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Original Article

Nursing Section

Risk for Smartphone Addiction among Adolescents: A Descriptive Study from Karnataka, India

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ABSTRACT

Introduction: Smartphones are widely used by adolescents in their everyday life and help them in communication, learning, and entertainment. However, too much and uncontrolled smartphone use can lead to addiction, which may cause sleep problems, emotional issues, and poor academic performance. Adolescents are particularly vulnerable due to ongoing psychological and behavioural development.

Aim: To identify adolescents at risk for smartphone addiction in selected schools in Mangalore, India.

Materials and Methods: A cross-sectional descriptive study was conducted in three private English-medium high schools in Mangaluru, Karnataka, India, from January to March 2025. A total of 540 adolescents aged 13-16 years were screened using a baseline proforma and the Smartphone Addiction Scale–Short Version (SAS-SV), a 10-item standardised tool with a 6-point Likert scale. Data were analysed using Statistical Package for the Social Sciences (SPSS) version 23.0, employing descriptive statistics such as frequency and percentage.

Results: The study revealed that 180 (33.3%) adolescents were addicted to smartphones, 165 (30.6%) were at high-risk and 195 (36.1%) had no risk. Although daily use was moderate 250 (46.3%) using smartphones for 1-3 hours and 240 (44.4%) for less than one hour, and 236 (43.7%) had used smartphones for more than three years. Most adolescents reported healthy habits, with 248 (45.9%) sleep between 10-11 p.m., 487 (90.2%) keeping phones away at night, only 2.8% waking to check phones, and 83.1% engaging in daily physical activity; parental use was also moderate (fathers 46.1%, mothers 45.6% up to four hours/day). Despite this, the high prevalence of addiction and risk highlights the need for early screening and preventive interventions in schools and communities.

Conclusion: The study concluded that that nearly two-thirds of adolescents were affected by smartphone addiction or were at risk, despite moderate use and generally healthy lifestyles. This suggests that long-term exposure, rather than daily duration alone, plays a key role, highlighting the need for early screening and preventive interventions in schools and communities.

Keywords: Adolescent behaviour, Behavioural addiction, Cellular phone, Internet addiction disorder, Teenagers

INTRODUCTION

The rapid advancement of smartphone technology over the past decade has profoundly transformed communication patterns, educational practices, and daily functioning across global populations. At present smartphones function as multifunctional digital platforms integrating social networking, academic resources, entertainment, and health-related applications. Recent research indicates that smartphone use has become deeply embedded in everyday life, particularly among adolescents influencing both cognitive and psychosocial domains [1]. In India, smartphone adoption has expanded rapidly over the past decade, with adolescents and young adults becoming the most frequent users [2]. Research shows that smartphones are now deeply integrated into adolescents' routines, facilitating online learning, social interaction, gaming, and multimedia access [3]. Consequently, the device has shifted from being a communication tool to an essential component of their lifestyle [4]. Reports indicate that many adolescents exhibit dependency-related symptoms such as irritability, reduced attention, and restlessness when separated from their devices [5], which parallels behavioural addiction patterns identified in global studies [6].

Overuse of smartphones has been connected to a number of negative health consequences [7], despite its benefits, which include improved connectivity, academic convenience, and rapid access to information [8]. Long-term screen use has been linked to postural abnormalities [9], musculoskeletal discomfort [10], and visual fatigue [11]. Psychological repercussions, including elevated anxiety [12], depressive symptoms, low self-esteem, and social disengagement, are also commonly documented. Adolescents with high smartphone involvement have been repeatedly shown to experience sleep-related disruptions, such as delayed sleep start and shorter sleep duration [13], which will contribute to worsen overall wellbeing.

A regional study conducted by Khan I et al., in Vidyanagar, Karad, revealed that a large proportion of adolescents use smartphones frequently, with excessive use significantly predicting poor academic outcomes, increased stress, and sleep disruption [14]. Comparable findings across India underscore the necessity for early awareness and preventive approaches [15]. These findings are supported by behavioural addiction theories, which explain how compulsive smartphone usage habits can be reinforced by frequent smartphone use [16]. Furthermore, excessive internet exposure is now acknowledged by international health organisations as a developing public health concern that affects teenage mental health [17].

Existing literature on smartphone usage among adolescents has been mainly focused on the prevalence of smartphone addiction or describing usage patterns. However, there is a clear lack of studies that emphasise the risk for smartphone addiction, which is crucial for early identification and prevention [18,19]. Moreover, many studies have been conducted in Western or urban settings, limiting their applicability to adolescents in the Indian context [20-25]. Thus, there remains a significant gap in evidence addressing risk assessment among adolescents to smartphone addiction, particularly within school-based populations in India. The novelty of this study lies in its focus on risk assessment rather than confirmed smartphone addiction, thereby shifting attention from treatment to preventive and promotive aspects. Early identification of at-risk adolescents is essential for planning targeted preventive, educational, and nursing

interventions within school and community settings. Therefore, this study aimed to explore the risk of smartphone addiction among adolescents, emphasising the urgent need for early identification.

MATERIALS AND METHODS

A cross-sectional descriptive research design was used for the study. The study was conducted at private English medium high schools at Mangaluru Karnataka, India from January 2025 to March 2025. Ethical clearance was obtained from the Institutional Ethics Committee for the study (Protocol No ACON IEC 28/2022). Formal permission was obtained from the concerned authority. Written informed consent was obtained from parents, and assent was obtained from adolescents. Confidentiality and anonymity were assured.

Inclusion criteria: Adolescents studying in English medium high schools; Adolescents in the age group of 13-16 years and able to speak, read and understand English were included in the study.

Exclusion criteria: Adolescents more than the age of 16 years were excluded from the study.

Sampling criteria: A total of 540 adolescents were screened from three different schools who were studying in the 8th, 9th and 10th standard.

Sample size calculation: The sample size was calculated based on the prevalence of smartphone addiction reported in a previous study (67%) [26].

Formula for estimating sample size based on proportion is:

$$N = \frac{(z_{1-\frac{\alpha}{2}})^2 pq}{E^2}$$

Where:

'p' is the estimated proportion of an attribute that is present in the population

q = 1-p

E is the acceptable margin of error

based on a previous study the prevalence was 67.0% [26].

Solution

Here, p= 67.0/100= 0.67

q= 1-p= 1-0.67= 0.33

z= 1.96 (assuming 95% confidence level)

If we take at least 4% precision, then E= 0.04

$$N = \frac{z^2 pq}{E^2}$$

$$N = \frac{1.96^2 \times 0.67 \times 0.33}{0.04^2} = 530$$

Anticipating loss to follow-up and missing of data, the minimum sample size was rounded to be 540. Participants were recruited using a non probability convenience sampling technique from three selected schools.

Data collection: The tool used for data collection was baseline variables and SAS-SV.

Tool 1: In the baseline proforma the first part included age, gender, religion, geographical background of residence, type of residence, class of study, education of father and mother, occupation of father and mother, number of siblings. In the second part of the baseline proforma regarding the patterns of mobile use which included the duration of mobile use, years of using a mobile, hours of sleep, location of smartphone while asleep, frequency of waking during sleep waking up in between to see your mobile, time doing any physical activity during the day and parents use of mobile.

Tool 2: Smartphone Addiction Scale- Short Version (SAS-SV)

It is a standardised tool developed in 2013 by four Chinese authors (Min Kwon, Dai-Jin Kim, Hyun Cho, Soo Yang). SAS-SV consists of 10 questions without subscales, and all weighted equally on a 6-point scale. According to the scoring criteria, a score above 33 for females and above 31 for males indicated smartphone addiction. A score ranging from 22 to 33 for females and 22 to 31 for males suggested a high-risk of addiction [27], while a score below 22 for both genders indicated no risk of addiction.

STATISTICAL ANALYSIS

The data were analysed using SPSS version 23.0. Frequency and percentage were used to describe the baseline data and to assess the risk for smartphone addiction. Mean, standard deviation, median, and range were computed. The data collected were presented as frequencies, percentages, mean and standard deviations.

RESULTS

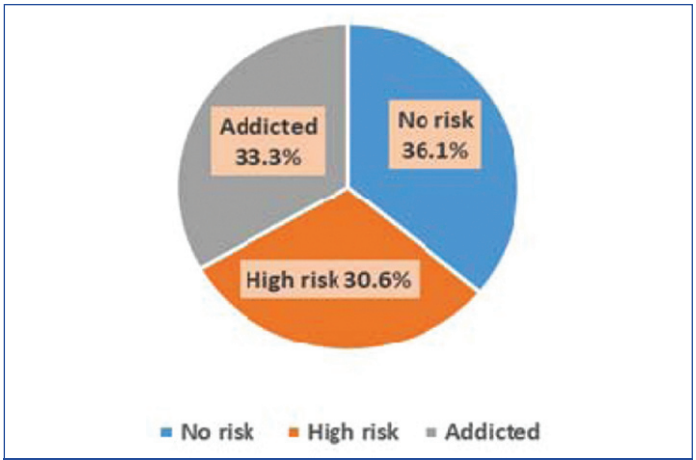
Part A: Baseline Proforma

The analysis of data revealed that among the 540 participants, the majority were 14 years old 226 (41.9%) and predominantly female 381 (70.6%). Most adolescents resided in urban areas 475 (88.0%) and lived at home 515 (95.4%). A higher proportion were studying in the 8th 225 (41.7%) and 9th standards 209 (38.7%). Regarding parental characteristics, most fathers 240 (44.4%) and mothers 220 (40.7%) had completed high school education, with very few having no formal education 10 (1.9% each). The largest proportion of fathers was employed in the private sector 218 (40.4%), while more than half of the mothers were homemakers 316 (58.5%). In terms of family composition, 217 (40.2%) had one sibling, followed by 131 (24.3%) with two siblings.

Part B: Pattern of Mobile Use

Regarding the pattern of mobile use nearly half of the participants 250 (46.3%) used mobile phones for 1-3 hours daily, and 236 (43.7%) had been using them for more than three years. Most adolescents reported going to bed between 10:00-11:00 pm 249 (46.1%), did not keep their phones beside them during sleep 487(90.2%), and did not wake at night to check their phones 487 (90.2%). A majority engaged in daily physical activity 449 (83.1%); regarding parental usage, most fathers used mobile phones for less than two hours per day 249 (46.1%), while 246 (45.6%) of mothers used them for 2-4 hours daily.

Grading of smartphone addiction risk: [Table/Fig-1] revealed that 180 (33.3%) adolescents were addicted to smartphones and 165 (30.6%) were at high-risk, while 195 (36.1%) had no risk. Overall, 63.9% of participants were either addicted or at high-risk.



[Table/Fig-1]: Distribution of subjects according to the grading of smartphone addiction.

Risk for smartphone addiction: [Table/Fig-2] demonstrates that smartphone addiction was proportionately higher among 13-year-old 57 (36.3%) and 14-year-old 78 (34.5%), whereas 15-year-old showed relatively lower addiction rates 42 (28.8%). A marginally

higher prevalence of addiction was observed among males 61 (38.4%) compared to females 119 (31.2%). Adolescents from rural areas exhibited a greater proportion of addiction 28 (43.1%) than their urban counterparts 152 (32.0%). With regard to parental education, higher addiction rates were noted among adolescents whose fathers 25 (46.3%) and mothers 31 (41.9) had postgraduate education, indicating possible socio-demographic influences on smartphone use patterns.

S. No.	Variables	Smartphone addiction scale- short version (SAS_SV)		
		No risk f %	High-risk f %	Addicted f %
1.	**Age in years**			
	a.13	56 (35.7)	44 (28.0)	57 (36.3)
	b.14	79 (35.0)	69 (30.5)	78 (34.5)
	c.15	57 (39.0)	47 (32.2)	42 (28.8)
	d.16	3 (27.3)	5 (45.5)	3 (27.3)
2	**Gender**			
	a. Male	57 (35.8)	41 (25.8)	61 (38.4)
	b. Female	138 (36.2)	124 (32.5)	119 (31.2)
3	**Religion**			
	a Hindu	88 (35.5)	77 (31.0)	83 (33.5)
	b. Christian	39 (40.2)	24 (24.7)	34 (35.1)
	c. Muslim	68 (34.9)	64 (32.8)	63 (32.3)
4	**Geographical background of residence**			
	a. Rural	15 (23.1)	22 (33.8)	28 (43.1)
	b. Urban	180 (37.9)	143 (30.1)	152 (32.0)
5	**Place of stay**			
	a. Home	191 (37.1)	153(29.7)	171 (33.2)
	b. Hostel	4 (21.1)	10 (52.6)	5 (26.3)
	c. Any other	0	2 (33.3)	4 (66.7)
6	**Class**			
	a. 8th	83 (36.9)	59 (26.2)	83 (36.9)
	b. 9th	71 (34.0)	70 (33.5)	68 (32.5)
	c.10th	41 (38.7)	36 (34.0)	29 (27.4)
7	**Education of the father**			
	a. No formal education	7 (70.0)	2 (20.0)	1 (10.0)
	b. Primary education	7 (28.0)	7 (28.0)	11 (44.0)
	c. High school	88 (36.7)	79 (32.9)	73 (30.4)
	d. Graduate	80 (37.9)	61 (28.9)	70 (33.2)
	e. Postgraduate	13 (24.1)	16 (29.6)	25 (46.3)
8	**Education of the mother**			
	a. No formal education	4 (40.0)	3 (30.0)	3 (30.0)
	b. Primary education	9 (34.6)	11 (42.3)	6 (23.1)
	c. High school	80 (36.4)	69 (31.4	71 (32.3)
	d. Graduate	78 (37.1)	63 (30.0)	69 (32.9)
	e. Postgraduate	24 (32.4)	19 (25.7)	31 (41.9)
9	**Occupation of Father**			
	a. Self employed	68 (36.0)	53 (28.0)	68 (36.0)
	b. Govt. employee	11 (36.7)	10 (33.3)	9 (30.0)
	c. Daily wager	26 (36.6)	21 (29.6)	24 (33.8)
	d. Private employee	75 (34.4)	74 (33.9)	69 (31.7)
	e. Any other	15 (46.9)	7 (21.9)	10 (31.3)
10	**Occupation of mother**			
	a. Home maker	106 (33.5)	103 (32.6)	107 (33.9)
	b. Daily wages	9 (37.5)	7 (29.2)	8 (33.3)
	c. Government employee	12 (36.4)	9 (27.2)	12 (36.4)
	d. Private employee	44 (40)	30 (27.3)	36 (32.7)
	e. Self-employee	17 (36.2)	14 (29.8)	16 (34.0)
	f. Any other	7 (70.0)	2 (20.0)	1 (10.0)
11	**Number of sibling**			
	a. None	34 (34.0)	35 (35.0)	31 (31.0)
	b. One	77 (35.5)	63 (29.0)	77 (35.5)
	c. Two	45 (34.4)	44 (33.6)	42 (32.1)
	d. Three and more	39 (42.4)	23 (25.0)	30 (32.6)

[Table/Fig-2]: Distribution of baseline variables of subjects according to the risk for smartphone addiction (n=540).

Analysis of pattern of the smartphone usage: The findings of smartphone use patterns [Table/Fig-3] revealed that adolescents using mobile phones for 3-6 hours/day demonstrated a higher proportion in the high-risk category 16 (42.1%), indicating a positive trend between longer daily usage and addiction risk. Participants with more than three years of mobile use showed a slightly higher addiction prevalence 83 (35.2%), suggesting cumulative exposure as a potential contributing factor. Early bedtime (<9 pm) was associated with a higher addiction proportion 13 (59.1%), whereas sleep between 9-11 pm showed relatively balanced distribution across risk groups. Engagement in 2-4 hours of physical activity appeared protective 38 (28.6% addicted), while higher parental mobile usage showed a modest proportional increase in adolescent addiction, indicating possible behavioural modeling effects.

S No	Variables	No risk f %	High-risk f %	Addicted f %
1	**Duration of mobile use per day**			
	a. Less than one hour	90 (37.5)	65 (27.1)	85 (35.4)
	b. 1 to 3 hours	89 (35.6)	81(32.4)	80 (32.0)
	c. 3 to 6 hours	10 (26.30)	16 (42.1)	12 (31.6)
	d. More than 6 hours	6 (50.0)	3 (25.0)	3 (25.0)
2	**For how many years have you been using mobile?**			
	a. Less than one year	32 (36.4)	26 (29.5)	30 (34.1)
	b. 1 to 3 years	81 (37.5)	68 (31.5)	67 (31.0)
	c. More than 3 years	82 (34.7)	71 (30.1)	83 (35.2)
3	**What time do you usually go to bed.**			
	a. Before 9 pm	4 (17.4)	5 (21.7)	14 (60.9)
	b. 9 to 10 pm	73 (42.0)	52 (29.9)	49 (28.2)
	c. 10 to 11 pm	85 (34.3)	78 (31.5)	85 (34.3)
	d. After 11 pm	33 (34.7)	30 (31.6)	32 (33.7)
4	**When you sleep do you keep you smartphone besides your.**			
	a. Yes	20 (40)	18 (34.0)	15 (28.3)
	b. No	175 (36)	147 (30.2)	165 (33.9)
5	**Do you wake in between to see your mobile.**			
	a. Yes	6 (40.0)	4 (26.7)	5 (33.3)
	b. No	189 (35.9)	161 (30.7)	175 (33.3)
6	**Do you spend time in doing any physical activity or recreation activity during the day?**			
	a. Yes	167 (37.2)	133 (29.6)	149 (33.2)
	b. No	28 (30.8)	32 (35.2)	31 (34.1)
	If Yes			
	a. < 2h	116 (36.7)	89 (28.2)	111 (35.1)
	b. 2 - 4h	51 (38.3)	44 (33.1)	38 (28.6)
7	**As per your knowledge how many hours your parents are using the mobile.**			
	A. Father			
	a. Nil	12 (36.4)	8 (24.2)	13 (39.4)
	b. <2 h	93 (37.3)	69 (27.7)	87 (34.9)
	c. 2 - 4 h	66 (35.5)	63 (33.9)	57 (30.6)
	d. More than 4 h	24 (33.3)	25 (34.7)	23 (31.9)
	B. Mother			

	a. Nil	30 (42.9)	17 (24.3)	23 (32.9)
	b. <2 h	70 (38.3)	49 (26.8)	64 (35.0)
	c. 2 - 4 h	82 (33.3)	85 (34.6)	79 (32.1)
	d. More than 4 hours	13 (31.7)	14 (34.1)	14 (34.1)

[Table/Fig-3]: Distribution of pattern of mobile usage of subjects according to the risk of smartphone addiction (n=540).

DISCUSSION

The prevalence of smartphone addiction observed in the present study (33.3%) aligns with broader trends in Asian populations but exceeds the pooled global prevalence of 23.3% reported in a multinational meta-analysis by Sohn SY et al., which included 41 studies encompassing 41,871 participants and utilised various validated addiction scales to assess prevalence and mental health outcomes [28]. Notably, they highlighted higher rates in Asian countries, which was consistent with the elevated prevalence in the present study from urban Karnataka, India, potentially reflecting regional sociocultural influences on smartphone usage [28]. Comparatively, Davey S and Davey A reported a prevalence of 39-44% among Indian adolescents in a meta-analysis, based on the Smartphone Addiction Scale (SAS) and evaluations of prevalence alongside duration of use. The present findings indicate a slightly lower rate (33.3%), but remain consistent with Indian trends, suggesting variations due to regional or temporal factors [29].

In a Chinese context, Li L et al., conducted a meta-analysis of observational studies, identifying a pooled prevalence of 11.3% for internet addiction disorder, with subgroup rates of 8.4-14.0% depending on the scale used [30]. This waes lower than the present results, where 63.9% of participants fell within the risk spectrum (33.3% addicted and 30.6% high-risk), but highlights similar patterns of elevated addiction risk in Asian adolescent populations. Cha SS and Seo BK studied 1,825 students in South Korea with a SAS, finding 30.9% at risk, particularly linked to usage exceeding three hours per day and associated sleep disturbances [31]. The present study echoes this, with elevated risks observed among adolescents using smartphones for 3-6 hours daily, reinforcing the connection between prolonged use and addiction. Domoff SE et al., assessed parents with the problematic media use measure, linking night-time phone access to poor sleep and emotional issues via parental mediation [32]. The present study findings show relatively better sleep hygiene (90% not keeping phones bedside), yet still elevated addiction rates, suggesting that while some protective behaviours exist, overall usage patterns dominate risk factors. Sohn SY et al., investigated 1,043 young adults in the UK using smartphone addiction screening, associating lower addiction with physical activity and reduced sedentary behaviour [33]. This study aligns with observation of lower addiction (28.6%) among adolescents engaging in 2-4 hours of daily physical activity, emphasising physical activity as a protective factor. Nagata JM et al., surveyed 5,412 adolescents in the USA with screen time assessments, linking parental high screen use to adolescent dependency [34]. The present study noted a modest increase in risk with parental usage exceeding four hours daily, supporting the role of parental modeling in perpetuating addiction. Similar studies have been tabulated in [Table/Fig-4] [28-34].

Bhanderi DJ et al., found the prevalence of smartphone use (83.9%) and addiction (37%) among adolescents indicates a substantial level of digital engagement and dependency in this population [21]. The association of smartphone use with age, residence, parental education, and income suggests that socio-demographic factors significantly influence usage patterns. The present study observed a marginally higher prevalence among males. Several recent Indian and Asian studies report similar trends, often attributing higher male addiction rates to gaming and risk-oriented digital engagement [35-37]. However, some Western studies have reported comparable or higher rates among females, particularly linked to social networking use [36,38]. These findings suggest that gender differences may reflect differences in patterns of smartphone engagement rather than overall exposure.

Contrary to earlier assumptions that urban adolescents are at greater risk, the present study found higher addiction proportions among rural adolescents. Recent Indian data indicate rapid digital penetration in rural areas without parallel digital literacy or parental monitoring frameworks, potentially increasing vulnerability. European studies by Haug S et al., however, continue to report higher risk in urban populations due to greater digital accessibility, suggesting that geographical risk patterns may be region-specific [36].

Higher addiction rates among adolescents with postgraduate-educated parents in the present study may reflect greater device accessibility and early smartphone ownership. Recent South Korean and Chinese studies conducted by Meng Z et al., and Peng Y et al., emphasise that parental monitoring and attachment patterns significantly influence adolescent smartphone behaviour [39,40].

S. No.	Author and year	Place of study	Sample size	Tools used	Parameters assessed	Conclusion
1	Sohn SY et al., 2019 [28]	Multinational (Meta-analysis)	41 studies (n=41,871)	Various validated addiction scales	Prevalence; mental health outcomes	Pooled prevalence 23.3%; higher rates in Asian countries. Present study shows higher prevalence (33.3%), consistent with Asian trends.
2	Davey S and Davey A, 2014 [29]	Urban India	Meta-analysis (6 studies; n=1,304)	Smartphone addiction scale	Prevalence; duration of use	39–44% addiction prevalence. Present study slightly lower (33.3%), but consistent with Indian trends.
3	Li L et al., 2018 [30]	China	Meta-analysis (observational studies)	Various (e.g., Young Diagnostic Questionnaire)	Addiction risk; psychosocial correlates	Pooled prevalence 11.3% for IAD; subgroup rates 8.4–14.0%; lower than present findings (63.9% risk spectrum), but highlights similar patterns in Asian populations.
4	Cha SS and Seo BK, 2018[31]	South Korea	1,825 students	Smartphone addiction scale	Duration; sleep disturbance	~30.9% at risk; significant link with >3 h/day use and sleep problems. Present study shows similar risk with 3-6 h/day users.
5	Domoff SE et al., 2019 [32]	USA	291 mothers (Study 1); 632 parents (Study 2)	Problematic Media Use Measure	Sleep; parental mediation	Nighttime phone access associated with poor sleep and emotional issues. Present study shows relatively better sleep hygiene (90% not keeping phone beside).
6	Sohn SY et al., 2021 [33]	UK	1,043 young adults	Smartphone addiction screening	Physical activity; sedentary behaviour	Lower addiction among physically active adolescents. Present study shows lower addiction in 2-4 hours/day physical activity group (28.6%).
7	Nagata JM et al., 2022 [34]	USA	5,412 adolescents	Screen time surveys	Parental screen modeling	Parental high screen use associated with adolescent dependency. Present study shows modest increase with parental >4 h/day usage.
8	Present study, 2026	India	540 Adolescents	Smartphone addiction scale	Risk of smartphone addiction	Early adolescents (13-14 years), males, rural students, and hostel residents showed higher vulnerability to addiction risk.

[Table/Fig-4]: Similar studies from the literature [28-34].

For instance, Meng Z et al., reported in a nationwide Chinese youth survey that parental monitoring mediates the relationship between parent-child harmony and smartphone addiction, while Peng Y et al., highlighted how parenting styles, including control and care, correlate with addiction tendencies in Chinese adolescents [39,40]. Similarly, Doo EY and Kim JH found in a South Korean cross-sectional study that parental smartphone addiction and negative attitudes contribute to adolescent dependency, and Peng Y et al., demonstrated the mediating role of parental attachment in problematic use among Chinese youth [41,42]. These findings underscore the complex interplay of family dynamics in modulating addiction risks, even in households with higher education levels.

Adolescents residing in hostels demonstrated comparatively higher risk levels. Recent international research conducted by Odgers CL and Jensen MR highlights reduced parental supervision and peer-influenced digital behaviour in residential settings as significant contributors to problematic use [43]. Ladani HM et al., in a mixed-method study of Indian adolescents found higher addiction rates linked to unsupervised environments, while Cho S et al., in South Korea noted elevated risks in residential areas due to lack of monitoring [44,45]. Kagathara J et al., also reported a 42% prevalence among secondary and higher secondary students in Gujarat, India, with hostel residency as a contributing factor [35].

Though most participants reported not keeping smartphones beside during sleep, global studies consistently demonstrate a strong association between prolonged smartphone use (>3 hours/day) and sleep disturbance [46,47]. A noteworthy and counterintuitive finding was the higher prevalence of smartphone addiction among students reporting bedtime before 9 PM. Although early bedtime is typically considered a healthy practice, evidence suggests that sleep timing alone does not reflect healthy digital behaviour. Studies have shown that adolescents often continue smartphone use after going to bed, which is associated with problematic smartphone use and poor sleep quality [48,49]. A systematic review by Li L et al., further confirms the consistent association between smartphone addiction and adverse sleep outcomes [50]. Original studies supporting this include Sohn SY et al., in the UK, reported 39% addiction linked to poor sleep in young adults. [28]; Parlak ME et al., in Turkey, finding 41% addiction correlating with 61% poor sleep quality in adolescents [51]; and Jeong K et al., in South Korea, where addiction was associated with sleep deprivation in children [52].

The observation that 63.9% of adolescents fall within the risk continuum highlights the urgent need for comprehensive preventive and corrective strategies. Early identification through systematic screening using validated tools such as the SAS-SV is essential to detect vulnerable individuals at an initial stage. School-based digital literacy programs should be implemented to promote responsible and balanced technology use. In addition, parental counseling and guidance on effective digital supervision can strengthen monitoring practices at home. Promotion of structured sleep hygiene practices is equally important to reduce late-night smartphone use and associated sleep disturbances. Encouraging regular physical activity may serve as a protective factor by reducing sedentary screen time. Furthermore, targeted behavioural interventions for high-risk adolescents are necessary to prevent progression to established addiction and to support healthier digital engagement.

Limitation(s)

The study employed purposive sampling and was limited to private English-medium schools, which may restrict generalisability. Self-reported data may have introduced recall and social desirability bias. The cross-sectional design limits causal inference.

CONCLUSION(S)

The study indicates that the risk of smartphone addiction in adolescents differs substantially across demographic and usage-related variables. Early adolescents (13-14 years), males, rural students, and hostel residents showed higher vulnerability, indicating the influence of age, gender, living environment, and supervision on addiction risk. Parental education, occupation, and family size also appeared to shape adolescents' smartphone behaviours, underscoring the role of family context. Usage pattern analysis revealed that duration of daily use alone does not fully explain addiction risk, as elevated risk was observed even among students reporting shorter usage times. Factors such as longer years of mobile phone exposure, bedtime habits, low physical activity, and parental phone use emerged as important contributors. Overall, the findings highlight that smartphone addiction risk is multifactorial, emphasising the need for early screening and context-specific preventive interventions targeting both adolescents and their families within school and community settings.

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