

ASSOCIATION OF SCREEN TIME AND DELAY IN GROSS MOTOR SKILLS IN EARLY SCHOOL-GOING CHILDREN IN HAYATABAD, PESHAWAR: A CROSS-SECTIONAL STUDY

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Abstract

Background: Early school years are important for the development of gross motor skills, while increasing screen exposure may reduce opportunities for active play and movement practice. This study aimed to determine the association between screen time and gross motor skill delay among early school-going children.

Methods: An analytical cross-sectional study was conducted among 100 children aged 3–10 years at Hayatabad Model School, Phase 4, Hayatabad, Peshawar. Participants were recruited using convenience sampling. Screen exposure was assessed using the SCREENS-Q questionnaire, while gross motor skills were evaluated using the Test of Gross Motor Development–Second Edition (TGMD-2). Descriptive statistics were used to summarize participant characteristics and outcome measures. Pearson's correlation was performed to determine the association between screen exposure and gross motor skill delay, with statistical significance set at $p < 0.05$.

Results: Among the 100 participants, 53 (53%) were male and 47 (47%) were female. Daily screen exposure exceeded 2 hours in 56 (56%) children, while 37 (37%) had 1–2 hours and 7 (7%) had less than 1 hour of exposure. TGMD-2 assessment identified mild gross motor skill delay in 53 (53%) children, moderate delay in 18 (18%), and severe delay in 2 (2%), while 27 (27%) showed no delay. Pearson's correlation demonstrated a weak positive and statistically significant association between screen exposure and gross motor skill delay ($r = 0.284$, $p = 0.004$).

Conclusion: Higher screen exposure was significantly associated with greater gross motor skill delay among early school-going children. Although the correlation was weak, the findings highlight the importance of balancing screen-based activities with regular physical activity and active play to support healthy motor development.

Introduction

Early childhood is a critical period of human development during which children undergo rapid physical, cognitive, emotional, social, and motor changes. During the early school-going years, children progressively develop fundamental motor abilities that allow them to participate independently in daily activities, play, sports, and educational tasks (1). Attainment of these milestones within expected age ranges is generally considered an indicator of healthy development. Because early developmental experiences can influence subsequent physical health, academic achievement, and psychosocial well-being, identifying factors associated with developmental delays is important for early screening and intervention (2,3). Gross motor skills (GMS) involve the coordinated use of large muscle groups to perform movements such as running, jumping, galloping, throwing, catching, and maintaining postural stability. These skills develop progressively during childhood and provide an important foundation for participation in physical activity and functional play. Fundamental movement skills acquired during childhood are also considered an important basis for lifelong physical activity and health (4,5). Delayed gross motor development may consequently reduce children's opportunities for physical activity and participation in play and may be associated with difficulties in coordination, physical fitness, and other areas of development. Early identification of motor delays is therefore important for appropriate assessment and intervention (6).

At the same time, children's exposure to digital devices has increased substantially, making screen-based activities an increasingly common part of daily life. Smartphones, tablets, televisions, computers, and other digital media provide opportunities for education, communication, and entertainment; however, excessive or sedentary screen exposure has raised concerns about children's health and development (7). Higher levels of screen time have been associated with outcomes including reduced physical activity, sleep disturbances, obesity, and difficulties in cognitive, behavioral, and psychosocial domains.

Increased screen exposure may also replace active play and other opportunities for children to practice fundamental movement skills (8). Recommendations from major health organizations emphasize limiting sedentary screen exposure during early childhood. The World Health Organization recommends no sedentary screen time for children younger than 2 years and no more than 1 hour per day for children aged 2–4 years, with less being preferable (9). Similarly, the American Academy of Pediatrics recommends avoiding screen media for children younger than 18 months, except for video communication, and limiting screen use among preschool-aged children while emphasizing high-quality content and caregiver involvement (10). These recommendations reflect concerns that excessive sedentary screen exposure may displace activities that support healthy physical and developmental outcomes.

One possible explanation for this association is displacement of physically active behaviors. When children spend prolonged periods watching television or using smartphones, tablets, or computers, they may have fewer opportunities to engage in active play and practice age-appropriate movement skills (11). Screen-based activities may also encourage prolonged sedentary behavior, which can limit the variety and frequency of movement experiences necessary for motor learning (12). Furthermore, excessive screen exposure may be accompanied by reduced opportunities for outdoor play and social interaction. However, screen use is not necessarily harmful in every circumstance. Educational content, interactive activities, parental involvement, and appropriately structured digital use may have different effects compared with prolonged passive viewing (13,14). Therefore, the amount and context of screen exposure should be considered when investigating its relationship with child development. This issue is particularly relevant in Pakistan, where access to smartphones and other digital devices among children has increased. A study conducted among preschool children in Sargodha reported a mean daily screen exposure of 2.42 ± 1.17 hours, exceeding WHO

recommendations for this age group (15). Evidence from Islamabad has similarly indicated increasing screen use among preschool-aged children and concerns regarding associated developmental outcomes (16). However, research examining the specific relationship between screen exposure and gross motor development among Pakistani children remains limited.

Hayatabad, Peshawar, represents an important urban setting in which children are increasingly exposed to digital technology as part of their educational and recreational activities. However, limited information is available regarding the extent of screen exposure among early school-going children in this setting and whether greater screen time is associated with delayed gross motor skill development. Investigating this relationship may provide useful baseline evidence for parents, teachers, physiotherapists, pediatric healthcare professionals, and policymakers. Therefore, the present study aims to determine the association of screen time with delay in gross motor skills among early school-going children at Hayatabad Model School, Phase 4, Hayatabad, Peshawar. By examining the relationship between children's screen exposure and gross motor development, this study may contribute to a better understanding of an increasingly relevant developmental issue and provide evidence that can support early identification, parental awareness, promotion of active lifestyles, and appropriate developmental interventions among school-going children.

Methodology

This analytical cross sectional study was conducted at Hayatabad Model School, Phase 4, Hayatabad, Peshawar, Pakistan to investigate the association between screen time and delayed gross motor skills among early school-going children. The study population comprised children aged 3–10 years enrolled at the selected school. This school was selected based on accessibility and permission obtained from the school administration. A total sample of 100 children was included in the study. The sample size was determined using the Rao Soft sample size calculator with a 95% confidence

level and 5% margin of error. Children aged 3–10 years who were enrolled in the selected school, physically and cognitively able to perform the required motor tasks, and whose parents or guardians provided informed consent were eligible for participation. Children with known developmental delays or visual or hearing impairments that could interfere with the performance of gross motor tasks were excluded. Participants meeting the eligibility criteria and available during the data collection period were recruited using a convenience sampling technique. Screen time was operationally defined as the total amount of time spent per day using screen-based devices, including television, smartphones, tablets, computers, and video games.

Gross motor skill delay was defined as below-average performance on age-appropriate gross motor tasks according to the assessment criteria of the Test of Gross Motor Development–Second Edition (TGMD-2) (17). Data were collected using two principal assessment tools. Screen exposure was assessed using the validated SCREENS-Q questionnaire (18), which was completed by the children's parents or guardians. The questionnaire collected information regarding children's average screen use on weekdays and weekends across different devices, including television, mobile phones, tablets, and computers. Gross motor skills were assessed using the TGMD-2, a standardized assessment instrument designed to evaluate fundamental gross motor development in children. The assessment comprises two major skill domains: locomotor skills, including running, hopping, and jumping, and object-control skills, including throwing, catching, and kicking. The TGMD-2 has established reliability and validity for assessing gross motor performance in children (17).

Following ethical approval and permission from the school administration, eligible participants were recruited after obtaining written informed consent from their parents or guardians. Parents or guardians completed the screen-time questionnaire, after which each child was individually assessed for gross motor performance in a quiet and controlled environment within the

school. The researcher provided standardized instructions and demonstrations for each TGMD-2 task, and children performed the required motor activities according to the assessment protocol. Performance was observed and scored according to the established TGMD-2 criteria, and the resulting scores were recorded for subsequent analysis. Data were entered and analyzed using SPSS version 20. Descriptive statistics, including means, standard deviations, frequencies, and percentages, were calculated for demographic characteristics, screen-time duration, and TGMD-2 scores. Appropriate inferential statistical tests were applied to determine the association between

screen-time exposure and gross motor skill performance. Statistical significance was established at a p-value of <0.05 .

Results

A total of 100 early school-going children aged 3–10 years participated in the study. Of the total sample, 53 (53%) were male, and 47 (47%) were female. Regarding academic level, 58 (58%) participants were enrolled in Prep, 24 (24%) in Nursery, and 18 (18%) in Play Group. The largest proportion of participants was therefore represented by children from the Prep class as shown in Table 1.

Table 1: Participant characteristics

Characteristic	Category	n	%
Gender	Male	53	53
	Female	47	47
Academic level	Play Group	18	18
	Nursery	24	24
	Prep	58	58
Total		100	100

Daily screen-time exposure

Figure 1 demonstrates that Daily screen-time exposure showed that 56 (56%) children spent more than 2 hours per day using screen-based devices, while 37 (37%) reported 1–2 hours of

daily screen exposure. Only 7 (7%) children had less than 1 hour of daily screen exposure. Thus, more than half of the participants reported daily screen exposure exceeding 2 hours.

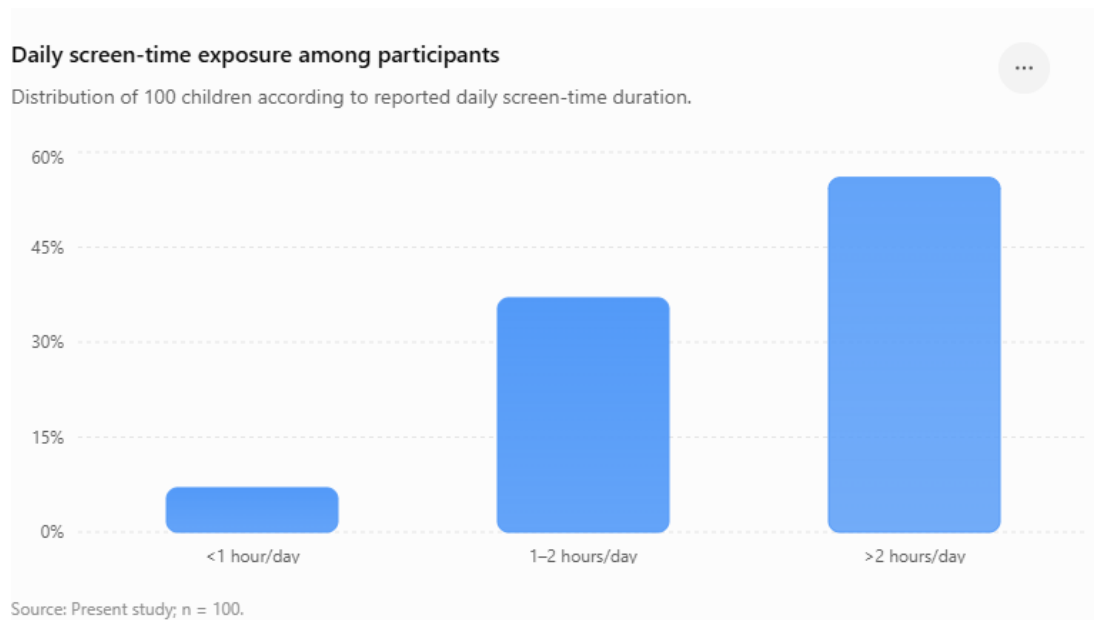


Figure 1: Daily screen-time exposure

Table 2: Gross motor skill delay

Gross motor status	n	%
No delay	27	27
Mild delay	53	53
Moderate delay	18	18
Severe delay	2	2
Total	100	100

Table 2 shows that Assessment using the Test of Gross Motor Development-Second Edition (TGMD-2) demonstrated that 53 (53%) children had mild gross motor skill delay, 18 (18%) had moderate delay, and 2 (2%) had severe delay. In

contrast, 27 (27%) children demonstrated no gross motor skill delay. Overall, 73% of the participants demonstrated some degree of gross motor skill delay, whereas 27% had no identified delay.

Table 3: Problematic screen exposure

Screen-exposure category	n	%
Low problematic exposure	39	39
High problematic exposure	61	61
Total	100	100

Table 3 shows that Based on the overall screen-exposure scoring, 61 (61%) participants were categorized as having high problematic screen exposure, whereas 39 (39%) were categorized as

having low problematic screen exposure. This indicates that problematic screen exposure was common in the study population.

Table 4: Pearson correlation between screen exposure and gross motor skill delay

Variables	n	Pearson's r	p-value	Interpretation
Total screen-exposure score vs. gross motor skill delay	100	0.284	0.004	Weak positive, statistically significant

Table 4 shows Pearson's correlation analysis demonstrated a statistically significant weak positive correlation between total screen-exposure score and gross motor skill delay ($r = 0.284$, $p = 0.004$, $n = 100$). The positive correlation indicates that higher screen-exposure scores were associated with greater gross motor skill delay. Although the association was statistically significant, its magnitude was weak, indicating that screen exposure alone does not explain all of the variation in gross motor skill delay.

Discussion

The present study investigated the association between screen exposure and gross motor skill delay among early school-going children. A statistically significant weak positive correlation was observed between total screen-exposure scores and gross motor skill delay ($r = 0.284$, $p = 0.004$). This finding indicates that children with higher levels of problematic screen exposure tended to demonstrate greater gross motor skill delay. Although the strength of the association was weak, its statistical significance suggests that screen exposure may be an important factor associated with gross motor development in this population. However, the magnitude of the correlation also indicates that screen exposure alone is unlikely to explain the variability in gross motor performance. Gross motor development is multifactorial and may be influenced by physical activity, opportunities for active play, environmental factors, family characteristics, and other developmental factors. Therefore, the present findings should be interpreted as evidence of an association rather than a direct effect of screen exposure on motor development.

The findings of the present study are consistent with the systematic review by Bakht et al. (2025). The analysis included 24 research that looked at the relationship between screen use and

developmental outcomes in kids ages 0 to 7. The research came to the conclusion that there was a negative correlation between increasing screen time and motor development in the majority of the included studies (19). The results of the current study support the findings of the review article mentioned above and offer more proof of the detrimental impact of excessive screen time on young children's motor development.

The findings of the current study are also in line with those of Sticca et al. (2025) who conducted a review study that evaluated the association between screen time and developmental outcomes in young children. The review evaluated 158 articles retrieved from various databases published between 2007 and 2024. It focused primarily on children below 36 months. The findings demonstrated that increased screen exposure had an overall negative effect on children's motor development. The authors caution against broad interpretation of the findings because of the variation in the design, analysis, and populations of the included studies. However, the review provides further evidence of the detrimental effect of excessive screen time on young children (20).

Duch et al.,(2013) Madigan et al.,(2019) and Zimmerman et al.,(2007) reported evidence supporting the negative relationship between screen exposure and child development. These studies, suggested that increased screen time was associated with poorer motor developmental outcomes. The proposed explanation was that prolonged screen-based activities may increase sedentary behaviour and reduce children's participation in active play, which is essential for developing balance, coordination, strength, and fundamental movement skills (21-23). These findings further strengthen the association observed in the present study.

However the present findings are not completely consistent with Takahashi et al. (2023). Their large

cohort study from the Tohoku Medical Megabank Project involving 7,097 mother-child pairs, the researchers examined the relationship between screen exposure at one year of age and developmental outcomes. Although higher screen exposure was associated with increased risk of delays in certain developmental areas, particularly communication and problem-solving skills, no consistent association was observed with motor development over time. The authors suggested that the effects of screen exposure may differ across developmental domains. Differences in study population, age group, assessment methods, and follow-up duration may explain the variation between their findings and the results of the present study (24).

Similarly another longitudinal study involving 179 parent-infant dyads also reported findings that differed from the present study. This study found that early screen exposure at 6 and 12 months was associated mainly with language and communication difficulties at 36 months, while no consistent association was observed with motor development outcomes. These findings suggest that the effects of screen exposure may depend on the developmental stage of children and may vary across different developmental domains (25). Differences in sample characteristics, measurement tools, and environmental factors may contribute to the inconsistency between these findings and the current study.

Despite its strengths, the present study has several limitations that should be considered when interpreting the findings. First, the study used a cross-sectional design; therefore, the observed association between problematic screen exposure and gross motor development cannot establish a causal relationship. Second, the participants were recruited from a limited population and setting, which may restrict the generalizability of the findings to children from different geographical, socioeconomic, and educational backgrounds. Third, screen exposure was assessed at a single point in time and may not fully reflect variations in children's daily screen-use patterns. Finally, the relatively limited sample size may have reduced the ability to detect stronger associations or

differences between subgroups. Future longitudinal and multicenter studies with larger and more diverse samples are recommended to further investigate the relationship between problematic screen exposure and gross motor development while accounting for potential confounding factors.

Conclusion

The study concluded that excessive screen exposure was significantly associated with gross motor development in early school-age children. Although the observed correlation was weak, the findings indicate that greater screen exposure may be related to poorer gross motor development. These results emphasize the importance of maintaining a healthy balance between screen-based activities and physical activity during childhood. Parents, teachers, and healthcare professionals should encourage appropriate screen-use practices and provide children with regular opportunities for active play and age-appropriate physical activities to support healthy motor development.

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