)	
Employment										
Student	17	(6.3)	66	66	0.078	66	(6.3)	101	(14.5)	0.271
Pensioner	66	(24.5)	117	117		117	(24.5)	158	(22.7)	
Unemployed	44	(16.4)	72	72		72	(16.4)	85	(12.2)	
Employed	142	(52.8)	283	283		283	(52.8)	351	(50.5)	
Income										
<175$	182	(67.7)	340	340	0.065	340	(67.7)	425	(61.2)	0.938
175-525	83	(30.9)	193	193		193	(30.9)	259	(37.3)	
>525$	4	(1.5)	5	5		5	(1.5)	11	(1.6)	
Living condition										
Apartment	71	(26.4)	171	171	0.152	171	(26.4)	238	(34.2)	0.401
Ger	101	(37.5)	162	162		162	(37.5)	218	(31.4)	

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House	93	(34.6)	185	185		185	(34.6)	217	(31.2)	
Others	4	(1.5)	20	20		20	(1.5)	22	(3.1)	
Place of residency										
Ulaanbaatar	141	(52.4)	285	285	0.311	285	(52.4)	339	(48.8)	0.009
Rural area	128	(47.6)	253	253		253	(47.6)	356	(51.2)	

** Significance tested using Kruskal-Wallis test, whereas Mann-Wittney U test for gender and place of residency*
 # Others included re-married, co-habiting, separated, divorced, and widowed, SD (standard deviation).

Vital function indices and psychological symptoms

Compared with healthy people, the mean of diastolic blood pressure, the PSQI total score, all component scores except C7, and anxiety scores were higher, and WHOQOL-BREF all domains mean scores except Domain 3, were lower in people, who had a non-organic sleep disorder by structured psychiatric interview. (Table 2).

Table 2. Vital function indices, sleep quality, QoL, and psychological symptoms of participants by psychiatric interview

Selected Variables	Non-organic sleep disorder (n=964)				P value*
	Yes n= 269, (27.90%)		No n=695, (72.10%)		
Vital function indices					
Body temperature, mean ± SD	36.4	±0.33	36.4	±0.32	0.561
Heart rate, mean ± SD	77.6	±10.9	78.7	±11.9	0.386
Diastolic pressure, mean ± SD	81.7	±13.9	78.5	±12.8	0.01
Systolic pressure, mean ± SD	127.9	±23.7	123.6	±19.3	0.083
SpO2, mean ± SD	94.6	±3.3	94.8	±2.8	0.301
PSQI					
PSQI total score, mean ± SD	7.13	±3.67	5.03	±3.15	<0.001
C1 score, mean ± SD	1.16	±1.10	0.67	±0.92	<0.001
C2 score, mean ± SD	1.04	±0.67	0.83	±0.61	<0.001
C3 score, mean ± SD	1.38	±0.99	0.95	±0.88	<0.001
C4 score, mean ± SD	1.35	±0.60	1.02	±0.63	<0.001
C5 score, mean ± SD	1.53	±1.15	1.09	±1.08	<0.001
C6 score, mean ± SD	0.25	±0.66	0.13	±0.48	0.001
C7 score, mean ± SD	0.43	±0.75	0.34	±0.67	0.064
WHOQOL-BREF					
General QoL	3.84	±0.68	3.96	±0.72	0.018
General health	3.50	±0.85	3.80	±0.82	<0.001
Domain 1 score, mean ± SD	56.86	±14.61	64.73	±13.46	<0.001
Domain 2 score, mean ± SD	69.90	±13.72	74.22	±13.07	<0.001
Domain 3 score, mean ± SD	68.15	±15.36	70.02	±16.73	0.101
Domain 4 score, mean ± SD	65.59	±13.60	69.12	±14.11	<0.001
HADS					
Anxiety score, mean ± SD	6.88	±3.50	6.03	±3.30	<0.001
Depression score, mean ± SD	6.09	±2.94	5.67	±2.83	0.074

**Significance tested using Kruskal-Wallis test.*

Risk factors related with the nonorganic sleep disorders

Binary logistic regression analyses found that an increased risk of non-organic sleep disorder was associated with those who had higher diastolic blood pressure (OR 1.018, p=0.045), those with poor sleep quality PSQI total score (OR 1.191, p < 0.001), C3 (OR 1.348, p < 0.001), and C4 (OR 1.651, p =0.003). Whereas, decreased risk of non-organic sleep disorders was associated with younger ages <18, and 18-29 (OR 0.242, p<0.001; OR 0.416, p<0.001 vs age older than 45, respectively), those who were pensioners (OR 0.399, p= 0.001 vs. employed), those who had higher mean scores in Domain 1 (OR 0.971, p= 0.001), and Domain 2 (OR 0.979, p=0.047) of QoL (Table 3). Full results of the regression analyses are shown in Appendix 1.

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Table 3. Risk factors related with non-organic sleep disorders

Characteristics	B	P Value*	Exp(B)	95% Confidence Interval for Exp(B)	
				Lower Bound	Upper Bound
Age by groups					
<18	-1.419	<0.001	0.242	0.117	0.498
18–29	-0.878	<0.001	0.416	0.260	0.666
Employment					
Pensioner	-0.051	0.001	0.399	0.227	0.701
Vital function indices					
Diastolic pressure	0.018	0.045	1.018	1.000	1.036
PSQI					
PSQI total	0.175	<0.001	1.191	1.142	1.243
C3	0.298	0.004	1.348	1.098	1.654
C4	0.501	0.003	1.651	1.184	2.300
WHOQOL- BREF					
General QoL	0.659	0.010	1.933	1.172	3.188
Domain 1	-0.029	0.001	0.971	0.955	0.988
Domain 2	-0.021	0.047	0.979	0.959	1.000

*B, Unstandardized Beta; Exp(B), Odds ratio; *Significance by the binary logistic regression analysis*

Sleep disorders are common; however, prevalence estimates of different sleep disorders vary. Although the prevalence of sleep disorder insomnia is high in the elderly population, reports from different parts of the world reveal of range of 6 to 60.9% [22]. In comparison, a multinational, large-scale study of sleep disturbances among populations of eight developing countries showed a 17% prevalence rate of sleep problems [23], and the prevalence of non-organic sleep disorders among Korean adults was 9.1% [24], suggesting no-norganic sleep disorders as a serious mental health issue in Mongolia compared to other countries.

Previous studies in China and Russia showed similar levels of poor sleep quality when compared to our result. Among the Chinese population, the prevalence of poor sleep quality was reported to be 33.8%-41.5% [25]. In Russia, the prevalence of poor sleep quality was reported at 56% among students [26]. Poor sleepers were much more likely to live in Ulaanbaatar city and to have low SpO2 levels. This may be related with the serious air pollution of Ulaanbaatar [27]. Poor sleep quality is associated with increased mental problems, the current results represent the urgent need for raising public awareness of brain health and sleep quality.

Based on the results of both EFA and CFA, a two-factor model demonstrated a better fit than the one-factor model proposed by Buysse [15], which was consistent with reports from several previous studies [28, 29]. Studies designed to further validate the three-factor structure of the PSQI across clinical, and ethnically diverse research populations are warranted in order to assess the comparative validity and clinical utility of the three-factor specific scoring [30, 31], our two-factor score [32], and the single global score of the PSQI. Our findings suggest that the use of a single summed global score of all seven componets of the PSQI might not be the best option for analyzing sleep quality. In view of the factor analysis literature, it is not a coincidence that the present model fits very well. Future studies are warranted to further explore variation between populations due to differences in culture, demographics, and linguistics.

The Mongolian version of the PSQI demonstrated good construct validity when used among the Mongolian population. An overall Cronbach's α cannot simply be interpreted as an index for the internal consistency of the PSQI because the calculation for the Cronbach's α requires that all items measure the same construct . Our review of the published literature revealed a wide range of reported Cronbach α for PSQI, with a low of 0.43 to a high of 0.8 [33, 34]. Given the observed two-factor structure, we reported an

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overall Cronbach's α of 0.73, which is consistent with other studies.

Previous studies in the USA demonstrated lower employment rates, lower wages, and higher welfare income utilization among those with sleep disorders [33]. This study agrees with other studies that have observed correlations between sleep quality measures and self-reported QoL measures and psychologigal symptoms. In a previous study, poor sleeper had decreased QoL in physical and social domains. Similarly, good sleepers had much higher QoL in all domains than poor sleepers. It has been previously reported that PSQI global scores negatively correlated significantly with measures of anxiety and depression. Although the presence of physiological sleep disturbance is characteristic of depression, there may be an alternate explanation, which are supported by these previous findings, as well as the present data. Perhaps, subjective sleep quality measures, such as the PSQI better detect this negative cognitive viewpoint than the types of sleep disturbances observed with other measurements [28].

The present study was limited as a cross-sectional study, meaning, it did not provide information regarding the persistence of sleep related symptoms over time. Longitudinal studies are warranted to estimate the bi-directional associations of non-organic sleep disorders, sleep quality and QoL in this population. Further studies are needed to determine the duration, the sleep stages, total sleep time, time awake in bed, and arousals than they have to do with quantities of each sleep stage using polysomnography. In addition, self-reported data from cohort should be linked to household dataset of the NSO. Despite these limitations, this is the first study to determine the prevalence of non-organic sleep disorders, sleep quality, and evaluate the psychometric properties of the Mongolian version of the PSQI among the general population of Mongolia. Given the relatively large sample size, we were able to examine factor structures and to ensure the stability of the factor solution.

Hence, this study is an important validation of the PSQI in Mongolia, and it provides an assessment of the tool's advantages and disadvantages for future work on sleep quality related to COVID-19.

The study was conducted from August to October of 2020, just before the introduction of the harshest COVID-19 restrictions due to a local outbreak in November. With further planned research in the summer of 2021, this provides a unique opportunity to see the sleep disturbances of the population immediately before and after the effects of the pandemic, providing insight into the sleep quality impacts of COVID-19 in Mongolia, as well as similar economic and societal disruptions. In this study, we present the data from the initial 2020 survey in order to describe the prevalence of non-organic sleep disorders prior to the disruptions from COVID-19.

Conflict of Interest

The authors state no conflict of interest.

Abbreviations

PSQI, Pittsburgh Sleep Quality Index; ICD-10, the International Classification of Diseases, Tenth Edition, Clinical Modification; C1, sleep duration; C2, sleep disturbance; C3, sleep latency; C4, daytime dysfunction due to sleepiness; C5, sleep efficiency; C6, overall sleep quality; C7, sleep medication use; ROC, receiver operating curve; QoL, quality of life; WHOQOL-BREF, World Health Organization Quality of Life Assessment; WHO, the World Health Organization; Domain 1, physical health; Domain 2, psychological state; Domain 3, social relationships; Domain 4, relationship to salient features of their environment; HADS, the Hospital Anxiety and Depression Scale; SpO2, arterial oxygen saturation; WHO, the World Health Organization; OR, odds ratio; CI, confidence interval; EFA, exploratory factor analysis; PCA, the principal component analysis; CFA, confirmatory factor analysis; CFI, goodness-of-fit index; SRMR, Standardized Root Mean Square Residual, RMSEA, root mean square error of approximation; β, unstandardized regression coefficients; SD, standard deviation; AUC, area under curve;

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Appendix 1. Factors related with non-organic sleep disorders

Characteristics		Unstandardized B	*P* Value	Exp(B)	95% Confidence Interval for Exp(B)	
					Lower Bound	Upper Bound
Gender	Male	0.072	0.716	1.074	0.730	1.581
	Female	0				
Partici-pants' age		0.046	0.146	1.047	0.984	1.114
Age by groups	<18	-1.419	<0.001	0.242	0.117	0.498
	18–29	-0.878	<0.001	0.416	0.260	0.666
	30–44	0.235	0.142	0.790	0.577	1.082
	>45	0				
Marital status	Married	0.025	0.919	1.026	0.627	1.677
	Never married	0.313	0.395	1.367	0.665	2.812
	Others	0				
Education	Middle school and below	-0.847	0.065	0.429	0.174	1.054
	Associate's degree	-0.586	0.195	0.556	0.229	1.351
	Bachelor's degree	-0.345	0.431	0.708	0.300	1.670
	Master's degree and above	0	0.065	0.429	0.174	1.054
Employ-ment	Student	-0.048	0.306	0.597	0.222	1.603
	Pensioner	-0.051	0.001	0.399	0.227	0.701
	Unemployed	-0.044	0.175	0.678	0.387	1.188
	Employed	0				
Income	<175$	-0.146	0.831	0.865	0.228	3.281
	175-525	-0.736	0.278	0.479	0.127	1.809
	>525$	0				
Living condition	Apartment	-1.100	0.490	0.333	0.015	7.561
	Ger	-0.318	0.841	0.728	0.032	16.301
	House	-0.586	0.712	0.557	0.025	12.458
	Others	0				
Place of residency	Ulaanbaatar	0.35	0.861	1.035	0.702	1.526
	Rural areas	0				
Vital function indices	Body temperature	-0.077	0.747	0.926	0.580	1.478
	Heart rate	-0.013	0.051	0.987	0.974	1.000
	Diastolic pressure	0.018	0.045	1.018	1.000	1.036
	Systolic pressure	0.001	0.859	1.001	0.990	1.012
	Oxygen saturation	-0.041	0.103	0.960	0.915	1.008
PSQI	PSQI total	0.175	<0.001	1.191	1.142	1.243
	1. Sleep duration	0.159	0.140	1.172	0.949	1.447
	2. Sleep disturbance	0.240	0.130	1.272	0.932	1.736
	3. Sleep latency	0.298	0.004	1.348	1.098	1.654
	4. Sleepiness	0.501	0.003	1.651	1.184	2.300
	5. Sleep efficiency	0.103	0.296	1.108	0.914	1.344
	6. Overall sleep quality	-0.118	0.457	0.889	0.651	1.213
	7. Sleep medication use	-0.242	0.077	0.785	0.600	1.027
WHOQOL-BREF	General QoL	0.659	0.010	1.933	1.172	3.188
	General health	-0.327	0.126	0.721	0.474	1.097
	Physical health domain	-0.029	0.001	0.971	0.955	0.988

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	Psychological domain	-0.021	0.047	0.979	0.959	1.000
	Social relationship domain	0.011	0.116	1.011	0.997	1.025
	Environmental domain	0.011	0.282	1.011	0.991	1.030
HADS	Anxiety	0.024	0.437	1.024	0.964	1.087
	Depression	-0.049	0.164	0.953	0.890	1.020

*Significance by the binary logistic regression analysis