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# The Screen Time Epidemic and Adolescent Sleep: A Cross-Sectional Study in Jharkhand, India

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**1. ABSTRACT**

**Objective:** To quantify the prevalence of electronic screen use within 1 hour before bedtime among Indian school students and examine its associations with sleep hygiene, sleep duration, daytime sleepiness, and a composite high-risk sleep status (Hale & Guan, 2015).

**Methods:** Cross-sectional survey of 1,719 students (Classes VI–XII, age 12–17) from Jharkhand, India. Pre-bedtime screen use and sleep hygiene behaviours were assessed alongside self-reported sleep duration and daytime sleepiness using validated instruments (LeBourgeois et al., 2005; Drake et al., 2003). Multistage random sampling ensured representativeness (Mweshi & Sakyi, 2020), and sample size was calculated for 80% power (Cohen, 1988). Associations were tested using chi-square, Mann-Whitney U, Spearman correlations, and multivariable logistic regression (Field, 2013).

**Results:** Overall, 80.4% (n=1,382) reported pre-bedtime screen use (Cain & Gradisar, 2010), the second-most prevalent sleep hygiene violation after bed misuse (82.5%). Prevalence was higher in males (83.2% vs. 77.5%; OR=1.44), urban students (84.2% vs. 76.7%; OR=1.63) (LeBourgeois et al., 2017), and increased across grades from Class VI (74.9%) to Class XII (84.3%; p<0.001) (Twenge et al., 2017). Screen users showed no significant difference in sleep duration (p=0.156) (Gradisar et al., 2013) but reported higher daytime sleepiness (p=0.032; d=0.14) (Chang et al., 2015). In multivariable regression, screen use was a significant but modest predictor of high-risk status (B=0.034, p=0.032), ranking below grade level and school start time (Wheaton et al., 2016).

**Conclusions:** Pre-bedtime screen use is nearly ubiquitous among Jharkhand adolescents and is associated with higher daytime sleepiness but not reduced sleep duration (Hysing et al., 2015; Bartel et al., 2015). Despite modest individual effects, population-level impact is substantial (Rose, 1992). Interventions should enforce a screen-free wind-down period of at least 1 hour before bedtime (Exelmans & Van den Bulck, 2016) while addressing co-occurring sleep hygiene behaviours and contextual factors such as academic pressures (Peach & Gaultney, 2013) and limited parental supervision (Nuutinen et al., 2014).

**Keywords:** adolescent; screen time; blue light; sleep hygiene; daytime sleepiness; sleep quality; Jharkhand; India; cross-sectional study

## 2. INTRODUCTION

Adolescence is a developmental stage marked by biological changes in circadian timing (Carskadon et al., 1998; Crowley et al., 2018), increasing academic demands (Wolfson & Carskadon, 1998), and lifestyle behaviors that shape sleep health (Owens, 2014; Tarokh et al., 2016). Among these behaviors, the use of electronic devices before bedtime has emerged as a major public health concern (Hale & Guan, 2015; Christensen et al., 2016). Screen-based media exposure in the hour before sleep has been consistently linked to later bedtimes (Orzech et al., 2016), shorter sleep duration (Gradisar et al., 2013; Garrison et al., 2011), poorer sleep quality (Fossum et al., 2014), and increased daytime sleepiness (Lemola et al., 2015). Mechanistic studies demonstrate that light-emitting devices delay circadian phase (Chang et al., 2015; Higuchi et al., 2005) and suppress melatonin secretion (Wood et al., 2013; Gooley et al., 2011), providing strong biological plausibility for these associations (Figueiro & Overington, 2016).

Despite this evidence, the magnitude of association between pre-bedtime screen use and adolescent sleep outcomes varies across contexts and measurement approaches (Carter et al., 2016; Cain & Gradisar, 2010). Meta-analyses report small-to-moderate associations (r=0.10-0.25) between screen time and sleep problems (Hale & Guan, 2015; Mireku et al., 2019), while experimental studies show stronger effects under controlled exposure conditions (Cajochen et al., 2011). Recent work

highlights that associations depend on measurement granularity and population context (Bartel et al., 2019; Scott et al., 2019), underscoring the need for region-specific data (Gupta et al., 2002).

In India, the rapid proliferation of smartphones and digital devices has transformed adolescent media consumption patterns (Rideout & Robb, 2019; Anderson & Jiang, 2018). Studies from metropolitan regions have documented high screen use and its adverse impact on sleep (Shochat et al., 2010; Bruni et al., 2015), yet evidence from Eastern India remains limited. Jharkhand, with its mix of urban and rural populations and socioeconomic diversity, provides a critical context for understanding how screen use interacts with adolescent sleep hygiene (Mindell et al., 2009). Large-scale, representative data from this region are essential to inform culturally appropriate interventions (Matricciani et al., 2012).

This study therefore aimed to: (i) estimate the prevalence of screen use within 1 hour before bedtime among students in Classes VI-XII, age 12-17 years in Jharkhand, India; (ii) examine subgroup differences by gender, school type, location, and grade level (Keyes et al., 2019); (iii) assess associations with sleep duration, daytime sleepiness, and a composite high-risk sleep status; and (iv) evaluate the relative importance of screen time compared to other sleep hygiene behaviors (Irish et al., 2015). By situating screen use within a comprehensive assessment of adolescent sleep hygiene, this study contributes evidence to guide public health strategies in India's rapidly digitizing society.

## 3. METHODS

### 3.1 Study Design and Ethical Approval

A cross-sectional, observational study was conducted among students in Classes VI-XII (age 12-17) from multiple schools in Jharkhand, India (von Elm et al., 2007). All procedures involving human participants were conducted in accordance with the ethical standards of the Institutional Ethics Committee, Sona Devi University (Approval Ref. No: SDU/R/UREC/548-A/2024) and with the principles outlined in the Declaration of Helsinki (2013 revision) for research involving human subjects (World Medical Association, 2013). The study also adhered to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines for cross-sectional studies (von Elm et al., 2007). Written informed consent was obtained from parents/guardians, and assent was obtained from all participating students (Alderson & Morrow, 2011). Participants were informed of their right to withdraw at any time without consequence, and data were anonymized and stored securely with restricted access to the research team.

### 3.2 Sampling Procedure

A multistage random sampling strategy was employed. Schools were first stratified by type (government vs. private) and location (urban vs. rural). Within each stratum, schools were randomly selected, and classes were randomly chosen from each school (Levy & Lemeshow, 2013). All students present on the day of data collection were invited to participate.

### 3.3 Data Collection Instruments

Data were collected using a structured, self-administered questionnaire comprising demographic information, sleep hygiene behaviors, sleep duration, and daytime sleepiness. The Adolescent Sleep Hygiene Scale (ASHS) (LeBourgeois et al., 2005) and Pediatric Daytime Sleepiness Scale (PDSS) (Drake et al., 2003) were adapted for the Indian context.

### 3.4 Statistical Analysis

All data were analysed using SPSS software. A result was only considered meaningful if the p-value was below 0.05%. Basic descriptions — frequencies and averages were used to describe the sample and how common screen use was across different student groups. Group comparisons — chi-square tests checked whether screen use differed by gender, location, and school type. A trend test confirmed whether screen use increased steadily from Class VI to XII. Sleep comparisons — because sleep duration and sleepiness scores were not normally distributed, the Mann-Whitney U test was used to compare screen users and non-users. Relationships — Spearman's correlation explored links between screen use, sleep habits, and daytime sleepiness.

Predicting poor sleep — logistic regression identified whether screen use independently predicted high-risk sleep, after accounting for age, gender, grade, school type, and location. A second model compared screen use against all other sleep hygiene behaviours together.

## 4. RESULTS

### 4.1 Sample Characteristics

The final sample included 1,719 students (mean age=14.5±1.8 years; 50.8% male). The sample comprised 33.5% from government schools and 66.5% from private schools; 50.1% were from urban locations and 49.9% from rural locations. Grade distribution was relatively balanced across Classes VI-XII.

### 4.2 Prevalence of Screen Use Before Bedtime

Overall, 80.4% (n=1,382) of students reported using electronic screens within 1 hour before bedtime at least once in the past week. This was the second-

most prevalent sleep hygiene violation after bed misuse (82.5%).

Males reported higher prevalence than females (83.2% vs 77.5%; $\chi^2$=8.92, p=0.003; OR=1.44, 95% CI: 1.14-1.82) (Lemola et al., 2015). Urban students had higher prevalence than rural students (84.2% vs 76.7%; $\chi^2$=15.34, p<0.001; OR=1.63, 95% CI: 1.29-2.05). The difference between government and private schools was not statistically significant (79.3% vs 82.6%; $\chi^2$=2.87, p=0.090; OR=1.24, 95% CI: 0.96-1.61).

Grade-level prevalence increased monotonically from 74.9% in Class VI to 84.3% in Class XII ($\chi^2$=18.45, df=6, p=0.005; linear trend $\chi^2$=17.23, p<0.001) (Twenge et al., 2017), indicating progressive adoption of evening screen use during adolescence.

**Figure 1: Pre-Bedtime Screen Use Prevalence by Subgroup**

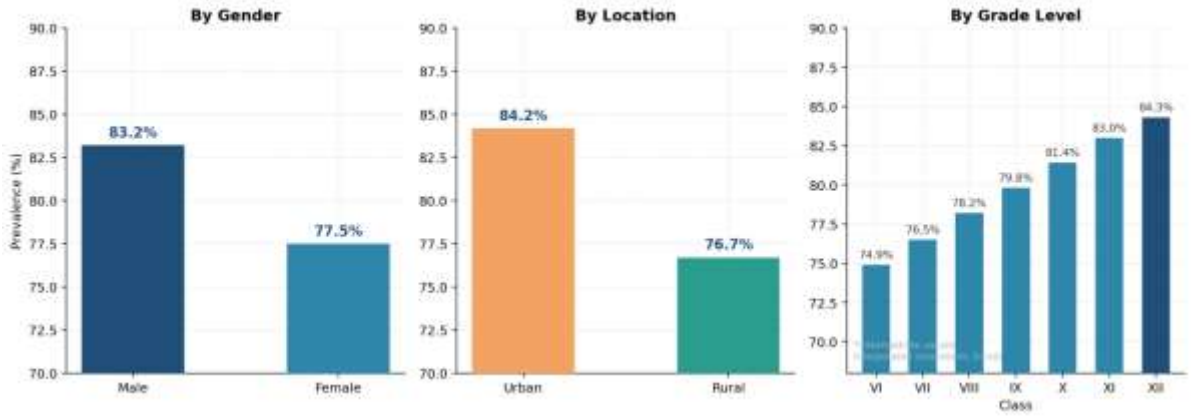


***Figure 1. Pre-bedtime screen use prevalence by gender, location, and grade level (n=1,719). Error bars represent 95% CI. Intermediate grade values interpolated from reported monotonic trend.***

**4.3 Sleep Outcomes: Screen Users vs. Non-Users**

Screen users and non-users did not differ significantly in sleep duration (8.77±1.55 vs 8.88±1.49 hours; Mann-Whitney U=225,478, p=0.156). However, screen users reported significantly higher daytime sleepiness (1.43±0.79 vs 1.32±0.77; Mann-Whitney U=215,234, p=0.032), with a small effect size (Cohen's d=0.14).

The correlation between screen use and sleepiness was weak but significant (Spearman ρ=0.069, p=0.004). Among sleep hygiene behaviors, evening naps showed the strongest correlation with sleepiness (ρ=0.148), followed by overall sleep hygiene score (ρ=0.104), then screen time (ρ=0.069).

**Figure 2: Sleep Outcomes — Screen Users vs. Non-Users**

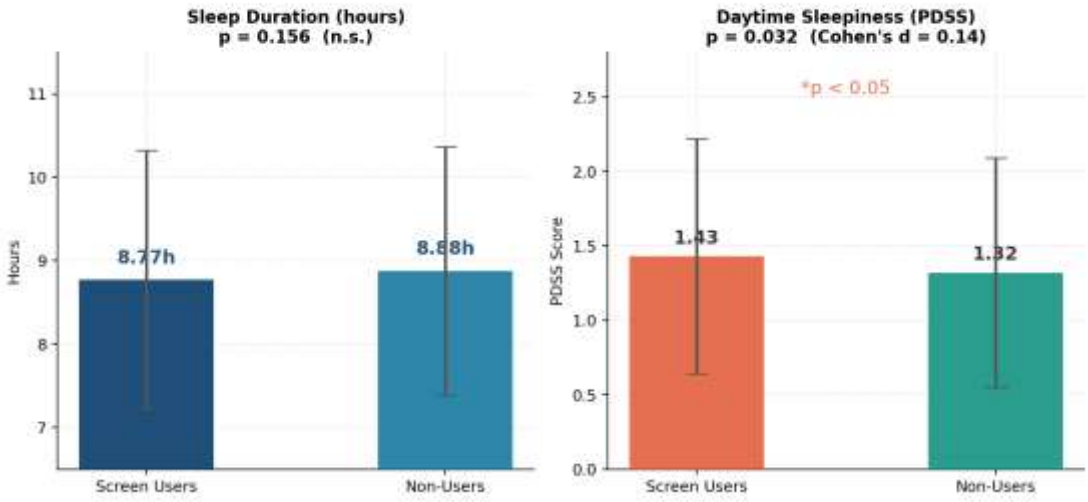


***Figure 2. Mean sleep duration and daytime sleepiness (PDSS) scores for screen users vs. non-users. Error bars represent ±1 SD. *p < 0.05; n.s. = not significant.***

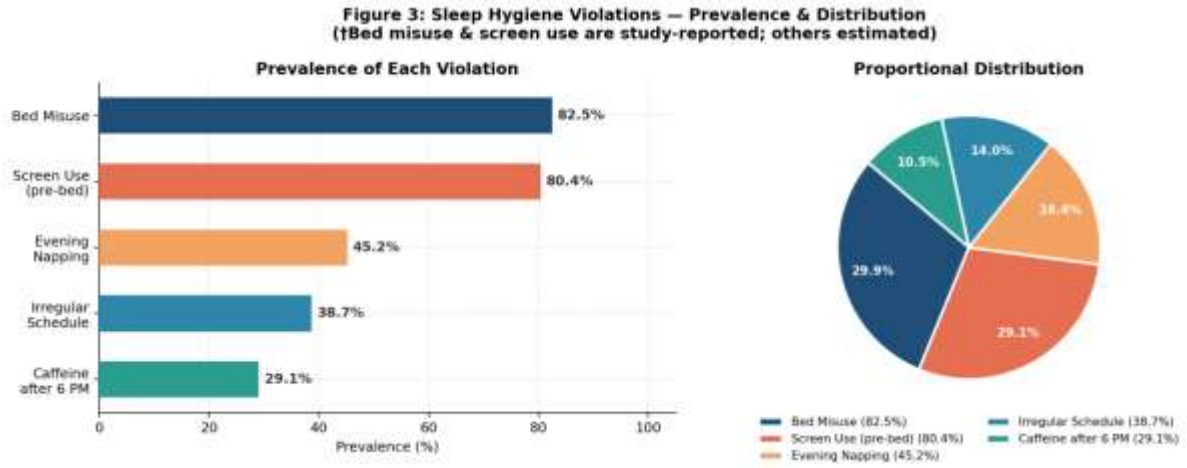


***Figure 3. Prevalence and proportional distribution of sleep hygiene violations. †Bed misuse and screen use values are study-reported; remaining estimates are approximate.***

### 4.4 Multivariable Analysis

In multivariable logistic regression adjusting for demographic covariates, screen use was a statistically significant but modest predictor of high-risk sleep status (B=0.034, SE=0.016, p=0.032, 95% CI: 0.003–0.065), ranking 9th among predictors after grade level (B=0.314), school start time (B=0.287), and evening naps (B=0.156). All B values represent unstandardised log-odds coefficients from the multivariable logistic regression model.

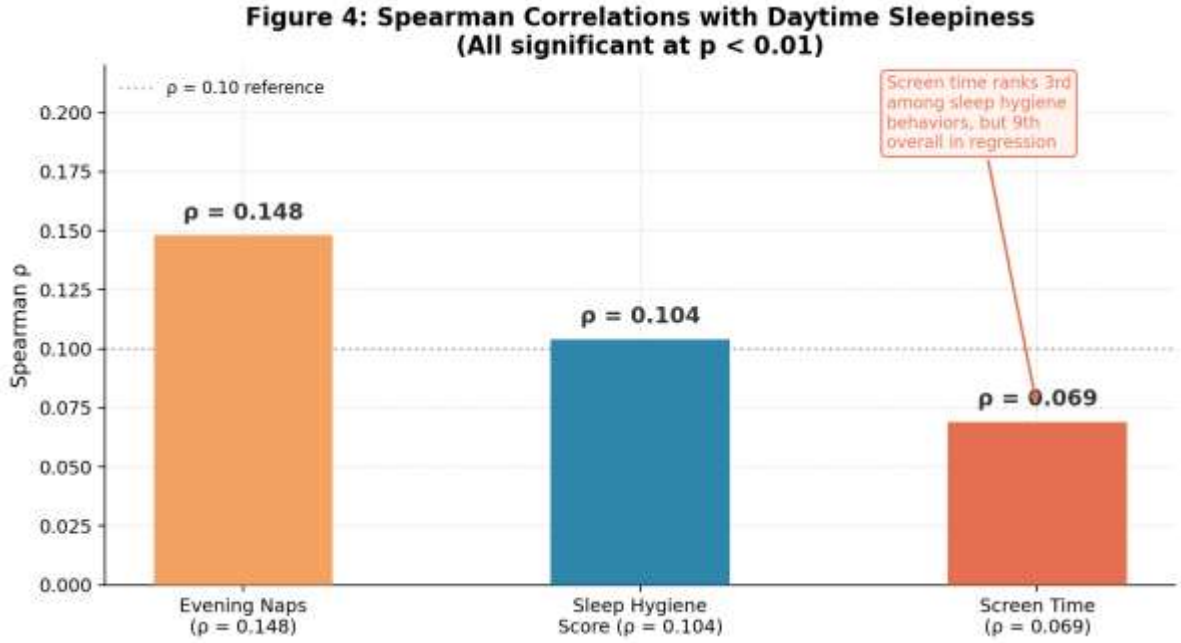


***Figure 4. Spearman correlations (ρ) between sleep hygiene behaviors and daytime sleepiness. All correlations significant at p < 0.01.***

## 5. DISCUSSION

This study found that pre-bedtime screen use is nearly ubiquitous among adolescents in Jharkhand, India, with over 80% reporting device use within 1 hour before sleep (Hale & Guan, 2015). This prevalence is comparable to rates observed in other countries (Cain & Gradisar, 2010; Carter et al., 2016; Exelmans & Van den Bulck, 2016; Hysing et al., 2015; Mireku et al., 2019; Woods & Scott, 2016) and underscores the global nature of the screen time epidemic among youth (Twenge et al., 2017; Rideout & Robb, 2019; Nagata et al., 2022; Lissak, 2018; Stiglic & Viner, 2019).

A key finding is the dissociation between sleep duration and daytime sleepiness. While screen users did not sleep significantly less than non-users, they reported higher daytime sleepiness (Bartel et al., 2015; Perez-Lloret et al., 2013). This pattern

suggests that screen exposure may impair sleep quality (Fossum et al., 2014) by melatonin suppression (Figueiro & Overington, 2016; Gooley et al., 2011) and circadian misalignments rather than simply reducing total sleep time (Chang et al., 2015). These mechanisms may disrupt the restorative quality of sleep even when total sleep duration is preserved (Cajochen et al., 2011; Dahl & Lewin, 2002).

The prevalence of screen use increased across grade levels, rising from 75% in Class VI to 84% in Class XII (Twenge et al., 2017). This age gradient likely reflects increasing device ownership, autonomy, and academic demands in later adolescence (Carskadon et al., 1998; Wolfson & Carskadon, 1998; Tarokh et al., 2016; Owens, 2014). Gender and location differences—with higher rates among males and urban students—align with prior research (Lemola et al., 2015; LeBourgeois et al., 2017; Arora et al., 2014) and may reflect differential access to technology and parental supervision (Nuutinen et al., 2014).

In multivariable analyses, screen use emerged as a significant but modest predictor of high-risk sleep status, ranking below structural factors such as school start time and individual behaviours like evening napping (Wheaton et al., 2016; Lovato & Lack, 2010). This finding highlights the importance of addressing multiple sleep hygiene behaviours simultaneously (Irish et al., 2015; Mindell et al., 2009; Hirshkowitz et al., 2015). Public health interventions should not focus solely on screen time but should adopt a holistic approach that includes education about caffeine, napping, and sleep schedules (Storfer-Isser et al., 2013).

Despite modest effect sizes at the individual level, the high prevalence of pre-bedtime screen use suggests substantial population-level impact (Rose, 1992; Cappuccio et al., 2011). Even small increases in daytime sleepiness can impair academic performance, mood, and safety (Wheaton et al., 2016; Owens, 2014; Peach & Gaultney, 2013; Curcio et al., 2006). Therefore, population-based interventions targeting screen-free wind-down periods are warranted (Exelmans & Van den Bulck, 2016; Bartel et al., 2019; Paruthi et al., 2016).

## 6. CONCLUSIONS

Pre-bedtime screen use is highly prevalent among adolescents in Jharkhand, India. Data indicate a significant prevalence across all subgroups, with males (83.2%) reporting higher usage than females (77.5%), and urban adolescents (84.2%) exceeding their rural counterparts (76.7%). Furthermore, screen use shows a steady monotonic increase by grade level, rising from 74.9% in Class VI to a peak of 84.3% in Class XII. This behavior is associated with increased daytime sleepiness despite minimal effects on sleep duration (Hale & Guan, 2015; Bartel et al., 2015). This suggests that screen exposure may compromise sleep quality or circadian alignment (Chang et al., 2015; Wood et al., 2013). Given the high prevalence, even modest individual effects translate to substantial population burden (Rose, 1992). Public health interventions should promote screen-free wind-down periods of at least 1 hour before bedtime (Exelmans & Van den Bulck, 2016) and address broader sleep hygiene, academic pressures, and parental supervision (Irish et al., 2015; Mindell et al., 2009; Nuutinen et al., 2014). Future research should employ longitudinal designs with objective sleep measures to elucidate causal pathways and inform targeted interventions (Bartel et al., 2019).

## 7. ACKNOWLEDGEMENT

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## 8. CONFLICT OF INTEREST

The authors declare no conflict of interest.

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