

**Original research article****Study of sleep problems and their correlation to severity of illness in patients with schizophrenia****<sup>1</sup>Pavurala Swathi, <sup>2</sup>Kinnari Prakashbhai Trivedi, <sup>3</sup>Parth Pandya**<sup>1</sup>Assistant Professor, Department of Psychiatry, Mamata Academy of Medical Sciences, Bachupally, Hyderabad, Telangana, India<sup>2</sup>Assistant Professor, Department of Psychiatry, GMERS Medical College and Hospital, Vadnagar, Gujarat, India<sup>3</sup>Senior Resident, Department of General Medicine, SIMS Medical College Kalol Gandhinagar, Gujarat, India**Corresponding Author:**Dr. Parth Pandya ([ppandya52@yahoo.com](mailto:ppandya52@yahoo.com))**Abstract****Objectives:** The present study is to assess the sleep disturbances in patients of schizophrenia and its relation to socio-demographic factors, clinical factors and severity of illness.**Materials and Methods:** This is a cross-sectional study conducted from June 2017 to December 2017 among 100 patients admitted for treatment of schizophrenia in Mamata Medical College and Hospital, Khammam, Telangana. Tools used are Semi\_structured proforma, ICD-10 criteria for diagnosis, Scale for assessment of negative symptoms (SANS), Scale for assessment of positive symptoms(SAPS) and Pittsburgh sleep quality index (PSQI).**Results:** Positive symptoms of schizophrenia severity were found to be positively correlated to poor sleep quality and its components except the sleep disturbance domain of PQSI and were statistically significant. Negative symptoms of schizophrenia were found to be positively correlated to poor sleep quality and its components except sleep disturbance, sleep duration and daytime dysfunction and are statistically significant.**Conclusion:** Sleep disturbances in patients of schizophrenia can worsen the psychotic symptoms. Thus the analysis of sleep disturbances in admitted patients with schizophrenia in relation to phenomenology will create better treatment protocols and improve the quality of life and functioning.**Keywords:** Sleep, PQSI components, severity of illness, schizophrenia**Introduction**

Sleep is a complex; natural, reversible state occurring at regular intervals generated and regulated by different complex neuronal systems <sup>[1]</sup>. Sleep has been considered as an active state, vital for physical, mental and emotional well-being and is important for active cognitive functioning <sup>[2]</sup>. Poor sleep quality may have serious health and personal consequences. It can lead to impairment or poor performance during daytime school or work, increase risk for motor vehicle or occupational accidents, exacerbate medical and psychiatric conditions and result in diminished quality of life<sup>6</sup>. Poor sleep may play an important role in schizophrenia pathophysiology <sup>[3]</sup>.

Sleep disturbances have been recognized as a potential contributor to the onset and maintenance of the disorder and as a possible target for intervention <sup>[4]</sup>. Insomnia is the most frequent symptom reported in advance of exacerbation of psychotic symptoms in schizophrenic patients <sup>[5]</sup>. Sleep disturbance is associated with increased illness severity <sup>[6]</sup> and often precedes relapse <sup>[7]</sup>. Sleep difficulties must occur for at least one month and be associated with daytime fatigue or day time functional impairment to be related to schizophrenia <sup>[8]</sup>. Positive symptoms have been associated with poor subjective sleep quality. Afonso *et al.* <sup>[9]</sup> studied 23 schizophrenia outpatients, who were grouped into predominantly positive and predominantly negative (based on PANNS scale) with 24 hour continuous wrist actigraphy during 7 days. They found that the patients with predominant positive symptoms had poor quality of sleep. Zarcone VP *et al.* <sup>[10]</sup> examined 20 male psychiatric in-patients. Clinical symptoms were assessed by the Brief Psychiatric Rating Scale (BPRS). Four sub factors, i.e., 'Thinking Disturbance', 'Withdrawal/Retardation', 'Hostility/Suspiciousness' and 'Anxiety/Depression' were correlated with five components of sleep architecture, namely, sleep onset latency, total sleep time, total slow wave sleep minutes, total REM minutes and REM latency. Sleep on set latency was positively correlated with the 'Thinking Disturbance' factor. (Positive symptoms).

The most consistent objective findings in patients of schizophrenia include prolonged sleep latency (SOL) and increased wake time after sleep onset (WASO) <sup>[11]</sup>. Studies also documented

poor sleep efficiency with reduction in total sleep time owing to initial, middle and late insomnia<sup>[12]</sup>. Sleep-onset insomnia and difficulty reaching a state of persistent sleep is characteristic of schizophrenia<sup>[13,14]</sup>. It was also found that reduced spindle activity correlated with higher level of positive symptoms in first episode patients with schizophrenia<sup>[15]</sup>. Slow wave sleep or NREM sleep deficits, shortened REM latency and unchanged REM sleep are other consistent findings reported in patients of schizophrenia<sup>[16]</sup>. Thus the relationship between sleep and schizophrenia at various levels makes it an important area of research. Sleep thus influences the choice of management in patients of schizophrenia. Prevention, screening, diagnosis and treatment for sleep disturbance should be a part of standard clinical care for individuals with schizophrenia<sup>[17]</sup>. Sleep disturbances in patients of schizophrenia can worsen the psychotic symptoms<sup>[18]</sup>. Thus the analysis of sleep disturbances in admitted patients with schizophrenia in relation to phenomenology will create better treatment protocols and improve the quality of life and functioning.

The present study is to assess the sleep disturbances in patients of schizophrenia and its relation to socio-demographic factors and severity of illness.

## Materials and Methodology

### Patients and Methods

- **Place of study:** Mamata General Hospital, Khammam.
- **Study design:** A cross sectional study
- **Study sample:** On patients admitted in psychiatry ward.
- **Study period:** From 1st January 2017 to 31<sup>st</sup> December 2017
- **Sample size:** A total of 100 patients suffering from schizophrenia are included in the study. Out of which 72 are drug naive and 28 members had a previous history of schizophrenia but are not taking medication for  $\geq 1$  month.

### Inclusion criteria

1. Patients admitted in psychiatric ward with diagnosis of schizophrenia as per ICD-10-clinical descriptions and diagnostic guidelines.
2. Patients of age 18 years to 60 years.
3. Patients/care givers who are willing to participate and give written consent.
4. Patients who are not on antipsychotics or other sleep altering medication at the time of study.

### Exclusion criteria

1. Patients/care givers not willing to give written consent to participate.
2. Patients with other co-morbid psychiatric and medical disorders.
3. Patients who are on antipsychotics or other sleep altering medication at the time of study.
4. Patients with extra-pyramidal side effects.

## Materials

### 1. Semi Structured Proforma [Annexure-1]

Special proforma was prepared for the study which included socio-demographic file, clinical profile (including history of present complaints, family history of similar psychiatric illness, past history of schizophrenia, type of schizophrenia).

### 2. Diagnostic criteria

ICD-10 criteria 30 were used for the diagnosis of schizophrenia in the study population.

### 3. Rating Scales and Tools

**a) Scale for assessment of positive symptoms (SAPS19) and Scale for assessment of negative symptoms (SANS20):** These scales are used for the assessment of positive and negative symptoms, principally those occurring in schizophrenia. Both the instruments are used in a way complimentary to each other. They have been widely used in many studies and well tested for reliability and validity. SAPS is a 34-item scale with four subscales:

Hallucinations, Delusions, Bizarre behavior, Positive formal thought disorder. Higher scores represent greater symptom severity. The SANS contains 25 items divided into 5 subscales i.e. Affective flattening or blunting, Alogia, Avolition-Apathy, Anhedonia-Asociality and Attention. Items in both the scales are scored between 0 (none) and 5 (severe). For both instruments, each subscale also contains a global rating index.

Subscale scores are the sum of all items, including the global rating item. Total scores for negative and positive symptoms are the sum of all items in each of the instruments to form the composite score. Total scores for the SANS range from 0 to 125 and 0 to 175 for the SAPS. Higher scores reflect more severe negative and positive symptomatology.

**b) Pittsburgh Sleep Quality Index (PSQI) (Annexure-V):** Pittsburgh Sleep Quality Index (PSQI) 21 is one of the most commonly used instrument in psychiatric practice and research developed by Daniel J. Buysse and associates. It is designed to assess sleep quality and patterns of sleep during the past month and contains 19 self-rated questions from which 7 component (subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medications and daytime dysfunction) scores are calculated and summed into a Global score. Component six is scored zero because the patients who used hypnotic sedative medication were not included in the study. Higher score represent poor sleep quality. Component scores range from 0 to 3 and Global scores range from 0 to 21. It differentiates ‘poor’ from ‘good’ sleep quality by measuring seven areas (components) over the last month. A total score of ‘5’ or greater is indicative of poor sleep quality.

**Statistical analysis:** Descriptive results are expressed as mean and SD of various parameters. Independent t-test is used to find association between sleep quality with various demographic and clinical factors. Pearson Correlation was used to assess relationship between sleep quality components and positive and negative symptoms of schizophrenia. The statistical analysis was done with PRISM 7 software. The level of significance was set at  $p < 0.05$  and  $p \text{ value} \geq 0.05$  was considered non-significant.

**Observation and Results**

**Table 1: Socio-Demographic profile**

S. No.	Demographic Factor	Frequency (N=100)	Percentage (%)		
1.	Age group (years)	18-24	31	31.00%	Mean =31.91, S.D = 10.36
		25-34	32	32.00%	
		35-44	21	21.00%	
		45-54	15	15.00%	
		55-64	1	1.00%	
2.	Gender	Male	53	53.00%	
		Female	47	47.00%	
3.	Occupation	Unemployed	44	44.00%	
		Unskilled	38	38.00%	
		Semi-skilled	14	14.00%	
		Skilled	4	4.00%	
4.	Marital Status	Single	57	57.00%	
		Married	37	37.00%	
		Divorced	3	3.00%	
		Widow	3	3.00%	
5.	Education	Illiterates	39	39.00%	
		Literates	61	61.00%	
6.	Place	Rural	53	53.00%	
		Urban	47	47.00%	
7.	Socio-economic status (SES)	Low	58	58.00%	
		Middle	39	39.00%	
		High	3	3.00%	

**Table 2: Clinical and Sleep profile**

S. No.	Clinical factor and Sleep factor	Frequency (N=100)	Percentage (%)	
1.	Type of schizophrenia	Paranoid	67	67.00%
		Hebephrenic	2	2.00%
		Catatonic	6	6.00%
		Undifferentiated	25	25.00%
2.	Family history of similar psychiatric illness	Absent	73	73.00%
		Present	27	27.00%
3.	Past history of schizophrenia	Absent	72	72.00%
		Present	28	28.00%
4.	Complaints related to sleep	Present	100	100.00%
		Absent	0	0.00%
5.	Sleep disturbances as	Chief complaint	78	78.00%
		Associated complaint	22	22.00%
7.	Distress to family members	Absent	47	47.00%
		Present	53	53.00%

**Table 3: Pittsburgh Sleep Quality Index (PSQI) Score**

S. No.	Components	N	Minimum	Maximum	Mean	S.D
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1.	Subjective Sleep Quality	100	1	3	2.29	0.74
2.	Sleep latency	100	0	3	1.63	0.90
3.	Sleep duration	100	1	3	2.43	0.57
4.	Habitual sleep efficiency	100	0	3	2.42	0.65
5.	Sleep disturbances	100	1	3	1.33	0.51
6.	Use of sleeping medication	100	0	0	0.00	0.00
7.	Daytime dysfunction	100	1	3	1.62	0.65
8.	Global PSQI Score	100	8	16	11.72	2.25

**Table 4:** Scale for Assessment of Positive Symptoms (SAPS) and Scale for Assessment of Negative Symptoms (SANS) Score

S. No.	Scale used	N (frequency)	Minimum score	Maximum score	Mean	SD
1.	SAPS	100	5	62	33.47	14.06
2.	SANS	100	18	42	29.52	5.22
3.	SAPS+SANS	100	29	98	62.99	16.50

**Table 5:** Comparison of mean Sleep Quality (Using Global PSQI Score) in relation to occupation

S. No.	Sleep Components	Occupation	N=100	Mean	SD	T value	p
1.	Subjective sleep quality	Unemployed	44	2.36	0.75	0.867	0.388, NS
		Employed	56	2.23	0.74		
2.	Sleep latency	Unemployed	44	1.43	0.87	2.028	0.045*
		Employed	56	1.79	0.89		
3.	Sleep Duration	Unemployed	44	2.36	0.57	1.045	0.299, NS
		Employed	56	2.48	0.57		
4.	Sleep efficiency	Unemployed	44	2.43	0.70	0.150	0.881, NS
		Employed	56	2.41	0.63		
5.	Sleep disturbances	Unemployed	44	1.39	0.58	0.962	0.339, NS
		Employed	56	1.29	0.46		
6.	Use of sleep medicines	Unemployed	0	0.00	0.00	-	-
		Employed	0	0.00	0.00		
7.	Daytime dysfunction	Unemployed	44	1.52	0.63	1.381	0.170, NS
		Employed	56	1.70	0.66		

Unpaired 't' test applied. \* -Significant, NS-Not Significant.

**Table 6:** Comparison of mean Sleep Quality (Using Global PSQI Score) in relation to type of schizophrenia

S. No.	Sleep Components	Type of Schizophrenia	N=100	Mean	SD	T value	p
1.	Subjective sleep quality	Paranoid	67	2.18	0.74	2.189	0.031*
		Others	33	2.52	0.71		
2.	Sleep latency	Paranoid	67	1.61	0.87	0.313	0.755, NS
		Others	33	1.67	0.96		
3.	Sleep Duration	Paranoid	67	2.45	0.56	0.489	0.626, NS
		Others	33	2.39	0.61		
4.	Sleep efficiency	Paranoid	67	2.39	0.65	0.645	0.521, NS
		Others	33	2.48	0.67		
5.	Sleep disturbances	Paranoid	67	1.31	0.53	0.455	0.650, NS
		Others	33	1.36	0.49		
6.	Use of sleep medicines	Paranoid	0	0.00	0.00	-	-
		Others	0	0.00	0.00		
7.	Daytime dysfunction	Paranoid	67	1.58	0.68	0.865	0.389, NS
		Others	33	1.70	0.59		

Unpaired 't' test applied. \* -Significant, NS-Not Significant

**Table 7:** Correlation between Sleep quality using (PSQI scale) and Severity of Positive Symptoms using (SAPS)

S. No.	Sleep component	Correlation coefficient (r)	p
1.	Subjective Sleep Quality	0.5053	<0.0001**
2.	Sleep Latency	0.4553	<0.0001**
3.	Sleep Duration	0.428	<0.0001**
4.	Sleep Efficiency	0.457	<0.0001**
5.	Sleep Disturbances	-0.020	0.841, NS
6.	Use Of Sleep Medication	Nil	Nil
7.	Daytime Dysfunction	0.3535	0.0003**
8.	Global PSQI score	0.687	<0.0001**

Pearson coefficient of Correlation 'r' test applied.

**Table 8:** Correlation between Sleep quality using (PSQI scale) and Severity of Negative Symptoms using (SANS)

S. No.	Sleep component	Correlation coefficient (r)	p
1.	Subjective Sleep Quality	0.912	<0.0001**
2.	Sleep Latency	0.314	0.001**
3.	Sleep Duration	0.154	0.125, NS
4.	Sleep Efficiency	0.370	0.0001**
5.	Sleep Disturbances	-0.106	0.841, NS
6.	Use of Sleep Medication	Nil	Nil
7.	Daytime Dysfunction	0.008	0.935, NS
8.	Global PSQI score	0.551	0.0001**

## Discussion

The study was carried out on a sample of 107 patients of schizophrenia. Based on the exclusion criteria 7, patients were excluded due to varied reasons like co-morbid medical disorders, co-morbid alcohol abuse and extrapyramidal symptoms. Therefore, a total of 100 patients were studied who attended inpatient ward of Mamata General Hospital, Khammam.

The mean age of the participating population was 31.91 years. Based on gender, patients were almost equally distributed. Majority of them were literates (61%) and were unmarried (57%). More than half of them were employed (56%) with unskilled workers amounting to (38%) and 14% of them were semi-skilled workers and hailed from rural background (53%). Majority of them belonged to low socio-economic status (58%). Majority of them were diagnosed as paranoid schizophrenia (67%) and presented as first episode (72%).

All the participating patients reported to have poor sleep quality with mean global PQSI score 11.72. The mean total score of positive symptoms (assessed by SAPS) for the 100 participants was 33.47 and the mean total score of negative symptoms (assessed by SANS) was 29.52.

When PSQI component scores were compared with groups of patients who are employed (N=56) and unemployed (N=44), statistical significant difference was noted in the sleep latency component (p value= 0.045). Thus employed patients had more sleep initiation difficulties. Previous studies have found that factors like bad work atmosphere, inter-personal conflicts, poor job satisfaction and performance increase the prevalence of sleep disturbances<sup>[19,20]</sup>.

In our study, participants were divided into two groups based on the type of schizophrenia into paranoid type (N=67) and other types (N=33), according to ICD-10. The sleep quality component scores (PQSI) were compared across these two groups as shown in Table no.6 Patients with paranoid type had a mean subjective sleep quality component score of 2.18 and other types had a mean score of 2.52. The difference was statistically significant (p =0.031). It implies that other types like undifferentiated, hebephrenic and catatonic patients reported poor sleep quality than paranoid type. The reason could be that paranoid patients believe that they are being persecuted unjustly and are easily angered and become hostile. As Pittsburgh Sleep Quality Index (PQSI) is a self-reported questionnaire. The scores of sleep scale were affected by the patient's emotional impact, so there were some deviations between the patient's actual situation and score. When the scores of other components (sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication and day time dysfunction) were compared across the two groups, no statistical significant difference was found<sup>[21]</sup>.

When correlation was made between global PQSI mean score 11.72 and positive symptoms mean score (SAPS) 33.47, the result was statistically significant and both are positively correlated (r=0.687) as depicted in Table no. 7. Out of all the component scores of PQSI, subjective sleep quality score had highest correlation with SAPS score and was statistically significant. These findings are in accordance with study conducted by Afonso P *et al.*<sup>[9]</sup> in which twenty-three schizophrenia patients were studied with 24 hour continuous wrist-actigraphy during 7 days. The quality of sleep was assessed with the Pittsburgh Sleep Quality Index (PSQI). They found that poor sleep quality and a more disrupted sleep-wake patterns in patients with predominantly positive symptoms.

When correlation was made between global PQSI mean score 11.72 and negative symptoms mean score (SANS) 29.52, the result was statistically significant (p value= <0.0001) and both are positively correlated (r=0.551) as shown in Table no. 8. Out of all the component scores of PQSI, subjective sleep quality score had highest correlation with SANS score and was statistically significant. Our present study findings are similar to study done by Lunsford-Avery JR *et al.*<sup>[22]</sup> where in thirty-three members meeting ultra-risk of psychosis criteria(UHR) and 33 healthy controls (HC) participated in a self-assessment of sleep functioning (Pittsburgh Sleep Quality Index; PSQI) and psychotic symptoms were assessed by SIPS (Structured Interview for Prodromal Syndrome). He examined associations between sleep quality (PSQI) and psychotic symptoms (SIPS), while controlling for medication and mood symptoms in an UHR sample. A regression analysis showed greater negative symptom severity was associated with increased sleep latency, shorter sleep duration, poorer sleep quality and greater total PSQI score.

Rouyela *et al.*<sup>[23]</sup> studied sleep using Spanish version of Pittsburgh Sleep Quality Index (PSQI). They

evaluated 44 schizophrenics and 44 healthy control group and found that schizophrenics scored more in components of sleep latency, hypnotic drugs use, and daytime dysfunction than the control group. It also suggested that negative symptoms are related to sleep quality deterioration because it is known that going without sleep leads to bad moods, bad performance and lack of desire to communicate.

### Conclusions

Psychotic (positive and negative) symptoms of schizophrenia are positively correlated to poor sleep quality. The self-report measures of sleep should be evaluated in conjunction with quantitative measurements like polysomnography and actigraphy. Future surveys should employ longitudinal assessment to define whether disturbed sleep is a risk factor for psychosis onset and relapse. Studies must be conducted to evaluate efficacy of psychological, behavioural and pharmacological interventions for sleep disturbances among patients of schizophrenia.

### Limitations

There are few limitations to our study which needs to be considered while interpreting the result. The study was single centre based done among inpatients of schizophrenia. A multi-centric study(different hospitals) could have increased the inclusion of various demographic factors to draw more generalised conclusions. The results of this study cannot be generalized to community settings as the sample size of the study is less. As its a cross-sectional study, causality of the relationships between sleep disturbance and socio-demographic and clinical variables cannot be determined. Sleep duration and sleep disturbances were only evaluated by self-report and not recorded or observed. There is lack of an appropriately matched control group that may have limited resolution for quantification of the sleep data.

### References

1. Lee-Chiong T. Sleep medicine: Essentials and review. Oxford University Press, 2008 Apr.
2. Banks S, Dinges DF. Behavioral and physiological consequences of sleep restriction. *Journal of clinical sleep medicine: JCSM: official publication of the American Academy of Sleep Medicine.* 2007 Aug;3(5):519.
3. Monti JM, Monti D. Sleep disturbance in schizophrenia. *International Review of Psychiatry.* 2005 Aug;17(4):247-53.
4. Wamsley EJ, Shinn AK, Tucker MA, Ono KE, McKinley SK, Ely AV, *et al.* The effects of eszopiclone on sleep spindles and memory consolidation in schizophrenia: a randomized placebo-controlled trial. *Sleep.* 2013 Sep;36(9):1369-76.
5. Herz MI, Melville C. Relapse in schizophrenia. *The American Journal of Psychiatry.* 1980 Jul.
6. Cohrs S. Sleep disturbances in patients with schizophrenia. *CNS drugs.* 2008 Nov;22(11):939-62.
7. Benson KL. Sleep in schizophrenia. *Sleep Medicine Clinics.* 2008 Jun30;3(2):251-60.
8. Monti JM, Monti D. Sleep in schizophrenia patients and the effects of antipsychotic drugs. *Sleep medicine reviews.* 2004 Apr;8(2):133-48.
9. Afonso P, Brissos S, Figueira ML, Paiva T. Schizophrenia patients with predominantly positive symptoms have more disturbed sleep-wake cycles measured by actigraphy. *Psychiatry research.* 2011 Aug;189(1):62-6.
10. Zarcone VP, Benson KL. BPRS symptom factors and sleep variables in schizophrenia. *Psychiatry research.* 1997 Feb;66(2):111-20.
11. Benson KL. Sleep in Schizophrenia. *Sleep medicine clinics.* 2015 Mar;10(1):49-55.
12. Benson KL. Sleep in schizophrenia: impairments, correlates and treatment. *Psychiatric Clinics of North America.* 2006 Dec;29(4):1033-45.
13. Chouinard S, Poulin J, Stip E, Godbout R. Sleep in untreated patients with schizophrenia: A meta-analysis. *Schizophr Bull.* 2004;30(4):957-67.
14. Benca RM, Obermeyer WH, Thisted RA, Gillin JC. Sleep and psychiatric disorders: a meta-analysis. *Archives of general psychiatry.* 1992 Aug;49(8):651-68.
15. Manoach DS, Demanuele C, Wamsley EJ, Vangel M, Montrose DM, Miewald J, *et al.* Sleep spindle deficits in antipsychotic-naïve early course schizophrenia and in non-psychotic first-degree relatives. *Frontiers in human neuroscience.* 2014, 8.
16. Monti JM, Ba Hammam AS, Pandi-Perumal SR, Bromundt V, Spence DW, Cardinali DP, *et al.* Sleep and circadian rhythm dysregulation in schizophrenia. *Progress in Neuron-Psychopharmacology and Biological Psychiatry.* 2013 Jun;43:209-16.
17. Klingaman EA, Palmer-Bacon J, Bennett ME, Rowland LM. Sleep disorders among people with schizophrenia: emerging research. *Current psychiatry reports.* 2015 Oct;17(10):79.
18. Chemerinski E, Ho BC, Flaum M, Arndt S, Fleming F, Andreasen NC. Insomnia as a predictor for symptom worsening following antipsychotic withdrawal in schizophrenia. *Comprehensive psychiatry.* 2002 Sep;43(5):393-6.
19. Andreasen NC. *The Scale for the Assessment of Positive Symptoms (SAPS).* Iowa City: University of Iowa, 1984.

20. Andreasen NC. The Scale for the Assessment of Negative Symptoms (SANS). Iowa City: University of Iowa, 1983.
21. Buysse DJ, Reynolds CF, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. *Psychiatry research*. 1989 May;28(2):193-213.
22. Lunsford-Avery JR, Orr JM, Gupta T, Pelletier-Baldelli A, Dean DJ, Watts AK, *et al*. Sleep dysfunction and thalamic abnormalities in adolescents at ultra-high-risk for psychosis. *Schizophrenia research*. 2013 Dec;151(1):148-53.
23. Royuela A, Macias JA, Gil-Verona JA, Pastou JF, Maniega MA, Alonso J, *et al*. Sleep in schizophrenia: a preliminary study using the Pittsburgh Sleep Quality Index. *Neurobiology of Sleep-Wakefulness Cycle*. 2002;2(2):37-9.