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Association of Excessive Screen Time with Behavior, Educational Performance and Physical Growth of Children

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ABSTRACT

OBJECTIVE: To determine the association between excessive screen time and behavioral patterns, educational performance, and physical growth among children.

METHODOLOGY: This cross-sectional analytical study was conducted at private secondary schools of Karachi, Pakistan, from September 2025 to February 2026, of included 266 students aged 5 to 15 years. We used a non-probability consecutive sampling technique to recruit students within each school. We evaluated each eligible child's screen time based of either parent's feedback. We classified screen time as excessive if a child had >2 hours of screen time per day. For behavioral assessment, the Strengths and Difficulties Questionnaire (SDQ) was used.

RESULTS: Among 266 children, 143 (53.8%) were boys. The median age was 10.5 years (8.5-12.0). Excessive screen time was reported in 149 (56.0%) children. Children with excessive screen time had significantly more weight (p=0.016). Absence of parental supervision was associated with excessive screen time (43.0% vs 59.8%, p=0.006), as was absence of household rules (57.7% vs 76.9%, p=0.001). Children with excessive screen time had significantly higher SDQ emotional ($p < 0.001$), conduct ($p = 0.002$), hyperactivity ($p < 0.001$), and peer scores ($p < 0.001$), and a significantly lower prosocial score ($p < 0.001$). Screen time significantly correlated with grades ($r = -0.38$, $p < 0.001$) and absenteeism ($r = 0.29$, $p < 0.001$).

CONCLUSION: Relatively higher screen exposure was associated with higher SDQ emotional, conduct, hyperactivity, and peer difficulty scores, lower prosocial scores, greater teacher-reported cognitive concerns, lower term grades, higher school absence, higher BMI, and lower physical activity participation.

KEYWORDS: Behavior, child, education, growth, screen time.

INTRODUCTION

Excessive screen time has become a widespread issue among school-aged children of digital devices become more integrated into daily life. While these devices serve educational and recreational purposes, unregulated screen exposure has raised concerns about its potential negative impact on children's behavior, educational performance, and physical growth[1]. Recent global data show that 46.4% of children aged 6 to 14 years spent≥ 2 hours of screen time per day[2]. A study from India analyzed 184 children from a secondary school and showed that 83.2% of children were found to have excessive screen time (≥2 hours)[3]. The shift towards digital classrooms during the COVID-19 pandemic further exacerbated these trends, as children spent extended hours on screens for both learning and leisure[4]. As screen time often displaces crucial activities like physical play, reading, and face-to-face social interactions, it is imperative to assess its impact comprehensively, particularly in structured environments such as schools.

Prolonged screen time has been linked to behavioral issues such as irritability, inattention, and aggression, as well as developmental delays in language and cognitive skills[5]. Excessive screen use can negatively influence academic performance by reducing concentration, disrupting sleep, and diminishing time spent on homework or study[6]. Longitudinal data showed that for every additional hour of television exposure at age of 2, classroom engagement declined by 7% and math proficiency declined by 6% by 4th grade[7]. A study by Patel et al. found that children with more than 2 hours of screen time had average scores of 69.0% vs 82.3% among those who spent ≤ 2 hours[8]. While evidence indicates that excessive screen time can be detrimental to children, a recent study found that over 80% of parents believed that screen time enhances their children's creativity and imagination[9]. Another study reported that 90% of households implemented rules to regulate screen time[10].

Although some data exist on the impact of screen time on behavioral and developmental aspects in preschool children[11], few studies have examined school-going children. Schools often serve as environments where children are exposed to both the advantages and potential drawbacks of screen-based learning. Excessive recreational screen time outside school hours can worsen issues such as reduced focus, poor sleep quality, and declining academic performance. Keeping all that in mind, this study was conducted among children aged 5 to 15 years enrolled in private secondary schools of Karachi to determine the association of excessive screen time with behavioral outcomes, educational performance, and physical growth.

METHODOLOGY

This cross-sectional analytical study was conducted at private secondary schools of Karachi, Pakistan, from September 2025 to February 2026. The study commenced after approval by the Institutional Ethics Committee (Ref: IRB/KMDC/KMU/110/2025). The study was conducted in three private secondary schools of Karachi selected using simple random sampling from a list of registered private secondary schools. Permission was obtained from the principal of each private secondary school to allow recruitment of students, access attendance and term grade records, and administer the study questionnaires and anthropometric measurements. We calculated a sample size of 266 using the OpenEpi online sample size calculator, assuming an expected proportion of school-going children with screen time of more than 2 hours of 46.4%2, a 95% confidence level, and a 6% margin of error. We used a non-probability consecutive sampling technique to recruit students within each school. The inclusion criteria were children of any gender aged 5-15 years. The exclusion criteria were children with diagnosed developmental or neurological conditions (e.g., autism, ADHD) that could independently impact outcomes (as per medical history) or those who had diabetes mellitus, congenital heart defects, or any disability. We also excluded children whose parents/guardians could not provide reliable screen time data. We obtained informed written consent from parents/guardians. Assent was sought from children > 7 years wherever possible.

At enrollment, we documented each student's age, gender, weight, height, class, BMI, and number of siblings of each student was documented. Parental information included mother's age, father's age, mother's education, father's educational background, family monthly income, and residential status. Families were categorized into three socioeconomic strata based on income in Pakistani Rupees: low socioeconomic status for income <50,000 PKR, middle socioeconomic status for income 50,000 to 100,000 PKR, and high socioeconomic status for income >100,000 PKR. Parental educational status was categorized as literate if they received formal education, or illiterate if they lacked formal schooling and could not read or write. Screen time (hours) was recorded based of either parent's feedback, regardless of whether the time spent in front of a screen was for recreational or educational purposes. We defined≥ 2 hours per day of screen time as excessive screen time.[12] Parents were asked about the type of screen device (television/smartphone/tablet/iPad/computer/laptop/gaming console/other) used primarily. Parents were asked whether they supervised their children during screen time (yes/no) during screen time of their children, and whether the household had rules for screen time (yes/no). We ascertained screen time from the parent primarily responsible for the child's daily routine. We obtained information from one respondent per child; when both parents were available, we confirmed the estimate jointly and recorded a single consensus value. For behavioral assessment, we used the Strengths and Difficulties Questionnaire (SDQ)13, which consisted of 25 questions across 5 domains. The developmental assessment evaluated cognitive and physical development. Cognitive development was evaluated by asking the respective teachers whether the child had difficulty with problem-solving or memory retention, or had any speech delays or abnormalities. Physical growth was assessed by measuring height and weight and calculating BMI. Parents were asked if their child was involved in physical activities, categorized as regular (if the child was engaged in physical activities for ≥ 3 days/week), occasional (if < 3 days/week), or never (if the child had not engaged in any physical activity throughout the week). Academic performance was evaluated based of the percentage of the total grade scored in the last term (obtained from the respective teachers). Attendance was also evaluated based on the number of days absent in the last term.

We analyzed the data using IBM SPSS Statistics, version 26.0. We calculated frequencies and percentages for qualitative variables. For the representation of quantitative data, we computed means and standard deviations (SD) for normally distributed data and medians and interquartile ranges (IQR) for non-normally distributed data. We checked the normality of the data using the Shapiro-Wilk test. To control for potential confounders, we stratified by age group, gender, socioeconomic status, and parental education, of compared categorical data using the chi-square test or Fisher's exact test. We compared quantitative data using the independent-samples t-test or Mann-Whitney U test. We also conducted bivariate correlation analyses using Spearman's correlation to measure the correlation coefficient (r) between screen time and SDQ domain scores, grade scores, and developmental outcomes such as height, weight, and BMI. P-value < 0.05 was considered statistically significant.

RESULTS

In a total of 266 children, 143 (53.8%) were boys, and 123 (46.2%) were girls. The median age and weight were 10.5 years (8.5 to 12.0) and 32.5 kg (25.5 to 41.0), respectively. Maternal educational status was illiterate among 28 (23.3%) participants. Screen time was ≥2 hours in 149 (56.0%) children. Gender (p=0.824) and age distribution (p=0.561) did not differ significantly by screen time distribution. Median weight was significantly higher in children with ≥2 hours of screen time (34.0 kg; 26.0 to 42.0) than in those with < 2 hours (31.0 kg; 24.5 to 39.0), p=0.016. Parents reported supervision during screen exposure for 134 (50.4%) children, including 70 (59.8%) with screen time <2 hours and 64 (43.0%) with screen time ≥2 hours (p=0.006). Household screen time rules were reported for 176 (66.2%) children, including 90 (76.9%) in the <2-hour group and 86 (57.7%) in the ≥2-hour group (p=0.001). Primary screen device differed between groups (p=0.028), with smartphone use reported in 39 (33.3%) children with screen time <2 hours and 80 (43.6%) with screen time ≥2 hours (**Table I**).

Table I: Characteristics of participants and their association with screen time (N=266)

Characteristics		Total (%)	Screen time <2 hours (n=117)	Screen time ≥2 hours (n=149)	P-value
Gender	Boys	143 (53.8%)	62 (53.0%)	81 (54.4%)	0.824
	Girls	123 (46.2%)	55 (47.0%)	68 (45.6%)	
Age (years)		10.5 (8.5-12.0)	10.4 (8.2-12.0)	10.5 (8.5-12.0)	0.561
Weight (kg)		32.5 (25.5-41.0)	31.0 (24.5-39.0)	34.0 (26.0-42.0)	0.016
Residence	Urban	190 (71.4%)	86 (73.5%)	104 (69.8%)	0.507
	Rural	76 (28.6%)	31 (26.5%)	45 (30.2%)	
Maternal educational status	Literate	204 (76.7%)	91 (77.8%)	113 (75.8%)	0.710
	Illiterate	62 (23.3%)	26 (22.2%)	36 (24.2%)	
Monthly family income (PKR)	<50,000	108 (40.6%)	48 (41.0%)	60 (40.3%)	0.992
	50,000 to 100,000	112 (42.1%)	49 (41.9%)	63 (42.3%)	
	>100,000	46 (17.3%)	20 (17.1%)	26 (17.4%)	
Parental supervision		134 (50.4%)	70 (59.8%)	64 (43.0%)	0.006
Household screen time rules		176 (66.2%)	90 (76.9%)	86 (57.7%)	0.001
Primary device	Smartphone	119 (44.7%)	39 (33.3%)	80 (53.7%)	0.028
	Television	52 (19.5%)	27 (23.1%)	25 (16.8%)	
	iPad or tablet	34 (12.8%)	17 (14.5%)	17 (11.4%)	
	Computer or laptop	30 (11.3%)	18 (15.4%)	12 (8.1%)	
	Gaming console/device	14 (5.3%)	6 (5.1%)	8 (5.4%)	
	Others	17 (6.4%)	10 (8.5%)	7 (4.7%)	

The median emotional difficulties score was 3.2 (2.1 to 5.3) in children with screen time <2 hours, and 5.1 (4.2 to 7.3) in children with screen time ≥2 hours (p<0.001). The median conduct difficulties score was 3.1 (2.2 to 4.1) in children with <2 hours of screen time and 4.2 (3.1 to 5.2) in the> 2-hour group (p=0.002). The median hyperactivity score was 4.1 (3.2 to 6.1) in the < 2-hour group, and 6.2 (4.3 to 8.2) in the> 2-hour group (p<0.001). The median peer difficulties score was 3.1 (2.1 to 4.2) in the <2-hour group and 4.1 (3.2 to 5.1) in the ≥ 2-hour group (p<0.001). The median prosocial behaviour score was 7.2 (6.2 to 9.1) in the <2-hour group and 6.2 (5.2 to 8.1) in the> 2-hour group (p<0.001). **Table II** shows details of domain scores by screen time among study participants.

Table II: Domain scores with respect to screen time among study participants (n=266)

Domains	Total	Screen time <2 hours (n=117)	Screen time ≥2 hours (n=149)	P-value
Emotional difficulties	4.3 (2.7-6.1)	3.2 (2.1-5.3)	5.1 (4.2-7.3)	<0.001
Conduct difficulties	3.4 (2.2-4.8)	3.1 (2.2-4.1)	4.2 (3.1-5.2)	0.002
Hyperactivity	5.2 (3.5-7.4)	4.1 (3.2-6.1)	6.2 (4.3-8.2)	<0.001
Peer difficulties	3.3 (2.1-4.3)	3.1 (2.1-4.2)	4.1 (3.2-5.1)	<0.001
Prosocial behaviour	6.4 (5.1-8.2)	7.2 (6.2-9.1)	6.2 (5.2-8.1)	<0.001

Mann-Whitney test applied

Teacher-reported difficulty in problem solving or memory retention was recorded in 24 (20.5%) children in the < 2-hour group and 55 (36.9%) in the > 2-hour group (p=0.003). Delayed speech abnormalities were reported in 9 (7.7%) children in the < 2-hour group, and 27 (18.1%) in the > 2-hour group (p=0.014). Physical activity was significantly lower among children with ≥2 hours of screen time (p=0.020). The median BMI was significantly higher among children with ≥2 hours of screen time (p<0.001). The median grade score was significantly lower among children with≥2 hours of screen time (p<0.001). As shown in **Table III**, the median days absent were significantly higher among children with ≥2 hours of screen time (p<0.001).

Table III: Developmental, physical activity, anthropometry, and educational outcomes with respect to screen time among study participants (n=266)

Domains		Total	Screen time <2 hours (n=117)	Screen time ≥2 hours (n=149)	P-value
Problem-solving or memory difficulty		79 (29.7%)	24 (20.5%)	55 (36.9%)	0.003
Delayed speech abnormalities		36 (13.5%)	9 (7.7%)	27 (18.1%)	0.014
Physical activity	Regular	92 (34.6%)	51 (43.6%)	41 (27.5%)	0.020
	Occasional	103 (38.7%)	41 (35.0%)	62 (41.6%)	
	Never	71 (26.7%)	25 (21.4%)	46 (30.9%)	
Body mass index (kg/m^2)		15.4 (14.1-17.1)	14.7 (13.6-16.3)	16.0 (14.7-17.8)	<0.001
Grade scores in the last term		72.0 (66.0-79.0)	77.0 (70.0-83.0)	69.0 (63.0-75.0)	<0.001
Days absent last term		7.0 (5.0-9.0)	6.0 (4.0-8.0)	8.0 (6.0-10.0)	<0.001

Screen time was positively correlated with emotional difficulties (r=0.28; p<0.001), conduct difficulties (r=0.19; p=0.002), hyperactivity (r=0.34; p<0.001), peer difficulties (r=0.22; p<0.001), days absent (r=0.29; p<0.001), and BMI (r=0.21; p=0.024). Screen time was negatively correlated with prosocial behavior (r=−0.26; p<0.001) and grade score (r=−0.38; p<0.001). Correlation analysis between screen time hours and outcomes is presented in **Table IV**.

Table IV: Correlation analysis between screen time (hours) and key outcome parameters

Parameters	Correlation coefficient (r)	P-value
Emotional difficulties	0.28	<0.001
Conduct difficulties	0.19	0.002
Hyperactivity	0.34	<0.001
Peer difficulties	0.22	<0.001
Prosocial behaviour	-0.26	<0.001
Grade score	-0.38	<0.001
Days absent	0.29	<0.001
Body mass index	0.21	0.024

Spearman's correlation applied.

DISCUSSION

Screen time of at least 2 h per day was linked to a less favourable behavioural profile across all SDQ problem domains in this study, as well as a lower prosocial score. Higher electronic media exposure has been associated with increased risk of psychosocial symptoms[14]. A large-scale school-based analysis also reported a positive association between screen exposure and socioemotional difficulties, including reductions in prosocial functioning[15]. The concordance across settings supports a dose-related behavioural gradient in which screen exposure could be associated with emotional regulation and attentional control through displacement of sleep and play, increased arousal, and reduced parent-mediated scaffolding of coping skills. The largest between-group separation in this dataset was seen for hyperactivity and emotional difficulties. This is consistent with mechanistic and observational literature linking screen exposure to attentional dysregulation, especially with fast-paced or highly reinforcing content. Higher screen exposure has been linked to poorer psychological wellbeing in children and adolescents, with stronger and more consistent associations for outcomes related to attention and internalizing symptoms than for some other domains[16]. The present findings extend that pattern to school-aged children in Karachi using SDQ domains rather than diagnostic categories, which is clinically useful in settings where formal neurodevelopmental assessment pathways are limited and early risk stratification often relies on brief screening tools.

Teacher-reported cognitive concerns were more common in the high screen time group, with problem-solving or memory difficulty rising from 20.5% to 36.9% and delayed speech abnormalities from 7.7% to 18.1%. While these indicators are not equivalent to standardized neuropsychological testing, they are directionally consistent with longitudinal evidence linking early screen exposure to later cognitive and academic vulnerabilities.

Academic outcomes in this study showed a clinically meaningful separation, with the median grade score falling from 77.0 to 69.0 and median absences rising from 6.0 to 8.0 days in the high-screen-time group. The Ontario cohort reported lower odds of achieving higher levels in grade 3 reading and mathematics and grade 6 mathematics with each additional hour of screen exposure[17]. A local survey focused on screen exposure at or below 1 h found no detrimental association with school performance, supporting a threshold effect in which low exposure may be neutral. In contrast, higher exposure becomes harmful of displacing study time, sleep, and sustained attention[18]. The present study used a 2-hour cut-off for excessive exposure, and the direction of findings is consistent with this dose-threshold framing.

The association with absenteeism merits clinical interpretation because absence is often a downstream marker of sleep disturbance, behavioural dysregulation, somatic complaints, and reduced school engagement[19]. While the causal direction cannot be inferred, the combination of higher emotional difficulties and hyperactivity scores with greater absence suggests that screen exposure may be associated with sleep routines, morning functioning, and classroom adaptation, leading to intermittent school non-attendance. These findings are relevant for paediatric and school health services because repeated minor absence often precedes later learning gaps and psychosocial stressors, and it represents a modifiable intervention target[20].

The social ecology signals within this research are important because they point toward feasible intervention levers. Parental supervision during screen exposure was less common in the high screen time group, and household screen rules were also less common. Guidance from global bodies emphasizes limiting sedentary behaviour and supporting healthier movement and sleep patterns across childhood, which many settings operationalize through home routines and school-based health promotion[21,22]. In practical terms, the results suggest that screening questions on family rules and supervision may identify higher-risk children even before applying detailed behavioural tools. Device type differed by screen exposure

time, with smartphone use reported more frequently in the high screen time group. This matters because handheld devices are portable, less observable, and more likely to be used close to bedtime, which can worsen sleep onset and sleep quality. Studies in diverse settings have linked recreational screen exposure to sleep disruption and to downstream academic and behavioural effects[23].

Physical growth indicators in the present study also varied by screen exposure. These findings are consistent with the sedentary displacement model described in prior work where increased screen exposure is associated with reduced time spent in moderate to vigorous physical activity and higher adiposity[24]. Evidence syntheses have reported that greater screen time is associated with higher BMI and adiposity outcomes in children and adolescents, supporting the plausibility of an association between screen behavior and growth-related indices[25]. The observed differences may reflect reduced energy expenditure, more frequent eating during screen use, and disrupted sleep patterns, each of which can influence weight-gain trajectories in school-aged children, particularly in urban settings where access to handheld devices and sedentary recreation is high.

Regarding the limitations of this study, the cross-sectional design prevents causal inference. It cannot determine directionality, since behavioural difficulties and lower school engagement may also lead to greater screen exposure. Screen time was parent-reported and did not separate educational from recreational exposure or capture content type. We estimated screen time using parent or guardian report, which can be influenced by recall and social desirability bias, and we did not use objective device-based tracking. We assessed cognitive development through teacher report rather than standardized testing. Future studies with larger samples and longitudinal follow-up should use multivariable regression to estimate adjusted effects and better address confounding.

CONCLUSION

Relatively higher screen exposure was associated with higher SDQ emotional, conduct, hyperactivity, and peer difficulty scores; lower prosocial scores; greater teacher-reported cognitive concerns; lower term grades; higher school absence; higher BMI; and lower physical activity participation. Screen time also showed positive correlations with behavioural difficulty scores, BMI, and absenteeism and negative correlations with prosocial behaviour and academic performance, supporting a coherent risk profile across behavioural, educational, and physical growth domains.

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AUTHOR CONTRIBUTION

Jafri UA: Data collection, drafting, responsible for data integrity, approved for publication
Shakoor I: Conception and design, proofreading, critical revisions, approved for publication
Khan K: Data collection, drafting, proofreading, critical revisions, approved for publication
Ghaffar TA: Data collection, proofreading, critical revisions, approved for publication

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