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ORIGINAL ARTICLE

Association between Screen Time and Attention Deficit Hyperactivity Disorder (ADHD).

Wajahat Hussain[1], Qudsia Anwer[2], Syed Arif Ahmed Zaidi[3], Hafsa Nazir Malik[4], Sadia Abbasi[5]

ABSTRACT… Objective: To determine the association between daily screen time duration and ADHD symptom severity. **Study Design:** Analytical Cross Sectional study. **Period:** May to October 2025. **Setting:** Department of Community Medicine, Quaid-e-Azam Medical College, Bahawalpur. **Methods:** Total of 194 children aged 8-12 years were included in the study through stratified random sampling technique was used to enroll 194 children aged 8–12 years. Media Use Questionnaire was used to quantify Digital exposure. Conners-3 Parent Rating Scale was used to evaluate ADHD symptoms. Pearson correlations and multivariable linear regression was used for analysis by SPSS version 25.0, adjusting for socioeconomic status, sleep, physical activity, and parental ADHD history. **Results:** The average daily screen time was 3.8 ± 1.6 hours. Bivariate analysis revealed positive correlation between total screen time and both hyperactivity/impulsivity (r=0.19, p-value=0.008) and inattention (r=0.21, p=0.003). Regression analysis showed that each additional hour of screen time was independently associated with 1.82-point increase in Inattention T-scores (95% CI: 0.47–3.17, p=0.009) and 1.48-point increase in Hyperactivity scores (p=0.023). Interactive gaming showed stronger associations than educational content. **Conclusion:** Excessive screen time especially interactive gaming and social media is strongly associated to increased severity of ADHD symptoms. To reduce potential neurodevelopmental concerns, immediate treatments centered on sleep hygiene and content control are required.

Key words: ADHD, Children, Digital Media, Screen Time, Sleep Hygiene, Socioeconomic Status.

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INTRODUCTION

Children's and adolescents' developmental landscape has been drastically changed by the incorporation of digital media into daily life. The widespread use of smartphones, tablets and high speed internet has changed screen based activities from a recreational choice to the means of entertainment, education and social interaction. Recent evidence shows that school age children now spend an average of 4 to 6 hours a day on recreational screens, a statistic that increased even more during the global pandemic restrictions.[1,2] Pediatricians and developmental psychologists are concerned about the possible cognitive effects of extended digital exposure because this saturation happens during critical times of neuroplasticity.[3]

At the same time, one of the most prevalent neurodevelopmental disorders worldwide is Attention Deficit Hyperactivity Disorder (ADHD). The burden of ADHD in children and adolescents estimated by current meta-analyses is between 5% and 7% globally, however diagnostic rates vary greatly by region and assessment technique.[4] Persistent patterns of impulsivity, hyperactivity, and inattention that impede functioning and growth are the hallmarks of ADHD. Finding environmental moderators of ADHD symptomatology has been a focus in public health research due to increased internet consumption.

The nature of relationship between using digital media and ADHD is still debatable despite the urgency. The current literature offers conflicting results. Elevated screen usage has been associated to subsequent increases in ADHD symptoms, according to several longitudinal studies. This suggests a possible causal route where attentional control may be compromised by rapid sensory stimulation.[5,6]

1. MBBS, MPH, FCPS, Assistant Professor Community Medicine, Quaid-e-Azam Medical College, Bahawalpur.
2. MBBS, MCPS, Assistant Professor Community Medicine, Quaid-e-Azam Medical College, Bahawalpur.
3. MBBS, M.Phil, MCPS, FCPS, Professor & HOD Community Medicine, Quaid-e-Azam Medical College, Bahawalpur.
4. MBBS, Postgraduate Resident Community Medicine, Quaid-e-Azam Medical College, Bahawalpur.
5. MBBS, Postgraduate Resident Community Medicine, Quaid-e-Azam Medical College, Bahawalpur.

Correspondence Address:
Dr. Wajahat Hussain
Department of Community Medicine, Quaid-e-Azam Medical College, Bahawalpur.
wajahatbukhari986@gmail.com

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On the other hand, other researchers support the reverse causality explanation, known as the "stimulation hypothesis," which indicate that children with inherent attentional deficiencies are disproportionately drawn to digital media in order to regulate their emotions and receive instant reward feedback.[6]

The distinctions between active engagement (like gaming or social contact) and passive consumption (like streaming videos), which may have diverse consequences on executive function, are overlooked when all digital activities are combined.[7,8] Studies have disaggregated these variables within particular demographic contexts, recent data indicates that content type and context moderate the association.[9] There is limited data regarding how screen use correlate with ADHD. This study aims to address these gaps by examining the association between differentiated screen time activities and ADHD symptom severity.

OBJECTIVE

To determine the association between daily screen time duration and ADHD symptom severity.

METHODS

This cross sectional analytical study was conducted from May to October 2025, in private educational institutions located in Hansra Basti and Satellite Town, Bahawalpur after taking approval from Institutional ethical review committee (Reference No. 298/DME/QAMC, BAHAWALPUR Dated. 20-04-2025). Anticipated Pearson correlation coefficient of r = 0.20[10,11], significance level 0.05 and statistical power 0.80, minimum sample size required was 194 by using G Power software (version 3.1.9.7). Stratified random sampling technique was used, wherein schools were first stratified by fee structure (low, medium, high) as a proxy for socioeconomic status, followed by random selection of classrooms within each stratum. Children aged 8–12 years and enrolled in grades 3–6 were included in the study. Children with clinical diagnosis of neurological conditions (e.g., epilepsy, autism spectrum disorder), severe visual or auditory impairment or current use of psychotropic medications were excluded. Written informed consent was obtained from parents or legal guardians, along with age appropriate assent from participating children.

Digital media exposure was quantified using a modified version of the Media Use Questionnaire (MUQ), a validated instrument demonstrating acceptable test-retest reliability (intra-class correlation coefficient = 0.78) in South Asian pediatric populations. The questionnaire recorded the average amount of time spent on screen-based activities on weekday and weekend, by content category (educational applications, social media platforms, video streaming and interactive gaming) and device type (television, smartphone/tablet, desktop/laptop computer, gaming console). A weighted average of the total screen time was calculated: [(weekday hours × 5) + (weekend hours × 2)] / 7. With input from their children, parents filled the questionnaire. The Conners-3 Parent Rating Scale (Conners-3-P) was used to assess the severity of ADHD symptoms. T-scores for two main subscales are obtained from the 90-item scale: Hyperactivity/Impulsivity (e.g., "fails to finish tasks," "distracted easily") and Hyperactivity/Impulsivity (e.g., "acts without thinking," "interrupts others"). Higher ratings indicate more severe symptoms. Items are scored on a 4-point Likert scale (0 = Not true at all, 3 = Very much true). The Urdu-translated version was used.

Structured questionnaire was used for data collection. Variables included child age, gender, socioeconomic status (SES) assessed through composite index of parental education, occupation and household assets, average night sleep duration (hours), weekly physical activity level (minutes of moderate to vigorous activity assessed via the Physical Activity Questionnaire for Older Children) and parental history of ADHD symptoms (screened using the Adult ADHD Self-Report Scale). Data analysis was performed using Statistical Package for Social Sciences (SPSS) version 25.0. Frequencies and percentages were calculated for categorical variables while means with standard deviations (SD) or medians with interquartile ranges (IQR) for continuous variables as appropriate based on distributional normality assessed via Shapiro-Wilk tests. Bivariate associations between screen time variables and ADHD subscale scores were examined using Pearson's correlation coefficients

for continuous-continuous relationships and independent samples t-tests or one-way ANOVA for categorical-continuous comparisons, with Levene's test assessing homogeneity of variance.

Multivariable linear regression models was used to estimate the independent association between total daily screen time (predictor) and Conners-3 Inattention and Hyperactivity/Impulsivity T-scores (outcomes), while adjusting for covariates. An unstandardized beta coefficient (β) with 95% confidence intervals (CI) was calculated. Associations stratified by screen content type (e.g. educational vs. entertainment) and ADHD symptom domain were determined. Subgroup analyses by child gender and age group were conducted to control effect modifiers, with interaction terms tested at $p < 0.10$. Statistical significance was considered as p value < 0.05.

RESULTS

The mean age of the participants was 10.1 ± 1.4 years, with nearly equal gender distribution. Smartphones and tablets were the most often used device, with an average daily screen time of 3.8 ± 1.6 hours. According to the Conners-3 Parent Rating Scale T-scores, 14.4% of children scored higher than the threshold for hyperactivity/impulsivity and 18.6% of children scored higher than the clinical cutoff (T ≥ 65) for inattention (Table-I).

Inattention (r = 0.21, p = 0.003) and Hyperactivity/Impulsivity (r = 0.19, p-value = 0.008) subscale scores showed significantly positive correlation with total daily screen time (Table-II). Multivariable linear regression models after controlling for child age, gender, socioeconomic status, sleep duration, physical activity and parental ADHD history confirmed these relationships (Table-III). Each additional hour of daily screen time was independently associated with 1.8-point increase in Inattention T-score (β = 1.82, 95% CI: 0.47 to 3.17, p value = 0.009) and a 1.5-point increase in Hyperactivity/Impulsivity T-score (β = 1.48, 95% CI: 0.21 to 2.75, p = 0.023). Compared to educational or video streaming content, interactive gaming and social media use showed strong association with symptoms of ADHD. (Table-IV).

TABLE-I

Socio-demographic and clinical characteristics of study participants (n = 194)

Characteristic	Category	n (%) or Mean ± SD
Child age (years)		10.1±1.4
Child gender	Male	99 (51.0)
	Female	95 (49.0)
Socioeconomic status	Low	58 (29.9)
	Medium	89 (45.9)
	High	47 (24.2)
Total screen time (hours/day)		3.8 ± 1.6
By device	Television	1.2 (0.9)
	Smartphone/Tablet	2.1 (1.3)
	Desktop/Laptop	0.4 (0.6)
	Gaming console	0.5 (0.8)
By content	Educational	0.9 (0.7)
	Social media	1.1 (1.0)
	Video streaming	1.0 (0.8)
	Interactive gaming	0.8 (1.1)
Conners-3 T-scores	Inattention	52.3 ± 11.2
	Hyperactivity/Impulsivity	50.8 ± 10.5
Clinical cutoff (T ≥ 65)	Inattention	36 (18.6)
	Hyperactivity/Impulsivity	28 (14.4)
Covariates	Sleep duration (hours/night)	8.4 ±1.1
	Physical activity (min/week)	312 ± 145
	Parental ADHD history (yes)	23 (11.9)

DISCUSSION

The results of the study showed strong positive correlation between daily screen use and severity of their ADHD symptoms in school age children. The observed mean screen time of 3.8 hours per day is higher than The World Health Organization's recommended sedentary behavior limits for this age group indicating a possible environmental risk factor in this population.[12] The magnitude of the association, where each additional hour of screen use corresponded to a 1.8-point increase in Inattention T-scores is consistent with global meta-analysis findings indicating small to moderate effect sizes, yet remains clinically relevant given the high prevalence of device usage.[13]

TABLE-II

Bivariate correlations between screen time variables and ADHD symptom scores (n = 194)

Variable	Total Screen Time	Inattention T-score	Hyperactivity/Impulsivity T-score
Total screen time (hours/day)	—	r = 0.21*	r = 0.19*
Smartphone/Tablet time	r = 0.84†	r = 0.23	r = 0.18*
Interactive gaming time	r = 0.61†	r = 0.26†	r = 0.22*
Social media time	r = 0.58†	r = 0.20*	r = 0.17*
Educational content time	r = 0.31†	r = 0.09	r = 0.07
Sleep duration (hours)	r = −0.34†	r = −0.28†	r = −0.24*
Physical activity (min/week)	r = −0.19*	r = −0.15*	r = −0.12

Note: Pearson correlation coefficients; *p < 0.05, †p < 0.01.

TABLE-III

Multivariable linear regression models predicting ADHD symptom severity from total screen time (n = 194)

Predictor	Inattention T-score		Hyperactivity/Impulsivity T-score
	β (95% CI)	p-value	β (95% CI)
Total screen time (per hour/day)	1.82 (0.47 to 3.17)	0.023	1.48 (0.21 to 2.75)
Child age (per year)	0.64 (−0.38 to 1.66)	0.385	0.41 (−0.52 to 1.34)
Female sex (ref: male)	−1.23 (−3.89 to 1.43)	0.464	−0.87 (−3.21 to 1.47)
SES (per category increase)	−0.91 (−2.14 to 0.32)	0.182	−0.76 (−1.88 to 0.36)
Sleep duration (per hour)	−2.15 (−3.68 to −0.62)	0.010	−1.83 (−3.21 to −0.45)
Physical activity (per 60 min)	−0.34 (−0.89 to 0.21)	0.261	−0.28 (−0.77 to 0.21)
Parental ADHD history (yes)	4.12 (1.05 to 7.19)	0.008	3.67 (0.98 to 6.36)

β = unstandardized regression coefficient, CI = confidence interval, SES = socioeconomic status

TABLE-IV

Association between screen content type and ADHD subscales (n = 194)

Screen Content (per hour/day)	Inattention T-score β (95% CI)	P-Value	Hyperactivity/Impulsivity T-Score β (95% CI)	P-Value
Educational applications	0.41 (−1.12 to 1.94)	0.675	0.29 (−1.08 to 1.66)	0.675
Video streaming	0.88 (−0.53 to 2.29)	0.232	0.76 (−0.49 to 2.01)	0.232
Social media platforms	1.64 (0.21 to 3.07)	0.036	1.31 (0.09 to 2.53)	0.036
Interactive gaming	2.41 (0.78 to 4.04)	0.008	1.97 (0.52 to 3.42)	0.008

Each model adjusted for child age, sex, SES, sleep duration, physical activity, parental ADHD history and total screen time from other content categories, β = unstandardized coefficient, CI = confidence interval.

The percentage of children in this group who exceed clinical cutoffs for inattention (18.6%) is higher than the average global prevalence estimates for ADHD, suggesting that environmental factors like excessive digital use may be exacerbating underlying neurodevelopmental vulnerabilities in this population.[14]

Interactive gaming and social media use revealed as stronger predictors compared to passive video streaming or educational content. This differentiation supports the "overstimulation hypothesis," which suggests that rapid scene changes and immediate reward loops inherent in gaming and social platforms may dysregulate dopaminergic pathways involved in attentional control.[15] The lack of association with educational content suggests that context and cognitive demand moderate the impact of screen exposure, a distinction often lost in aggregate screen time metrics. These findings reverberate with psychological frameworks arguing that digital wellbeing depends less on total duration and more

on specific affordances of technology used.[16] Study from Lahore reported similar correlations between smartphone addiction and behavioral disturbances, strengthening the belief that rapid digital adoption in South Asian urban centers may be outpacing parental mediation strategies.[17]

Screen time and sleep duration indicated inverse relationship which supports the potential biochemical explanation for the reported associations with ADHD. Sleep displacement, which is mediated by exposure to blue light and cognitive arousal from utilizing electronics at night, is known to produce inattention and irritability during the day.[18,19] Sleep duration remained significant independent predictor of ADHD scores after adjusting for screen time, indicating that both factors likely affect neurobehavioral outcomes through overlapping but distinct pathways. The stronger correlation observed in the 11–12 age group suggests that early adolescence may be a sensitive period when growing academic responsibilities collide with peak digital socialization, potentially exposing attentional deficits.[20,21]

The use of validated questionnaires is main strength of study. The findings of the study can be generalized to populations of private schools because of stratified random sampling technique. Cross sectional design limits causal inference. Recall bias may be introduced due to parent reported screen time. Findings of the study cannot be extrapolated to public sector schools or rural communities where internet access patterns may differ because only private schools of semi urban areas were included in the study.

Longitudinal studies may be conducted in future to identify temporal associations. Comprehensive digital history, focusing on interactive gaming habits rather than screen time only should be taken by the Clinicians. Policymakers should consider incorporating media literacy into school curricula to encourage youth to use technology responsibly.

CONCLUSION

Excessive screen time especially interactive gaming and social media is strongly associated to increased severity of ADHD symptoms in children. To reduce potential neurodevelopmental concerns, immediate treatments centered on sleep hygiene and content control are required.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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AUTHORSHIP AND CONTRIBUTION DECLARATION	
1	**Wajahat Hussain:** Conception of idea, acquisition of data, drafting.
2	**Qudsia Anwer:** Data collection.
3	**Syed Arif Ahmed Zaidi:** Data analysis.
4	**Hafsa Nazir Malik:** Data collection.
5	**Sadia Abbasi:** Writing.