

Assessment of Sleep Quality among Adolescents in Urban and Rural Areas of Indore District, Madhya Pradesh: A School-Based Cross-Sectional Study

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Abstract

Background: Declining sleep quality is an emerging public health concern driven by rapidly changing modern lifestyles. Adolescents are particularly vulnerable to deteriorating sleep patterns. This study aimed to evaluate sleep quality and determine the prevalence of poor sleep quality among school going adolescents (9th-12th standards) residing in urban and rural areas of Indore district. **Aims & Objectives:** To assess sleep quality and determine the prevalence of poor sleep quality among adolescents in urban and rural areas of Indore district. **Material & Methods:** A school-based cross-sectional study was conducted among 400 adolescent students (9th to 12th standards) across urban and rural sectors of Indore district. Data were collected through face-to-face interviews using a pre-designed, pre-tested, semi-structured questionnaire incorporating the Pittsburgh Sleep Quality Index (PSQI). Group variations and statistical associations were analysed using the Chi-square using χ^2 test; $p < 0.05$ was considered statistically significant. **Result:** In the study 39.2% adolescents were found to have poor sleep quality with PSQI score > 5 . The overall mean PSQI score was 5.17 ± 3.20 , with slightly higher scores among urban adolescents (5.26 ± 3.16) in comparison to rural adolescents (5.08 ± 3.25). The main contributors were found to be sleep disturbance, sleep latency, and daytime dysfunction. **Conclusion:** Poor sleep quality is highly prevalent among adolescents in Indore district. Urban adolescents experience significantly greater daytime dysfunction, whereas rural adolescents exhibit poorer habitual sleep efficiency. Targeted sleep hygiene interventions are necessary for both cohorts.

Keywords: Adolescents, Pittsburgh Sleep Quality Index (PSQI), rural area, Sleep Quality, Urban area

Introduction

Sleep is a vital physiological process essential for physical growth, cognitive development, emotional regulation, learning, memory consolidation, and overall health and well-being. Consistently achieving both optimal sleep quality and adequate sleep duration is critical for maintaining metabolic health and daily functional capacity.^[1,2]

Globally, and within India, poor sleep quality has emerged as a critical public health concern due to its rising incidence and established associations with adverse health outcomes. Despite their profound impact on overall quality of life and academic productivity, sleep disturbances frequently remain under-recognized and under-reported in clinical and community settings.^[3]

Rapid urbanization is increasingly altering modern lifestyles, directly impacting sleep hygiene and quality. Furthermore, competitive academic demands, increasing screen time, and shifting socio-economic dynamics have uniquely compromised the sleep health of younger populations. Despite the growing burden of sleep disorders, comparative literature focusing on sleep quality variations between urban

and rural adolescents remains scarce. Therefore, it is imperative to evaluate the distinct impacts of urbanization and geographic settings on adolescent sleep patterns to guide targeted public health interventions.

The objective of the study was to assess sleep quality and determine prevalence of sleep disturbances and poor sleep quality among school-going adolescents (9th–12th standards) in urban and rural areas of Indore district, Madhya Pradesh. The study also sought to provide evidence-based recommendations for improving sleep hygiene and quality among adolescents

Material & Methods:

Study Design and Setting

A school-based, cross-sectional study was conducted in randomly selected high schools and higher secondary schools across the urban and rural areas of Indore district, Madhya Pradesh, India.

Study Population and Period

The study population comprised school going adolescents enrolled in grades 9th to 12th within the selected institutions.

Data collection was carried out over a one-year period from December 2022 to December 2023.

Sample Size calculation

For school going adolescents $n = \frac{(Z\alpha)^2 \cdot P \cdot Q}{d^2}$

P = Prevalence -37.6% as per Saxena et al^[4]

Q = 100-P

d = Absolute error (5 %)

n = 375.39 = 400 (rounded off).

Inclusion Criteria:

- Adolescents (9th to 12th standards) enrolled in the selected schools within the study area.
- Students who voluntarily assented and whose legal guardians provided written informed consent.

Exclusion Criteria:

- Adolescents beyond the defined 9th & 12th standards.
- Adolescents not formally enrolled in the selected schools.
- Adolescents or legal guardians who refused to participate or provide formal consent.

Sampling Strategy

A multistage simple random sampling technique was utilized to recruit participants:

1. School Selection: Schools were selected via the lottery method (chit method) from an official list of institutions.
2. Participant Selection: Within the selected schools, eligible students from the 9th, 10th, 11th, and 12th standards were randomly chosen using the same lottery approach.

Data Collection

Data were collected through face-to-face interviews using a pre-designed, pre-tested, semi-structured questionnaire available in both English and Hindi. The tool captured comprehensive socio-demographic characteristics and integrated the standardized Pittsburgh Sleep Quality Index (PSQI) to assess sleep quality.

Study Tools and Operational Definitions

The primary instrument used was the PSQI, which evaluates sleep quality over a 1-month interval. The scale exhibits high internal consistency Cronbach's $\alpha = 0.83$ and high test-retest reliability of 0.85 ($P < 0.001$).^[1]

Global PSQI scores range from 0 to 21, and an operational cut-off score of (>5) was utilized to define poor sleep quality.

Ethical Considerations

Ethical clearance was granted by the Institutional Review Board & Scientific Review Committee of M.G.M. Medical College, Indore (Letter No: EC/MGM/Dec-22/66). Prior to data collection, written informed consent was obtained from the

parents/guardians, alongside written assent from the adolescent participants. Strict data anonymity and confidentiality were maintained throughout the study.

Statistical Analysis

Data were systematically cleared, coded, and entered into Microsoft Excel, and subsequent statistical analysis was performed using SPSS version 25.0 trial version and, applying the Chi-square (χ^2) test, with p value of <0.05 considered statistically significant.

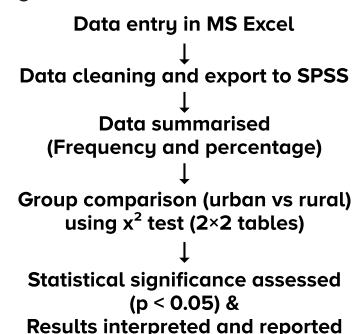


Figure1: Flow chart of data entry and statistical analysis

Results

Socio-demographic Characteristics

A total of 400 adolescents were enrolled in the study, with an equal distribution of 200 participants each from urban and rural areas. The majority of the participants belonged to the 14-16 years age group ($n = 282$). In terms of gender distribution, females ($n = 211$) outnumbered males ($n = 189$). The detailed socio-demographic profile of the study participants is presented in Table 1.

Table 1: Baseline Socio-Demographic Characteristics of Urban and Rural Adolescents (n = 200 each)

Variable		Urban (n=200)	Rural (n=200)
Age (in years)	14-16	137 (68.5%)	145 (72.5%)
	17-19	63 (31.5%)	55 (27.5%)
Gender	Male	93 (46.5%)	96 (48.0%)
	Female	107 (53.5%)	104 (52.0%)
	Other	00 (0%)	00 (0%)
Education	9th	54 (27.0%)	46 (23.0%)
	10th	38 (19.0%)	62 (31.0%)
	11th	44 (22.0%)	56 (28.0%)
	12th	64 (32.0%)	36 (18.%)
No. of siblings	0	14 (7.0%)	8 (4.0%)
	1	104 (52.0%)	79 (39.5%)
	2	29 (14.5%)	65 (32.5%)
	3	20 (10.0%)	23 (11.5%)
	>3	33 (16.5%)	25 (12.5%)

Out of the 400 adolescents surveyed, 243 (60.8%) exhibited good sleep quality (PSQI score ≤ 5) while 157 (39.2%) were classified as having poor sleep quality (PSQI score >5). Consequently, the overall prevalence of poor sleep quality among the study participants was 39.2% (figure 2).

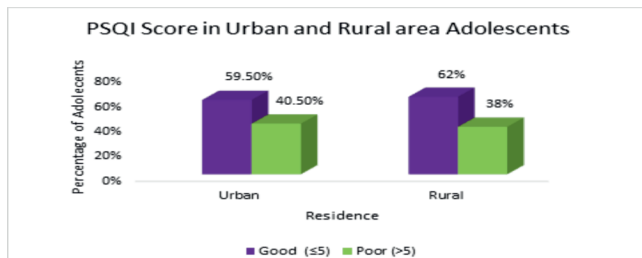


Figure 2: Comparison of Sleep Quality Between Urban and Rural Adolescents Based on Pittsburgh Sleep Quality Index (PSQI) Scores.

The overall cohort demonstrated a mean sleep latency of 23.41 ± 24.10 minutes and mean sleep duration of 7.06 ± 1.65 hours. As detailed in Table 3, these parameters were comparable between the two geographic groups. No statistically significant urban-rural differences were observed for subjective sleep quality, sleep latency, or sleep duration ($p > 0.05$). Similarly, the prevalence of sleep disturbances and the usage of sleep medications did not differ significantly between urban and rural cohorts ($p > 0.05$).

However, a low habitual sleep efficiency was significantly more prevalent among rural adolescents than their urban counterparts ($p = 0.046$). Conversely, daytime dysfunction was significantly higher among urban adolescents compared to rural adolescents (66.0% vs. 59.5%; $p = 0.034$).

Table 2 : Comparison of Sleep Characteristics and Pittsburgh Sleep Quality Index (PSQI) Components Among Urban and Rural Adolescents (n=400)

Variable	Urban n=200 (%)	Rural n=200 (%)	Total n=400 (%)	p- Value
Average time to go off to sleep (min) / Sleep Latency. Mean $\pm$ SD	22.17 $\pm$ 17.52	25.05 $\pm$ 29.06	23.41 $\pm$ 24.10	-
Average duration of actual sleep(h) Mean $\pm$ SD	7.1 $\pm$ 1.52	7.01 $\pm$ 1.77	7.06 $\pm$ 1.65	-
Subjective sleep quality, n (%)				.791
Very good	86(43.0%)	92(46.0%)	178(44.5)	
Fairly good	79(39.5%)	71(35.5%)	150(37.5)	
Fairly bad	25(12.5%)	24 (12.0%)	49(12.3%)	
Very bad	10(5.0%)	13 (6.5%)	23(5.8%)	
Sleep latency (min), n (%)				.816
<15	62(31.0%)	56(28.0%)	118(29.5%)	
15-30	75(37.5%)	81(40.5%)	156(39.0%)	
31-60	50(25.0%)	47(23.5%)	97(24.3%)	
>60	13(6.5%)	16(8.0%)	29(7.2%)	
Sleep duration (h), n (%)				.184
>7	96(48.0%)	98(49.0%)	194(48.5%)	
6-7	47(23.5%)	43(21.5%)	90(22.5%)	
5-6	46(23.0%)	37(18.5%)	83(20.8%)	
<5	11(5.5%)	22(11.0%)	33(8.3%)	
Habitual sleep efficiency, n (%)				.046
>85	193(96.5%)	186(93.0%)	379(94.8%)	
75-84	6(3.0%)	5(2.5%)	11(2.8%)	
65-74	0(0.0%)	6(3.0%)	6(1.5%)	
<65	1(0.5%)	3(1.5%)	4(1.0%)	
Some sleep disturbance, n (%)	181(90.5)	180(90.0%)	361(90.2)	.510

Medication used for sleep, n (%)	27(13.5)	21(10.5%)	48(12.0%)	.251
Daytime dysfunction, n (%)	132(66.0%)	119(59.5%)	251(62.7)	.034

Table 3 illustrates the variations in the mean component and global scores of the Pittsburgh Sleep Quality Index (PSQI) between urban and rural cohorts. The global mean PSQI score for the entire sample was 5.17 ± 3.20 , with urban adolescents scoring slightly higher (5.26 ± 3.16) than rural adolescents (5.08 ± 3.25).

Among the individual PSQI domains, the highest mean score was recorded for sleep disturbance (1.17 ± 0.59), followed by sleep latency (1.09 ± 0.90) and daytime dysfunction (0.94 ± 0.90). The lowest mean domain score was observed for habitual sleep efficiency (0.09 ± 0.41).

Table 3: Comparison of Mean PSQI Component Scores and Global PSQI Scores Among Urban and Rural Adolescents

Variable	Urban (Mean $\pm$ SD)	Rural (Mean $\pm$ SD)	Overall (Mean $\pm$ SD)
Subjective sleep quality	0.80 $\pm$ 0.846	0.79 $\pm$ 0.894	0.79 $\pm$ 0.870
Sleep latency	1.07 $\pm$ 0.905	1.11 $\pm$ 0.909	1.09 $\pm$ 0.906
Sleep duration	0.86 $\pm$ 0.957	0.91 $\pm$ 1.055	0.89 $\pm$ 1.006
Habitual sleep efficiency	0.05 $\pm$ 0.271	0.13 $\pm$ 0.514	0.09 $\pm$ 0.413
Sleep disturbance	1.20 $\pm$ 0.602	1.14 $\pm$ 0.585	1.17 $\pm$ 0.593
Use of Sleep Medications	0.22 $\pm$ 0.661	0.16 $\pm$ 0.525	0.19 $\pm$ 0.597
Daytime dysfunction	1.06 $\pm$ 0.954	0.83 $\pm$ 0.94	0.94 $\pm$ 0.901
Total score of sleep quality	5.26 $\pm$ 3.16	5.08 $\pm$ 3.25	5.17 $\pm$ 3.207

Discussion

The prevalence of poor sleep quality observed in the present study (39.2%) closely mirrors findings from several previous Indian studies. For instance, Saxena et al. reported a remarkably similar prevalence of 37.6% among adolescents. Similarly, Mohanambal et al. documented a poor sleep quality prevalence of 39.1%, which aligns almost exactly with our current findings.^[4,5]

In contrast, substantially higher rates were reported by Moitra et al. and Jam et al., who observed a prevalence of 52.5% and 63.5%, respectively.^[6,7] Conversely, some studies have recorded much lower figures. For example, Dubey et al. identified poor sleep quality in only 7.3% of their adolescent cohort, while Rajendran et al. observed a prevalence of 9.2% specifically among adolescent girls.^[8,9]

The moderately high prevalence detected in our study could be attributed to escalating academic pressures, highly

competitive educational environments, excessive screen time exposure, and rapidly shifting lifestyle patterns among modern adolescents. Furthermore, the overall mean PSQI score was slightly higher among urban adolescents than their rural counterparts, indicating marginally poorer sleep quality in the urban cohort. This trend likely reflects the pronounced impact of urbanization on sleep architecture.

In the present study, the majority of adolescents perceived their sleep quality as "very good" or "fairly good." This finding contrasts with the study by Moitra et al., where participants predominantly perceived their sleep quality as ranging from fairly good to moderately disturbed. Despite this positive subjective perception among our participants, objective sleep-related problems remained highly prevalent across the cohort, indicating a potential disconnect between perceived and actual sleep health.^[6]

Furthermore, sleep latency trends in our study were comparable to those reported by Moitra et al.^[6] A prolonged sleep latency of over 30 minutes was observed in 31.5% of our study population. This aligns closely with the findings of Saxena et al., who reported that 35.6% of adolescents experienced a sleep latency exceeding 30 minutes. In epidemiological literature, such prolonged sleep latency has consistently been linked to an increased risk of insomnia and related sleep disorders.^[4,10]

The mean duration of actual sleep in the present study was 7.06 ± 1.65 hours, which falls below the universally recommended sleep duration guidelines for adolescents.^[2] This trend of restricted sleep mirrors findings from earlier Indian literature. For instance, Dubey et al. reported average adolescent sleep duration of 7.7 hours during school days.^[8] Similarly, Saxena et al. documented a mean sleep duration of 7.1 ± 0.67 hours during weekdays and 7.42 ± 0.33 hours during weekends, which closely aligns with our current observations.^[4] Furthermore, Moitra et al. reported sleep duration parameters comparable to those of the present study.^[6]

According to Gupta et al., short sleep duration is particularly pronounced among urban school-going adolescents, especially those in higher standards, due to escalating academic demands and competitive curriculum workloads.^[11] This is further supported by Jam et al., who observed even shorter mean self-reported sleep duration 6.2 ± 1.3 hours on school nights.^[7] Cumulatively, such a reduction in sleep duration among adolescents has been established to exert a significant negative impact on their concentration levels, academic performance, and overall physical health.

In the present study, habitual sleep efficiency was significantly poorer among rural adolescents than their urban peers ($p=0.046$), although overall habitual sleep efficiency remained adequate among the majority of participants. This preservation of sleep efficiency aligns with the findings reported by Moitra et al., who similarly documented preserved sleep efficiency within their study population.^[6] Regarding the

sleep disturbance component, no statistically significant urban-rural variance was observed. Notably, some form of sleep disturbance was reported by 90.2% of all participants, emerging as one of the primary drivers of overall poor sleep quality across the cohort. This finding is reinforced by Singh et al., who observed that poor sleep hygiene practices among adolescents directly lead to heightened daytime sleepiness and compromised sleep quality.^[3] Conversely, these rates contrast with the data from Moitra et al., who reported a lower prevalence of sleep disturbances in their adolescent sample.^[6]

In the present study, daytime dysfunction was significantly higher among urban adolescents compared to their rural counterparts (66.0% vs. 59.5%; $p=0.034$). This finding may be linked to a higher academic burden, increased electronic device usage, sedentary lifestyles, and altered sleep schedules among urban youth. Correspondingly, Singh et al. reported similar trends of heightened daytime sleepiness and compromised sleep quality, particularly among older adolescents and female participants.^[3] Furthermore, the prevalence of daytime dysfunction in this study was considerably higher than that documented by Moitra et al.^[6]

Regarding pharmacological interventions, the use of sleep medication was reported by 12.0% of the participants, with no statistically significant urban-rural variance. Comparable findings of minimal sleep medication usage have been documented in previous literature. This trend could be attributed to the fact that adolescents are generally less likely to seek clinical care for sleep-related problems, meaning their sleep issues frequently remain unrecognized and untreated by healthcare professionals.

An evaluation of individual PSQI domains revealed that sleep disturbances, prolonged sleep latency, and daytime dysfunction yielded the highest mean scores. This pattern indicates that these three domains are the predominant contributors to decreased overall sleep quality within this adolescent cohort.

Conclusion

This study highlights a high prevalence of poor sleep quality (39.2%) among school-going adolescents in Indore district, establishing sleep deprivation as a significant but hidden public health concern. While global sleep metrics were comparable between geographic regions, critical domain-specific variations emerged. Urban adolescents face a significantly higher burden of daytime dysfunction, likely driven by accelerated modern lifestyles, heavy electronic screen exposure, and intense academic demands. Conversely, rural adolescents demonstrate significantly lower habitual sleep efficiency, suggesting that while their overall sleep duration appears adequate, the micro-architecture and continuity of their sleep are compromised. Ultimately, elevated sleep latency and frequent night-time disruptions remain the predominant drivers of overall sleep degradation across the entire adolescent cohort.

Recommendation

- 1. Implementation of Sleep Hygiene Education:** Schools should integrate structured sleep health and hygiene education into their regular health curricula to teach adolescents the importance of consistent sleep schedules, bedtime routines, and optimal sleep environments.
- 2. Institutional Screen-Time Regulations:** Public health campaigns should target parents and educators to advocate for "digital curfews" or screen-free windows at least one hour before bed to mitigate the high rates of daytime dysfunction, particularly among urban youth.
- 3. Academic Schedule Optimization:** Educational policymakers should consider delayed school start times to align institutional schedules with the natural biological circadian shifts (delayed sleep phase) characteristic of the adolescent age group.
- 4. Community-Level Rural Interventions:** Further community-specific research is needed in rural areas to identify and address the environmental, domestic, or cultural factors causing fragmented rest and low sleep efficiency among rural students.
- 5. Routine Institutional Screening:** School health programs should incorporate simple, validated screening tools like the PSQI during annual student check-ups to identify, catch, and clinically refer adolescents suffering from unrecognized sleep disturbances.
- Lifestyle and behavioral variables-such as electronic screen time, dietary habits. Therefore further extensive studies therefore incorporation of these co-factors could have provided a more comprehensive explanation for the observed differences in sleep architecture between urban and rural adolescents

Limitation of the study

- Due to the cross-sectional nature of this study, definite causal relationships between geographic or environmental factors and sleep quality could not be established.
- All sleep-related data were self-reported via questionnaires rather than measured objectively therefore, rendering the findings vulnerable to subjective recall and reporting biases.
- Potential confounding lifestyle and behavioral variables-such as electronic screen time, dietary habits, physical exercise levels, and psychological stress could not be extensively studied.

Relevance of the Study

This study holds significant clinical and public health relevance, as there is currently a paucity of comparative literature focusing on the sleep profiles of school-going adolescents within Madhya Pradesh. By assessing localized geographic variations, this study contributes valuable data to the existing body of knowledge regarding adolescent sleep medicine in central India. Furthermore, our findings underscore

an urgent need for institutional and policy-level interventions aimed at cultivating sleep hygiene and mitigating sleep degradation in this vulnerable demographic.

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Conflicts of Interest-None

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Declaration of Generative AI and AI-Assisted Technologies in the Writing Process:

We have utilized generative AI and AI-assisted technologies exclusively to improve structural grammar, language clarity, and academic readability. We have critically reviewed, verified, and edited the contents as necessary and assume full accountability for the accuracy and originality of the final published text.

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