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A STUDY OF SMARTPHONE DEPENDENCE AND ITS RELATIONSHIP WITH SLEEP DISTURBANCE AND DAYTIME DROWSINESS IN LATE ADOLESCENTS: AN ANALYTICAL CROSS-SECTIONAL APPROACH

Paediatrics

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ABSTRACT

Background: The rapid integration of smartphones into daily life has notably impacted adolescents, who are particularly vulnerable to behavioral dependencies. Excessive use of smartphones has been increasingly linked to disrupted sleep patterns and impaired daytime functioning in this age group. **Objectives:** This study aimed to evaluate the prevalence of smartphone addiction among school-going late adolescents and examine its association with sleep quality and daytime sleepiness. **Methods:** A cross-sectional analytical study was conducted over 18 months among 489 adolescents aged 15–18 years from three semi-government schools in Dehradun. Smartphone addiction, sleep quality, and daytime sleepiness were assessed using the Smartphone Addiction Scale–Short Version (SAS-SV), Pittsburgh Sleep Quality Index (PSQI), and Epworth Sleepiness Scale for Children and Adolescents (ESS-CHAD), respectively. Data were analyzed using Spearman's correlation and logistic regression. **Results:** Smartphone addiction was found in 32.9% of participants. A significant negative correlation was observed between smartphone usage and both sleep quality ($\rho = -0.224$, $p < 0.001$) and daytime alertness ($\rho = -0.173$, $p < 0.001$). Higher PSQI and ESS scores were noted among addicted individuals. **Conclusion:** Smartphone addiction is significantly associated with poor sleep quality and increased daytime sleepiness in adolescents. Structured interventions are essential to address this emerging public health concern.

KEYWORDS

Smartphone Addiction; Sleep Wake Disorders; Daytime Sleepiness; Adolescents; Sleep Quality; Cross-Sectional Studies

INTRODUCTION

The rapid advancement of digital technology, particularly the widespread adoption of smartphones, has significantly transformed the lifestyle and behavioral patterns of individuals across all age groups. Among these, adolescents represent a particularly vulnerable population due to the ongoing neurodevelopmental, psychological, and social transitions occurring during this life stage. The smartphone, a multifunctional device offering instant access to information, social connectivity, and entertainment, has become a ubiquitous tool integrated into the daily routines of teenagers globally (1,2). While the advantages of smartphone use are well documented, including educational facilitation and enhanced communication, emerging evidence indicates potential adverse consequences associated with its excessive and unregulated use. Smartphone addiction—characterized by compulsive use, withdrawal symptoms, and disruption in normal functioning—has increasingly been recognized as a behavioral concern with parallels to other forms of non-substance-related addiction (3,4). The Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5), has acknowledged behavioral addictions by incorporating conditions such as internet gaming disorder, thereby providing a framework for evaluating similar technology-related compulsions (5). A growing body of literature has highlighted the association between problematic smartphone use and disturbances in sleep architecture among adolescents. The use of smartphones during evening and nighttime hours is associated with delayed sleep onset, reduced sleep duration, and increased sleep fragmentation, largely attributed to the suppression of melatonin by blue light exposure and heightened psychological arousal (6-8). These disruptions contribute to poor sleep quality and an increased prevalence of daytime sleepiness—manifesting as reduced cognitive performance, irritability, and impaired academic functioning (8,9).

This study explores smartphone addiction and its association with sleep disturbances and daytime drowsiness among school-going late adolescents in Dehradun, aiming to provide region-specific evidence for targeted health interventions.

MATERIAL AND METHODS

This cross-sectional, school-based study was conducted over a period of 18 months among school-going late adolescents in Dehradun, Uttarakhand.

A sample size of 489 was calculated using the standard formula for estimating proportions:

$$n = Z^2(1-\alpha/2) \times P(1-P) / L^2$$

where $Z = 1.96$ at a 95% confidence level, $P = 0.44$ (based on a previously reported prevalence of smartphone addiction), and $L = 10\%$ of P as the allowable error.

Participants were recruited from three semi-government schools managed by the Sri Guru Ram Rai (SGRR) Public School Trust, located in Patel Nagar, Talab, and Race Course areas of Dehradun. Adolescents aged between 15 and 18 years who had regular access to a smartphone and were willing to participate were enrolled in the study. Exclusion criteria included students with developmental delays, pre-existing sleep disorders, a past history of central nervous system conditions such as meningitis or epilepsy, prolonged medication use, or any chronic systemic illness.

Data collection was performed during scheduled school visits following prior approval from school authorities. Written permission was obtained from each principal, and the purpose of the study was explained to both participants and teachers. The self-reporting questionnaires were distributed in the classroom and completed by the students within approximately 15 minutes. The three standardized tools used in this study were the Smartphone Addiction Scale – Short Version (SAS-SV), the Pittsburgh Sleep Quality Index (PSQI), and the Epworth Sleepiness Scale for Children and Adolescents (ESS-CHAD).

The SAS-SV is a validated 10-item scale used to assess smartphone addiction severity on a 6-point Likert scale, with a total score ranging from 10 to 60. Higher scores indicate greater addiction risk, with cutoffs of 31 for boys and 33 for girls yielding high sensitivity and specificity. The PSQI, a widely accepted instrument to assess sleep quality over a one-month interval, includes 19 questions grouped into seven components that generate a global score from 0 to 21. A score above 5 suggests poor sleep quality. The ESS-CHAD, adapted from the adult version, includes eight items measuring the likelihood of dozing in various situations, with a total score of 0 to 24. A score of 16 or more was considered indicative of significant daytime sleepiness. All three tools used in the study are validated and reliable for adolescent populations, ensuring robust and meaningful data collection.

RESULTS

In our study, the mean age was identical (15.9 years) for both groups, with no significant age-related difference. Smartphone addiction was slightly more prevalent in males (18.6%) than females (14.3%).

Table 1: Comparison of Sleep Quality, Daytime Sleepiness, and Smartphone Addiction Severity Between Individuals With and Without Addiction (95% Confidence Interval Analysis)

Variable	Addiction Status	Mean	95% CI (Lower–Upper)	SD
PSQI	Absent	5.48	5.16 – 5.81	3.03
	Present	9.07	8.29 – 9.86	5.04
ESS	Absent	8.71	8.20 – 9.21	4.63
	Present	12.71	11.79 – 13.64	5.93
SAS-SV	Absent	21.23	20.56 – 21.89	5.93
	Present	38.68	37.86 – 39.51	5.32

Table 2: Correlation Between Smartphone Usage, Sleep Quality, Daytime Sleepiness, and Smartphone Addiction in a Sample Population

	Smartphone Usage	PSQI	ESS	SAS-SV
PSQI	Spearman's ρ = -0.224	—		
	df = 487			
	p < 0.001			
ESS	Spearman's ρ = -0.173	0.561	—	
	df = 487	df = 487		
	p < 0.001	p < 0.001		
SAS-SV	Spearman's ρ = -0.386	0.365	0.329	—
	df = 487	df = 487	df = 487	
	p < 0.001	p < 0.001	p < 0.001	

Table 3: Logistic Regression Analysis of Factors Associated with Smartphone Addiction

Predictor	Comparison	Estimate	SE	Z	p-value
Intercept	—	0.201	0.186	—	—
Family Type	Joint vs Nuclear	0.318	0.227	1.398	0.162
Smartphone Usage	User vs Non-user	-1.554	0.21	-7.414	< 0.001
Sex	Female vs Male	-0.205	0.208	-0.982	0.326

Table 4: Association Between Smartphone Ownership and Addiction Status

Smartphone Ownership	Addiction Status	Count	% of Total	95% CI for Addiction Rate
Personal Smartphone	Present	142	29.0%	25.4% – 32.8%
	Absent	200	40.9%	—
Shared/Family Phone	Present	19	3.9%	2.1% – 5.7%
	Absent	79	16.2%	—
No Smartphone	Present	0	0%	0% – 0.5%
	Absent	49	10.0%	—
Total	—	489	100%	—

DISCUSSION

The study evaluated the prevalence of smartphone addiction and its association with sleep quality and daytime sleepiness among school-going late adolescents in Dehradun. Using validated tools—Smartphone Addiction Scale-Short Version (SAS-SV), Pittsburgh Sleep Quality Index (PSQI), and Epworth Sleepiness Scale for Children and Adolescents (ESS-CHAD)—the study found that 32.9% of participants were addicted to smartphones. This prevalence is slightly lower than that reported in university-based studies, possibly due to differences in age, autonomy, and smartphone ownership among school students.

A significant negative correlation was observed between smartphone usage and sleep quality ($\rho = -0.224$, $p < 0.001$), as well as daytime alertness (ESS score) ($\rho = -0.173$, $p < 0.001$). Furthermore, smartphone addiction severity was strongly associated with poor sleep quality and increased daytime sleepiness. Participants with addiction had higher PSQI and ESS scores compared to non-addicted individuals, indicating a direct impact of excessive smartphone use on adolescent sleep health and alertness.

The study also explored demographic variations. While the mean age of addicted and non-addicted adolescents was the same (15.9 years), a slightly higher addiction prevalence was seen in males (18.6%) than females (14.3%), though the difference was not statistically significant. This aligns with previous findings by Chatterjee et al., who noted gender-based behavioral differences, with males showing higher engagement in digital activities (10). Similarly, Sadiq et al. reported a female-dominated sample (57.2%), highlighting the need for gender-sensitive interpretations in digital behavior research (11).

In summary, this study demonstrates a significant association between smartphone addiction and deteriorated sleep quality and daytime functioning in adolescents. These findings highlight the urgent need for awareness programs, parental guidance, and structured interventions to foster healthy technology habits and safeguard adolescent well-being in the digital era.

CONCLUSION

We concluded that smartphone addiction is significantly associated with poor sleep quality and increased daytime sleepiness among school-going late adolescents. Higher addiction was observed in students with personal smartphones. Our study emphasizes the need for targeted awareness, behavioral interventions, and digital hygiene education to mitigate the adverse effects of excessive smartphone use in adolescents.

Strengths Of The Study

This study used validated and widely accepted tools—SAS-SV, PSQI, and ESS-CHAD—ensuring reliable measurement of smartphone addiction, sleep quality, and daytime sleepiness. It focused on a specific and under-researched population—school-going late adolescents in urban India—thus offering valuable regional insights. The large sample size and school-based approach enhanced the study's representativeness and relevance to real-world settings.

Limitations Of The Study

As a cross-sectional study, causal relationships could not be established. Self-reported data may be subject to recall or social desirability bias. The study was limited to semi-government schools in Dehradun, which may restrict generalizability to other adolescent populations. Additionally, factors like screen time duration or specific content use were not individually analyzed.

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