

## The Effects of BMI, Socioeconomic Status, and Bedtime Technology Use on Sleep Duration in Adolescents

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### Abstract

**Objective:** Adolescents and sleep-related factors are poorly understood. In 8th graders (N = 200) involved in a school-based wellness initiative, the associations between bedtime technology usage (TU), TV in the bedroom, weight, and socioeconomic status were assessed.

**Method:** This was a cross-sectional study carried out in Department of Paediatric, MGM Medical College and LSK Hospital, Kishanganj from January 2021 To February 2022. High TU before sleep was determined by use "a few evenings each week" or "every, or practically every night." Sleep duration was dichotomized as inadequate (<7 hours) or sufficient (≥7 hours).

**Result:** The most often mentioned issues were insufficient sleep (38.6%), TV in the bedroom (72.8%), and high TU (83.0%). Students with high TU had a decreased chance of getting enough sleep (odds ratio [OR] = 0.528 [0.462-0.604]), as did obese students (OR = 0.814 [0.701-0.948]) and those who watched TV in bed (OR = 0.816 [0.702-0.951]). Moreover, attending a school with a higher percentage of pupils from low socioeconomic backgrounds was linked to insufficient sleep (P = .025).

**Conclusion:** Treatments to lower TU may be crucial for increasing the amount of sleep, particularly for some susceptible populations.

**Keywords:** Obesity, Socioeconomic Status, Technology, Sleep.

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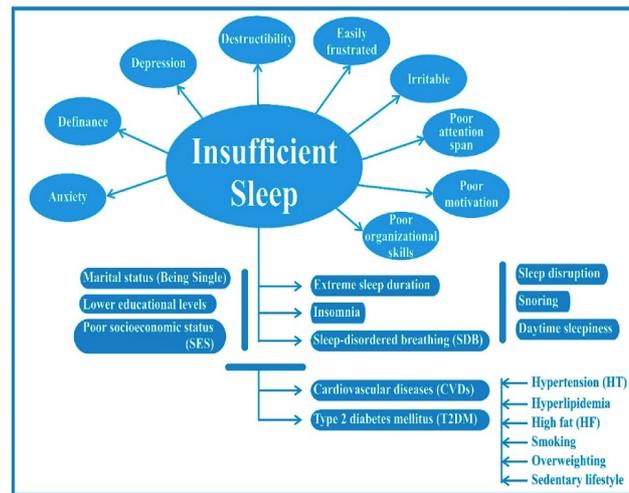
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### Introduction

It has been demonstrated that getting enough sleep has a good impact on health [1]. On the other hand, it has been demonstrated that children and teenagers'

physical health and cognitive development are negatively impacted by inadequate sleep [Figure 1; 2].



**Figure 1: Association of different factors linked with Insufficient**

For instance, in these populations, inadequate sleep is linked to a higher risk of accidents, hypertension, obesity, diabetes, and depression/self-harm [3]. Moreover, lack of sleep has an effect on emotional control, learning, memory, behaviour, attention, and behaviour [4].

There is a growing body of evidence showing how using technology (TU) before bed affects sleep quality. The presence of a television in the bedroom and easy access to smart devices like smartphones can directly interfere with sleep, throw off the circadian cycle, and encourage emotional arousal while trying to fall asleep [5]. Self-reported inadequate sleep has been linked to handheld smart gadgets [6]. Moreover, TU is a known risk factor for excessive weight gain [7] and has been linked to snacking and beverage consumption [8]. Obesity development may be accelerated by inadequate sleep in and of itself [9].

In this study, 300 students were used as the study population, and the goal was to examine the association between self-reported TU before sleep and self-reported sleep duration. Also, we wanted to know if and how weight and socioeconomic status (SES) affected the link between TU and the probability of reporting getting enough sleep.

We predicted that

- (1) having a TV in the bedroom, being overweight (OW) or obese (OB), and having a low SES would all raise the chance of getting insufficient rest, whereas
- (2) Neither gender nor race/ethnicity would affect the amount of sleep that was actually reported.

## Method

### Study design:

This was a cross-sectional study carried out in Department of Paediatric, MGM Medical College and LSK Hospital, Kishanganj.

### Methodology:

An examination of observational data from young adolescents participating in the previously mentioned MATCH (Motivating Adolescents with Technology to Choose Health) schoolbased wellness program. All eighth-graders enrolled in the school's mainstream classrooms got the MATCH curriculum and were qualified to take part in the study. the results of a self-administered "Sleep, Eating, Activity, and Technology" (SEAT) health behavior questionnaire[11], demographic data such as age, sex, and race as recorded in school registration records, and school-level participation in the National School Lunch Program (NSLP), the programme that subsidizes the cost of school meals to qualifying students. As a substitute for

measuring SES, the percentage of students at the school level who participated in the NSLP was used.

#### Technology use:

How many times in the last three weeks have you used a screen-based piece of technology within two hours of attempting to go asleep? (Television, computer, laptop, smartphone, Wii, PS3, Xbox, MP3 player, iPod, or e-book reader).

- A. Never
- B. Infrequently
- C. Many nights per week
- D. Almost every night

Responses were divided into two categories for the sake of this study: yes and no for high TU. Responses C and D were combined into a single category, meaning "yes" for high TU, whereas responses A and B were combined into a single category, meaning "no" for high TU.

**Sleeping time:** How much time do you spend sleeping at night?

Answers available:

- A. less than seven hours
- B. Longer than 7 but shorter than 8 hours
- C. A minimum of 7 hours but not more than 11 hours
- D. At least 11 hours

Responses to the study's questions were divided into two categories: "yes" for sufficient sleep (defined as more than seven hours) for replies C and D, and "no" for sufficient sleep (defined as less than seven hours) for responses A and B.

**Sample size:** 300 subjects were enrolled in this study.

**Inclusion Criteria:** All kids with recorded data on their body mass index (BMI) and sleep habits who did not provide a signed parent or student opt-out form were included.

**Statistical analysis:** Cochran-Armitage tests were used to look for trends in proportions, while chi-square tests were employed to look for bivariate relationships between variables. The likelihood of getting enough sleep was examined in relation to weight category, high TU, TV in the room, and %NSLP using a multiple logistic regression model. At the school level, the Pearson correlation coefficient was calculated to show the relationship between the percentages of pupils reporting less than 7 hours of sleep each night and the NSLP. A significance level of  $P < 0.04$  was used for all statistical tests, and SAS 9.4 was used for all analyses.

**Ethical Consideration:** The study was approved by MGM Medical College and LSK Hospital, Kishanganj, and written consent was provided by the patients

#### Results

Table 1 displays the characteristics of the participants ( $N = 3956$ ). The majority of participants—roughly 50 percent of them women—attended institutions with high proportions of low-SES pupils. 18.7% of the students were classified as OW and 28.8% as OB, representing a 47.6% increase over the HW (Table 1). The study group's participant demographics were generally comparable to those of kids in ABC public schools during the same academic year.

**Table 1** also displays responses to queries regarding TV in the bedroom, TU, and sleep. More than a third of individuals (38.6%) said they slept too little (less than 7 hours), and more than half (55.2%) said they had TU "every night or almost every night." The majority of individuals (83.0%) fell into the high TU before sleep category when those who reported TU "a few evenings per week" were added. The majority of participants (72.8%) claimed to have a TV in their bedroom

**Table 1: Baseline characteristics**

<b>Characteristics</b>	<b>Percentage</b>
<b>Gender</b>	
Male	51%
Female	49%
<b>Weight category</b>	
Underweight	2.2%
Healthy weight	50.1%
Overweight	18.7%
Obese	28.8%
<b>School-level socioeconomic status</b>	
<51% in NSLP	15.6%
51% to 75% in NSLP	40.7%
76% to 99% in NSLP	7.1%
100% in NSLP	36.2%
<b>Sleep duration</b>	
< 7 hours	8.7%
>7 hours but <8 hours	29.8%
> 8 hours but 9 hours	51.6%
> 9 hours	9.5%
<b>TU before sleep</b>	
Never	3.4%
Rarely	13.3%
A few nights each week	27.8%
Every night or most every night	55.2%
<b>TV in bedrooms</b>	
Yes	72.8%

62.3% of men and 60.2% of women reported getting enough sleep, with no variations in significance ( $P = 0.115$ ). But, when comparing adequate sleep by TU frequency, weight category, and having a TV in the bedroom, there were variances. The percentage of subjects who got enough sleep varied significantly between the TU groups ( $P < 0.002$ ). As a comparison to adolescents in lower TU categories, those in higher TU categories were less likely to report getting enough sleep, according to the Cochran-Armitage test ( $P < 0.002$ ). In the highest TU group, just 54.5% of subjects reported getting enough sleep. Among weight groups, the percentage of participants who slept well differed considerably ( $P < 0.002$ ).

According to the Cochran-Armitage test, students in weight categories with lower BMIs were more likely than those in weight categories with higher BMIs to report getting enough sleep. Last but not least, fewer participants with a TV in the bedroom reported getting enough sleep than their peers without one (65.8% vs 59.5%, respectively;  $P < 0.002$ ). A multiple logistic regression study revealed that having a TV in the bedroom, being overweight, and having a high TU all reduced the likelihood that people would report getting enough sleep. In particular, the likelihood that participants with high TU would get enough sleep was only almost half that of participants with low TU (odds ratio [OR]

= 0.528, 95% confidence interval [CI] = 0.462-0.604).

Obesity and high TU together are linked to a reduced likelihood of getting enough sleep (OR = 0.430, 95% CI = 0.351-0.528). Also, a logit regression analysis showed that the probability of getting enough sleep dropped as the % of NSLP at the participant's school rose ( $P = 0.025$ ). 37.6% of those who report not getting enough sleep are from schools, which account for 36.2% of the study's participants, and 39.7% are from NSLP schools, which account for 7.1% of participants.

As a result, 77.4% of the kids who report not getting enough sleep come from schools in the lowest SES category, which accounts for only 43.4% of the study's participants. Analysis showed that schools with higher percentages of NSLP tended to have a higher proportion of students who reported less than 7 hours of sleep per night ( $r = 0.3521$ ,  $P = 0.0176$ ). At the school level, the percentage of students who reported less than 7 hours of sleep per night was also calculated for each school.

## Discussion

In accordance with the consensus statement released by the American Academy of Sleep Medicine (AASM) and the American Academy of Pediatrics (AAP), [7] children aged 6 to 12 are advised to get at least 9 hours of sleep each night, while adolescents aged 13 to 18 are advised to get at least 8 hours. However according to recent, extensive demographic surveys, just 40% of teenagers in the US obtain the required amount of sleep each night [12]. In fact, 71.4% of the 24800 kids included in the 2013-2015 Youth Risk Behavioral Surveillance System study who were between the ages of 9 and 12 reported sleeping less than 8 hours on an average school night [14].

In our study, including weekend nights with potentially longer sleep duration will tend to understate the reporting of inadequate

sleep on weekdays. The national data show a 58% increase in people sleeping less than 7 hours per night since 1991 [15], which may be of greater concern. In line with these findings, we also discovered that roughly 9% of our participants report getting less than 6 hours of sleep per night on a regular basis and that those who do tend to be from low-SES schools. There are probably other contributing factors to this alarming trend in adolescent sleep decrease [16].

The presence of media devices in the bedroom increased TV viewing before bedtime, and heavy screen use (>5 hours daily) have all been linked to shorter sleep durations and/or lower quality sleep in the past [17]. Also, we discovered that having a TV in the bedroom and having a high TU right before bed decreased the likelihood of getting enough rest. We discovered that high TU had a lower likelihood of being associated with adequate sleep than reporting the presence of a TV in the bedroom, which is consistent with earlier studies showing that among children aged 10 years and older, use of portable electronic devices had a stronger detrimental effect on sleep duration than use of nonportable devices [18].

Insufficient sleep is associated with both OW and OB weight status, and this association has been extensively established [14-16]. Insufficient sleep, in and of itself, promotes the development of obesity [1,6,14-17] and can make therapies targeted at reducing obesity less effective [20]. OB populations may have greater incidences of comorbidities promoting insufficient sleep, such as higher incidences of sleep apnea. Moreover, OB kids are less likely to "catch up" on sleep on the weekends, which could make them more susceptible to negative metabolic effects [17]. Also, we discovered that OW/OB kids were less likely than their peers with healthy weights to report getting enough sleep. The notably low likelihood of getting enough sleep in OB patients who also

reported high TU is an important novel result of our investigation.

Our findings further emphasise the detrimental link between obesity and sleep, which is particularly concerning given that 20.6% of US teenagers are currently obese [21]. having a class 2 obesity rate of more than 9% among 12- to 15-year-old African American and Hispanic kids (BMI 120% of the 95th percentile) [22]. Our results highlight the significance of researching and putting into practice strategies intended at lowering both childhood obesity and high TU-induced sleep disturbance.

Although our study lacked data on SES at the individual level, our school-level results corroborate earlier findings that the likelihood of getting enough sleep falls as SES rises [23]. There is proof that these populations may experience poor sleep results, which could then affect cognitive performance outcomes [24]. Further studies in this area are necessary given the relative dearth of research addressing the link between SES and sleep.

Recent studies have shown that weekend recovery sleep does not prevent the metabolic dysregulation brought on by insufficient sleep [25] and that adolescents who sleep longer on catch-up sleep actually perform worse on tasks requiring objective attention [26,27].

### Conclusion

Many kids don't get enough sleep on a regular basis. It's noteworthy that visiting a school with a higher number of lower SES children may be linked to getting insufficient sleep in this primarily underdeveloped, rural area. Yet it's important to understand the variables that mediate the connection between SES and sleep. High TU before bedtime and BMI both showed a dose-dependent inverse connection with adequate sleep. Studies to examine the impact of lowering TU before a night on sleep duration are necessary because TU is a controllable behavior.

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