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Screen time behaviour and its association with physical, psychological, and social health outcomes among Indian adolescents

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Abstract
Background: Smartphones, computers, and other digital devices have significantly contributed to extending screen time for adolescents and young adults. Too much screen time is recognized as a public health problem, with negative psychological, physical, and social health consequences.
Objective: To explore the relationship between screen time behaviour and psychological, physical and social health outcomes in 17-19-year-old college students.
Methods: The study adopted a quantitative cross sectional method of analysis using a sample of 200 college students (17- 19 years) in a selected college in Chennai, Tamilnadu, India. Simple random sampling was used for selection of the sample. The socio-demographic questionnaire, the Depression Anxiety Stress Scale (DASS-21), the Pittsburgh Sleep Quality Index (PSQI) and the Physical Activity Questionnaire for Adolescents (PAQ-A) were used to collect data. The data was analysed with IBM SPSS Statistics. Descriptive statistics, Pearson correlation, multiple regression and mediation analyses were conducted, and $p < 0.05$ was considered significant.
Results: Participants identified a significant amount of time spent on digital devices each day, with the majority of the time dedicated to social media. A significant number of participants exhibited moderate levels of depression, anxiety, and stress. Common symptoms were having poor quality of sleep, lack of physical activity, eye strain, headache, fatigue, neck pain, and back pain. Pearson correlation analysis revealed higher significant positive correlations between the psychological distress, poor sleep quality and social isolation with screen time behaviour and significant negative correlation with physical activity. Multiple regression analysis revealed that screen time behaviour was the most significant predictor of psychological health and associated with sleep quality and physical activity. Results of mediation analysis showed that sleep quality and physical activity partially mediated the relationship between screen time behavior and psychological health.
Conclusion: Increased screen time behaviour was associated with poorer psychological, physical, and social health outcomes among college students. Promoting healthy digital habits, improving sleep quality, and encouraging regular physical activity may help reduce the adverse effects of excessive screen time and support better overall well-being.

Keywords: Screen time behaviour, college students, psychological health, physical health, social health, DASS-21, sleep quality, physical activity

Introduction

Digital technologies have changed the lives of young people around the globe. Smartphones, tablet computers, laptops, games and platforms that are connected to the Internet are essential devices for teaching, communication, entertainment and social interaction [1]. The widespread proliferation of internet access and the drop in mobile device costs in India has significantly contributed to young adults and college students' screen time [2]. Students spend a significant share of their day interacting on social media platforms, playing games through applications, watching videos on streaming platforms, and learning online [3]. While there are many positive education and social outcomes from digital technologies, there are also concerns about excessive screen time and its potential effects on physical, psychological and social health [4].

Late adolescence and early adulthood (ages 17–19 years) is a pivotal developmental phase in which young people go through major academic, psychological, emotional and social transitions [5]. In this phase, it is important to have a healthy lifestyle to ensure good physical health and school attainment. But there are some negative health effects linked to time spent in front of screens [6]. Studies have shown that excessive screen time leads to increased levels of depression, anxiety, stress, decreased emotional well-being, and decreased self-esteem [7]. Likewise, extended use of digital technology has been associated with sleep disturbances, decreased physical activity, eye strain, headaches, tiredness and other health complaints associated with sitting [8]. Moreover, overuse of digital media could cause less social interaction in the real world and lead to loneliness and social isolation among the youth [9].

In the present study, a comprehensive approach is taken to explore how screen time behaviour relates to multiple dimensions of health for college students. This study examines psychological, physical and social health outcomes together, rather than focusing on a single health outcome, as are most studies. This study also explores the various types of screen use, such as social media, learning, games, and entertainment, to shed light on the correlation between the types of digital engagement and health outcomes. Additionally, other factors that may mediate between the relationship between screen time behaviour and psychological health are explored, including sleep quality and physical activity, to gain a wider understanding of the pathways by which digital behaviour can impact on students' psychological health.

The main aim of the study is to explore the relationship between screen time behaviour and psychological, physical and social health outcomes of college students aged between 17 and 19 years. Specifically, the study aims to be able to determine the pattern of screen time use over the course of a

day, to identify the primary uses of digital devices, to assess depression, anxiety, stress and sleep quality indicators, to assess physical activity levels and social health indicators, and to evaluate the relationship between screen time behaviour and these health outcomes. Additionally, the study explores the mediating role of sleep quality and physical activity in the association between screen time behaviour and psychological health.

The findings of this study are expected to contribute to the growing body of evidence on digital health among young adults by providing a comprehensive understanding of screen time behaviour and its association with psychological, physical, and social health. Results could help educators, health care providers, college administrators, parents and policy makers design evidence-based digital wellness programs, health promotion strategies, and interventions that support healthy technology use, healthy lifestyle behaviors, and better health among college students.

Literature Review

1. Screen Time among Adolescents

Technology and the prevalence of smartphones, tablets, computers and the Internet have led to a significant rise in screen time for adolescent students [10]. Educational activities, social networking, games, video streaming and online communication are all common uses of digital devices in education [11]. A recent study found that many youth are using digital screens for multiple hours a day, more than the recommended amount [12]. Digital technology has become so prevalent that there has been a recent focus on its possible impacts on health and wellbeing [13].

2. Screen Time and Psychological Health

Psychological health is one of the most frequently studied outcomes associated with screen time [14]. Studies have indicated that overuse of electronic devices can lead to increased depression, anxiety and stress in adolescents [15]. There are risks associated with frequent use of social media, including social comparison, fear of missing out, cyberbullying and emotional distress [16]. Extended screen time can also limit time for relaxation, in-person social interaction, and positive coping skills, impacting mental health [17].

3. Screen Time and Sleep Quality

Sleep plays a vital role in adolescent growth, development, and overall health [18]. Excessive screen time has been shown to be associated with poor sleep quality, delayed sleep onset, decreased sleep duration, and daytime sleepiness [19]. Screen light can disrupt sleepiness and sleep quality in teens [20].

4. Screen Time and Physical Health

There is a connection between excessive screen time and sedentary lifestyle and lack of physical activity [21]. Adolescents that spend more time with digital devices are less active in outdoor activities and exercise sessions [22]. The decrease in physical activity could lead to obesity and other lifestyle-related diseases [23].

5. Research Gap

There are many studies that have explored the impact of screen time on adolescent health, but there are gaps in research [24]. Past research has tended to include just one factor (psychological health, sleep quality, physical activity) and not all three factors of health (physical, psychological, social) together [25]. Not much research has been carried out with adolescents in India, particularly in urban and semi-urban areas where digital devices are being increasingly used by teens [26].

Problem Statement

Screen-time has become an important public health issue due to the growing childhood use of screen-based devices including smart phones, computers, tablets, and other digital devices [27]. Digital technologies improve the educational, informational and social outcomes of students, however, excessive exposure to digital technology has been linked to adverse health effects, such as depression, anxiety and stress, and poor sleep quality, less physical activity, eye strain, headaches, fatigue and social isolation [28]. Adolescents are especially at risk from such impacts because they are still in the process of physical, psychological and social development [29]. While some studies have explored the relationship of screen time to any one aspect of health, few studies have examined screen time in relation to psychological, physical and social health simultaneously in Indian adolescents [30]. In addition, little is known about the effect of sleep quality and physical activity on these relationships. The aim of this study is to explore the relationship between youth's screen time behaviors and health outcomes in Indian adolescents and to generate evidence to inform intervention development and digital wellness strategies.

Methodology

1. Research Design

This study used a quantitative cross sectional analytical research design to assess the relationship between screen time behaviour and physical, psychological and social health outcomes in college students. The design was used to examine the relationships between screen time behaviour and health outcomes at one time and place, via the appropriate statistical tests.

2. Study Setting

The study was carried out in the selected colleges of Chennai in the state of Tamilnadu, India. The institution was chosen on the basis of administrative permission and ease of access.

3. Study Population

The study population consisted of the college students (17-19 years) who were studying in the selected college during the study period.

4. Sample Size

A total of 200 college students participated in the study. The number of participants was calculated according to similar studies and was sufficient in order to attain the goals of the study.

5. Sampling Technique

Simple random sampling method was used to recruit the eligible participants from the selected college.

6. Inclusion Criteria

The study participants were 17- to 19-year-old college students enrolled in the college during the study period. Participants had to be regular users of digital devices for a minimum of 1 hour each day, and agree to be involved in the study and to sign a written informed consent.

7. Exclusion Criteria

Students with a known neurological disorder or severe psychiatric illness that might interfere with participation or answer to questionnaires were excluded. Student who could not complete the questionnaires independently and those who refused to answer the questionnaires were also excluded.

8. Study Variables

The study's main independent variable was the screen time behaviour, including average screen time per day, social media usage, gaming, education, and entertainment or video-streaming. The dependent variables included psychological health (depression, anxiety, and stress), physical health (sleep quality, physical activity, eye strain, headache, fatigue, neck pain, back pain), and social health (peer interaction, and social isolation). Demographic data such as age, gender and place of residence were also gathered to provide information about the study participants and enable the analysis and interpretation of the results.

9. Data Collection Instruments

Standardized and validated instruments were used to collect data. A structured Socio-demographic Questionnaire was used to obtain information on participants' demographic characteristics. Average daily screen time and digital device usage patterns were measured using the Screen Time Questionnaire. Psychological health was assessed using the Depression Anxiety Stress Scale (DASS-21), a self-report instrument that assesses depression, anxiety and stress. The Pittsburgh Sleep Quality Index (PSQI) was used to measure sleep quality and the Physical Activity Questionnaire for Adolescents (PAQ-A) was used to measure physical activity.

10. Data Collection Procedure

Permission was given by the institutions, and ethical approval was taken before collection of data. The study goals, confidentiality, voluntary participation and the right to withdraw, were explained to eligible participants. Ethical informed consent was obtained before data was collected. The questionnaires were filled out with the supervision of the researcher, and the completed questionnaires were verified for completeness before data was entered.

11. Data Analysis

The IBM SPSS Statistics software was used to analyse the data. Socio-demographic characteristics of the participants and variables of the study were summarized using descriptive statistics such as frequency, percentages, mean and standard deviation. Pearson correlation analysis was used to explore the associations between the screen time behaviour and psychological, physical and social health outcomes. Multiple regression was performed to determine predictors of psychological health and social isolation. Mediation analysis was used to evaluate the mediation effect of sleep quality and physical activity between the association of screen time behaviour and psychological health outcomes. For all analyses, a p value of < 0.05 ($p < 0.05$) was deemed significant.

Results

1. Socio-Demographic Characteristics of Participants

There were 200 college students aged 17-19 years who participated in the study. The students were selected from the college in Chennai. To balance the study population, both male and female students were included.

Table 1: Socio-Demographic Characteristics of Participants (N = 200)

Variable	Category	Frequency (n)	Percentage (%)
Age	17 Years	62	31.0
	18 Years	76	38.0
	19 Years	62	31.0
Gender	Male	98	49.0
	Female	102	51.0
Residence	Urban	126	63.0
	Semi-Urban	74	37.0
Total		200	100.0

A total of 200 college students (17-19 years) were involved in the hypothetical study. The majority of the students were 18 years of age (38.0%) and 19 years of age (31.0%). Female students (51.0%) slightly outnumbered male students (49.0%). Majority of the participants lived in urban areas (63.0%) while 37.0% were in semi-urban areas.

2. Screen Time Behavior among Adolescents

The average daily screen time distribution showed that many of the respondents used digital devices for four hours or more each day. The most common daily usage types of screen time were social media and entertainment apps.

Table 2: Distribution of Daily Screen Time among Participants

Screen Time Category	Frequency (n)	Percentage (%)
1–2 Hours	24	12.0
2–4 Hours	54	27.0
4–6 Hours	72	36.0
More than 6 Hours	50	25.0
Total	200	100.0

The results in Table 2 show that the 200 college students have been grouped according to the number of hours they spend each day on screens. 36.0% of participants reported using digital devices for 4-6 hours a day, while 27.0% of participants reported using digital devices between 2-4 hours per day. Additionally, 25.0% of the respondents spent more than 6 hours daily on digital devices, and 12.0% spent 1-2 hours daily on digital devices. The overall prevalence of prolonged use of digital devices is high, with 61.0% of participants reporting using digital devices for 4 hours a day or more.

Table 3: Purpose of Screen Usage

Screen Activity	Percentage of Total Screen Use (%)
Social Media	40.4
Entertainment/Streaming	28.8
Educational Use	17.3
Gaming	13.5
Total	100.0

Table 3 presents a distribution based on the main digital activities carried out by the respondents. Social media made up the biggest share of total screen time (40.4%) and entertainment and video streaming (28.8%) were next. The screen time spent on educational activities was 17.3% of total screen time while gaming was the smallest (13.5%). The results of this study suggest that the principal reason for the students to use the screens was for social networking and entertainment.

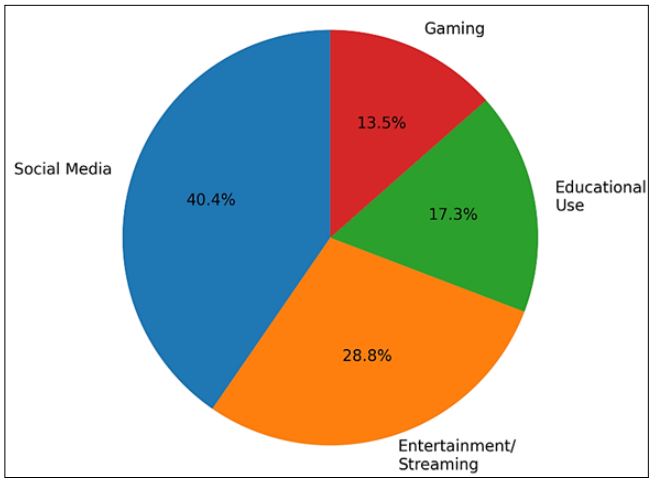

Fig 1: Comparing Average Time Spent on Different Screen Activities

As shown in figure 1, the college students' screen usage varies across digital activities. Social media was the top category of screen time (40.4%), followed by entertainment and video streaming (28.8%). The largest share was for educational activities (17.3%, followed by gaming (13.5%).

The results revealed that the major uses of the screens for the college students were social networking and entertainment.

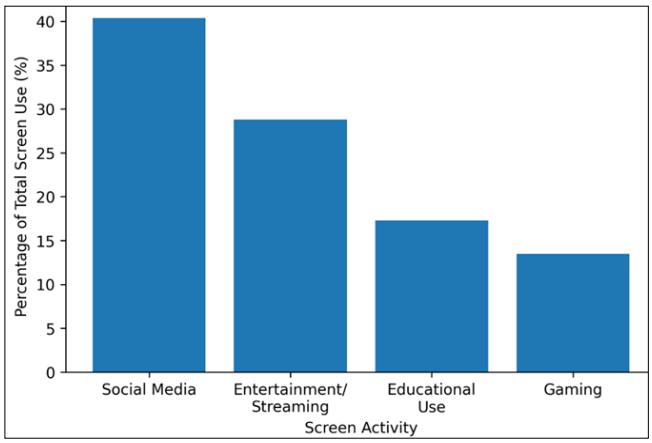

Fig 2: Distribution of Screen Usage by Activity

The percentage distribution of screen usage according to the type of digital activity is displayed in figure 2. The most common use of the screens was for social media, which was followed by entertainment and video streaming. Educational activities made up a smaller portion of total screen time than gaming, the lowest proportion. This figure also illustrates that the college students' daily screen time was mostly accounted for by recreational screen activities.

3. Psychological Health Outcomes

Depression, anxiety, and stress were measured with the Depression Anxiety Stress Scale (DASS-21). Table 4 shows the distribution of depression, anxiety and stress level among participants.

Table 4: Psychological Health Status of Participants (N = 200) (Illustrative Example)\

Variable	Normal	Mild	Moderate	Severe	Extremely Severe
Depression	62 (31.0%)	38 (19.0%)	54 (27.0%)	28 (14.0%)	18 (9.0%)
Anxiety	54 (27.0%)	36 (18.0%)	58 (29.0%)	30 (15.0%)	22 (11.0%)
Stress	70 (35.0%)	34 (17.0%)	50 (25.0%)	28 (14.0%)	18 (9.0%)

Interpretation

Psychological health status of the participants as measured by DASS-21 is shown in table 4. The highest percentage of participants was considered as normal (31.0%) followed by moderate depression (27.0%) for depression. In regard to anxiety, moderate anxiety was the most common (29.0%) and 27.0% were within normal range. The biggest group of participants (35.0%) expressed a normal level of stress, while 25.0% expressed moderate stress. Overall, results suggest that participants had different levels of depression, anxiety, and stress and that moderate levels of depression, anxiety, and stress were more prevalent than severe and extremely severe.

4. Physical Health Outcomes

Physical health outcomes were measured using the Pittsburgh Sleep Quality Index (PSQI), the Physical Activity Questionnaire for Adolescents (PAQ-A) and a structured questionnaire to capture common complaints of physical health related to screen time behaviour. The results of the analyses on sleep quality, physical activity, eye strain, headache, fatigue, neck pain and back pain are summarized in Tables 5-7, respectively.

Table 5: Sleep Quality of Participants (N = 200)

Sleep Quality	Frequency (n)	Percentage (%)
Good	74	37.0
Poor	126	63.0
Total	200	100.0

The sleep quality of the participants is presented in **table 5**. Most of the college students (63.0%) had poor sleep quality while 37.0% had good sleep quality. These results imply that sleep problems occurred in a high proportion of the subjects in this study.

Table 6: Physical Activity Level of Participants (N = 200)

Physical Activity Level	Frequency (n)	Percentage (%)
Low	88	44.0
Moderate	76	38.0
High	36	18.0
Total	200	100.0

The physical activity level of the subjects is shown in Table 6. Almost half of the participants (44.0%) were classified as low, and 38.0% were classified as moderate, with regard to physical activity. The study population had a low level of

physical activity, with only 18.0 per cent reporting high physical activity.

Table 7: Physical Complaints Reported by Participants (N = 200)

Physical Complaint	Yes n (%)	No n (%)
Eye Strain	142 (71.0)	58 (29.0)
Headache	118 (59.0)	82 (41.0)
Fatigue	124 (62.0)	76 (38.0)
Neck Pain	104 (52.0)	96 (48.0)
Back Pain	96 (48.0)	104 (52.0)

The prevalence of physical complaints of the participants is presented in Table 7. Symptoms of eye strain (71.0%), fatigue (62.0%), headache (59.0%), and neck pain (52.0%) were the most common complaints. Almost half of them (48.0%) also suffered from back pain. The results suggest that the college students had reported the occurrence of visual discomfort and musculoskeletal complaints in general.

5. Social Health Outcomes

A structured questionnaire was used to measure the social health outcomes by measuring peer interaction and peer isolation among the subjects. The results are shown in Table 8.

Table 8: Social Health Outcomes of Participants (N = 200)

Social Health Variable	Category	Frequency (n)	Percentage (%)
Peer Interaction	Good	118	59.0
	Poor	82	41.0
Social Isolation	Low	124	62.0
	High	76	38.0
Total		200	100.0

The social health outcomes of participants are reported in Table 8. 59.0% of the students of the college reported good peer interaction while the remaining 41.0% reported poor peer interaction. The social isolation aspect of the study showed that 62.0% of the participants had low levels of social isolation and 38.0% had high levels of social isolation.

6. Correlation Analysis

Pearson correlation analysis was conducted to explore the relationships between screen time behavior and psychological, physical and social health outcomes of participants. Table 9 shows the results of the correlation analysis.

Table 9: Pearson Correlation between Screen Time Behaviour and Health Outcomes (N = 200)

Variables	Pearson Correlation (r)	p-value
Screen Time vs. Depression	0.48	<0.001
Screen Time vs. Anxiety	0.52	<0.001
Screen Time vs. Stress	0.45	<0.001
Screen Time vs. Sleep Quality	0.41	<0.001
Screen Time vs. Physical Activity	-0.36	<0.001
Screen Time vs. Social Isolation	0.39	<0.001

Table 9 shows the Pearson correlation between screen time behaviour and the study variables. Screen time behaviour was moderately positively correlated with depression ($r = 0.48$), anxiety ($r = 0.52$), stress ($r = 0.45$), poor sleep quality ($r = 0.41$) and social isolation ($r = 0.39$). Screen time behaviour, on the other hand, was moderately negatively correlated with physical activity ($r = -0.36$). The relationships between screen time and psychological distress, sleep quality, social isolation, and physical activity were all statistically significant ($p < 0.001$), meaning the more screen time participants had, the higher their psychological distress, the poorer their sleep quality, the more socially isolated they were, and the lower their level of physical activity.

7. Multiple Regression Analysis

Multiple regression analysis was used to determine the key factors predicting the overall psychological health score (DASS-21) for the participants. Screen time behaviour, sleep quality, physical activity, social isolation, age and gender were included in the regression model as independent variables. The results are shown in Table 10.

Table 10: Multiple Regression Analysis for Predictors of Psychological Health (N = 200)

Predictor Variable	β	SE	T	p-value
Screen Time Behaviour	0.39	0.06	6.52	<0.001
Sleep Quality	0.28	0.07	4.18	<0.001
Physical Activity	-0.22	0.08	-3.11	0.002
Social Isolation	0.19	0.07	2.87	0.005
Age	0.05	0.05	0.94	0.348
Gender	0.04	0.05	0.81	0.420

Model Summary: $R^2 = 0.49$, Adjusted $R^2 = 0.47$, $F = 31.62$, $p < 0.001$

Table 10 presents the results of the multiple regression analysis for the overall psychological health score (DASS-21). Screen time behaviour was the strongest positive predictor of psychological distress ($\beta = 0.39$, $p < 0.001$), followed by poor sleep quality ($\beta = 0.28$, $p < 0.001$) and social isolation ($\beta = 0.19$, $p = 0.005$). Physical activity demonstrated a significant negative association with psychological distress ($\beta = –0.22$, $p = 0.002$), indicating that higher physical activity levels were associated with lower psychological distress. Age and gender were not statistically significant predictors ($p > 0.05$). The regression model explained 49% of the variance in the overall psychological health score ($R^2 = 0.49$), and the overall model was statistically significant ($F = 31.62$, $p < 0.001$).

8. Mediation Analysis

Mediation analysis was performed to examine whether sleep quality and physical activity mediated the relationship between screen time behaviour and the overall psychological health score (DASS-21). The direct and indirect effects of screen time behaviour on psychological health are presented in Table 11.

Table 11: Mediation Analysis of the Relationship between Screen Time Behaviour and Psychological Health (N = 200)

Path	Effect Estimate (β)	95% Confidence Interval	p-value
Direct Effect (Screen Time → Psychological Health)	0.31	0.18 – 0.44	<0.001
Indirect Effect via Sleep Quality	0.12	0.06 – 0.19	0.001
Indirect Effect via Physical Activity	0.09	0.03 – 0.15	0.003
Total Effect	0.52	0.39 – 0.65	<0.001

Table 11 presents the mediation analysis examining the relationship between screen time behaviour and the overall psychological health score (DASS-21). The direct effect of screen time behaviour on psychological health remained statistically significant ($\beta = 0.31$, $p < 0.001$), indicating that greater screen time was associated with higher psychological distress after accounting for the mediating variables. Significant indirect effects were also observed through sleep quality ($\beta = 0.12$, $p = 0.001$) and physical activity ($\beta = 0.09$, $p = 0.003$), suggesting that both variables partially mediated the relationship between screen time behaviour and psychological health. The total effect of screen time behaviour on psychological health was statistically significant ($\beta = 0.52$, $p < 0.001$), indicating that both the direct and indirect pathways contributed to the observed association.

Conclusion and Future Works

The present study examined the association between screen time behaviour and psychological, physical, and social health outcomes among college students aged 17–19 years. The findings indicated that a substantial proportion of participants spent four hours or more per day using digital devices, with social media and entertainment being the predominant purposes of screen use. Increased screen time was associated with higher levels of psychological distress, poor sleep quality, reduced physical activity, common physical complaints, and greater social isolation. Screen time behaviour emerged as a significant predictor of psychological health, while sleep quality and physical activity partially mediated this relationship. These findings highlight the importance of promoting healthy digital habits, adequate sleep, regular physical activity, and awareness programmes to minimize the adverse effects of excessive screen use among college students. Future studies should include larger and more diverse samples from multiple educational institutions, employ longitudinal designs to establish temporal relationships, incorporate objective measures of screen time, and evaluate intervention strategies aimed at improving digital well-being and overall student health.

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