



Effects of Screen Time on Problematic Behavior in Children During the COVID-19 Pandemic in South Korea

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Objectives: The coronavirus disease 2019 (COVID-19) pandemic has led to a decrease in face-to-face classes worldwide, affecting the mental health of children and their parents. The global pandemic has increased children's overall use of electronic media. This study analyzed the effect of children's screen time on problematic behaviors during the COVID-19 pandemic.

Methods: A total of 186 parents from Suwon, South Korea, were recruited to participate in an online survey. The mean age of the children was 10.14 years old, and 44.1% were females. The questionnaire included questions on children's screen time, problematic behaviors, and parental stress. Children's behavioral problems were evaluated using the Behavior Problem Index, whereas the Parental Stress Scale was used to estimate parental stress.

Results: The mean smartphone usage frequency of the children was 5.35 days per week, and the mean smartphone screen time was 3.52 hours per day. Smartphone screen time ($Z=4.49$, $p<0.001$) and usage frequency ($Z=2.75$, $p=0.006$) were significantly correlated with children's behavioral problem scores. The indirect effect of parental stress on this relationship was also statistically significant ($p=0.049$, $p=0.045$, respectively).

Conclusion: This study suggests that children's smartphone screen time has affected problematic behaviors during the COVID-19 pandemic. Furthermore, parental stress is related to the relationship between children's screen time and problematic behaviors.

Keywords: COVID-19; Child; Mental health; Smartphone.

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INTRODUCTION

The impact of the global coronavirus disease 2019 (COVID-19) on physical and psychological health has been documented [1]. As the COVID-19 outbreak in December 2019 led to a call for people who contracted the infection to be isolated in quarantine facilities or at home, countries have implemented international social distancing and lockdown measures to prevent the spread of COVID-19 [2]. Since schools, nursery facilities, and parks have shut down worldwide, families' regular lives have been affected. While parents resorted to telecommuting for work, non-face-to-face classes were conducted from home due to school closures [3]. With the increase in online classes across schools, children's outdoor and social activities have decreased, thereby increasing the time spent on media using smartphones, tablets, personal computers (PCs), and televisions (TVs) [4,5]. In the Nether-

lands, as screen time increased, studies have reported that children became more sedentary during the COVID-19 pandemic [6]. In Germany, adherence to the "recreational screen time guidelines for children and adolescents" decreased by 17.5% during the lockdown [7]. A Canadian study of 254 families with young children reported an 87% increase in the screening time for their children during the COVID-19 pandemic [8].

Children's excessive use of digital media is a critical factor in decreasing their psychological resilience [9]. The American Academy of Pediatrics (AAP) guidelines suggest that children below the age of 2 years should be inhibited from screen exposure, and screen time should not exceed an hour per day for children aged 2–5 years [10]. Furthermore, screen time of more than 2 hours per day is considered excessive for children over 5 years of age [11]. Excessive screen time has been associated with impediments to children's behavioral, psychological, and physical well-being.

Among several risk factors for poor mental health among children, chronic physical illnesses cause lifelong difficulties

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with their mental health [12]. Furthermore, threats and fears of armed conflict and war cause mental, social, and behavioral problems in children [13], and low socioeconomic status affects the mental health of children and adolescents [14]. Experiences of mental health or violence among caregivers were found to negatively affect their children's mental health [15], as was severe physical punishment of children [16]. One study reported the association of children's behavioral problems with maternal age, education, mental disorders, and home environment [17], and another risk factor for children's mental health was parental stress and anxiety [18]. In a study conducted on children aged 10–11 years, a significant relationship between parental stress and psychological symptoms was asserted [19].

This study aimed to identify the association between children's screen time and problematic behaviors during the COVID-19 pandemic. We hypothesized that children's screen time would affect their problematic behaviors.

METHODS

Participants

The parents received information about the study via e-mail and filled out a questionnaire on its webpage. Surveys were distributed to parents using a face-to-face class model after the COVID-19 quarantine period (September 2021). The data were collected from September 17 to October 31, 2021.

In total, 186 parents from elementary school children's community mental health centers in Suwon City, South Korea, were randomly recruited. The inclusion criteria were as follows: 1) parents who completed the surveys; 2) parents of elementary school children; and 3) parents who were able to read and write in Korean.

Measures

Screen time and media usage frequency

Screen time was examined based on the results of a self-reported online questionnaire that parents completed on the time spent per day, while media usage frequency was measured based on the number of days during the week of their children's smartphone use. The answers on the mean length of time spent consuming electronic media per day were connected, and the corresponding coded scores were as follows: none (score: 0), less than 1 hour (score: 1), more than 1 hour and less than 2 hours (score: 2), more than 2 hours and less than 3 hours (score: 3), more than 3 hours and less than 4 hours (score: 4), and more than 4 hours (score: 5).

Children's behavioral problems

Children's behavioral problems were assessed using the Behavioral Problem Index (BPI) developed by Peterson and Zill [20]. It comprises 23 common questions, five additional questions for children under the age of 11, and four additional questions for those over 12 years. It consists of six domains: 1) anxious/depressed, 2) headstrong, 3) hyperactive, 4) immature, 5) antisocial, and 6) peer conflict/social withdrawal. The ratings relied on feedback from the primary caregivers, who were asked to rate their children using a 3-point Likert-type scale (0=not true, 1=sometimes true, and 2=often true). In the current study, Cronbach's α was 0.090–0.092 for the BPI.

Parental stress

The Perceived Stress Scale (PSS-10) was used to assess parental stress. Parents were asked to provide scores to 10 questions about their feelings and perceived stress in the past month. The responses were scored as follows: 0=never; 1=almost never; 2=sometimes; 3=fairly often; and 4=very often.

Statistical analysis

Variables were summarized using descriptive statistics for demographic information, including frequencies, means, and standard deviations. Correlation analysis for each variable was conducted using Spearman's correlation analysis. A logistic regression analysis was performed to reveal the predictive variables for children's behavioral problems and to explore whether screen time and media usage frequency mediated the effects of caregivers' stress on their children's behaviors. The bootstrap method with 1000 samples was implemented. We used SPSS (version 25.0; IBM Corp., Armonk, NY, USA) and jamovi version 2.3.17 (<https://www.jamovi.org/>; Sydney, Australia) for the statistical analyses.

Ethics statement

This study was approved by the Institutional Review Board (IRB) at the Ajou University School of Medicine, Suwon, South Korea (IRB No. AJIRB-SBR-SUR-21-345).

RESULT

The participant characteristics are presented in Table 1. The mean age was 10.14 years old (range: 8–13 years). Most caregivers were mothers (91.9%), fathers (3.2%), grandparents (4.3%), and others (0.5%). Previous mental healthcare services provided by children revealed that 26.3% had a history of psychiatric treatment at the time of the survey. The mean smartphone usage frequency was 5.35 days per week, and the mean smartphone screen time was 3.52 hours per day.

The Spearman's correlation coefficients for each variable are presented in Table 2. TV screen time ($\rho=0.201$, $p<0.01$), tablet PC screen time ($\rho=0.169$, $p<0.5$), smartphone usage frequency ($\rho=0.237$, $p<0.001$), and smartphone screen time ($\rho=0.338$, $p<0.001$) were significantly correlated with children's behavioral problem scores. Caregivers' perceived stress scores were also positively correlated with children's behavioral problem scores ($\rho=0.505$, $p<0.001$).

The total, direct, and indirect effects of confidence intervals for the mediation models are presented in Table 3. The results showed that smartphone screen time affected children's behavioral problems ($Z=4.49$, $p<0.001$). Smartphone

Table 1. Demographic characteristics of study participants (n=186)

Variables	Value
Sex, female	82 (44.1)
Age (yr)	10.14±1.44
Main caregiver	
Mother	171 (91.9)
Father	6 (3.2)
Grandparents	8 (4.3)
Others	1 (0.5)
Monthly household income (per month)	
<\$840	14 (7.5)
\$840-\$1680	19 (10.2)
\$1680-\$3360	57 (30.6)
\$3360-\$5040	58 (31.2)
>\$5040	38 (20.4)
Previous received mental health service	
Outpatient	49 (26.3)
No	137 (73.7)
School closure	
Full closure	71 (38.2)
Partial closure	115 (61.8)
Smartphone usage frequency (days per week)	5.35
Smartphone screen time (hours per day)	3.52

Values are presented as mean±standard deviation, mean, or number (%)

usage frequency also affected children's behavioral problems ($Z=2.75$, $p=0.006$). Mediation analysis showed that the partial pathway from smartphone screen time (independent variable) through parental stress (mediator) to children's behavioral problems (dependent variable) was significant ($Z=1.97$, $p=0.049$). The pathway from smartphone usage frequency through parental stress (the mediator) to children's behavioral problems was also significant ($Z=2.01$, $p=0.045$).

DISCUSSION

The COVID-19 pandemic has led to systemic changes worldwide, such as school closures and social distancing, social media usage, and the communication mediums of smartphones, TVs, and tablet PCs, which have emerged as good online platforms for children and adolescents to continue studying and maintain communication with their friends during the COVID-19 pandemic. Compared to before the COVID-19 pandemic, the time spent on screening by children significantly increased. A Canadian study found that only 4.8% of children (aged 12–17 years) and 0.6% of youths (aged 5–11 years) met the combined movement behavior guidelines, which indicated lower physical levels, less time spent outside screens, and higher screen time [21], whereas another study conducted in South Korea reported an increase in children's screen time during the COVID-19 period [22]. The data from the Korean Media Panel Survey revealed that the mean daily media screen time of elementary school students significantly increased to 2.8 hours during the COVID-19 period, compared to the 1.8 hours spent in 2019, before the COVID-19 pandemic [23]. This increase in children's media screen time can be explained by the environmental conditions during the COVID-19 period: social distancing, school closures, and non-face-to-face classes. Policy statements from the AAP suggest limiting children's screen time. The most recent policy statement published in 2016 recommended that screen time for children aged 2–5 years should

Table 2. Correlations between parental stress and children's screen time and problematic behavior (n=186)

	Correlation coefficients between factors						
	1	2	3	4	5	6	7
1. Parental stress	1						
2. TV usage frequency	0.647	1					
3. TV screen time	0.266	<0.001***	1				
4. Tablet usage frequency	0.620	0.648	0.956	1			
5. Tablet screen time	0.212	0.770	0.600	<0.001***	1		
6. Smartphone usage frequency	0.012*	0.191	0.278	0.749	0.649	1	
7. Smartphone screen time	0.093	0.839	0.036*	0.515	0.184	<0.001***	1
8. Behavioral problem index	<0.001***	0.134	<0.010**	0.193	0.021*	<0.001***	<0.001***

* $p<0.05$; ** $p<0.01$; *** $p<0.001$

Table 3. Mediating effect of parental stress (PSS-10) on the association between children's screen time and children's problematic behavior (BPI)

Effect	Estimate	SE	95% CI	Z	p
Direct effect					
Smartphone screen time → BPI	1.385	0.349	0.735–2.117	3.97	<0.001***
Smartphone usage frequency → BPI	0.443	0.208	0.023–0.860	2.12	0.034*
Indirect effect					
Smartphone screen time → PSS-10 → BPI	0.311	0.158	0.018–0.640	1.97	0.049*
Smartphone usage frequency → PSS-10 → BPI	0.227	0.113	0.015–0.452	2.01	0.045*
Total effect					
Smartphone screen time → BPI	1.696	0.377	0.996–2.489	4.49	<0.001***
Smartphone usage frequency → BPI	0.670	0.244	0.173–1.157	2.75	0.006**

*p<0.05; **p<0.01; ***p<0.001. PSS-10, Perceived Stress Scale; BPI, Behavior Problem Index; SE, standard error; CI, confidence interval

be limited to less than 1 hour per day and that children younger than 2 years should have no media exposure [10]. The World Health Organization guidelines suggest that sedentary screen time for children aged 1–4 years should be no more than 1 hour at a time, and the shorter the screen time, the better [24]. Therefore, close monitoring of children's screening times during the COVID-19 pandemic is essential.

This study attempted to understand the relationship between screen time and children's behavioral problems in South Korea. Our results showed that smartphone screen time and usage frequency affected children's behavioral problems. The negative consequences of excessive screen time, such as physical, emotional, and behavioral problems, are well documented. Previous studies have found screen time to be associated with children's behavioral and emotional problems, leading to our results. Some studies have ascertained associations between excessive digital media use in children and social [25], language, and cognitive delays [26]. According to the social withdrawal hypothesis, increased screen time reduces social interaction, which can affect children's mental health and lead to aggression, impulsivity, and attention-related problems [27]. The earlier children begin using digital media, the more time they spend using it, affecting executive functions such as impulse control, self-regulation, and mental flexibility. Therefore, an increase in screening time during the ongoing COVID-19 pandemic is likely to expose children to a greater risk of negative health outcomes. As hypothesized, we found a positive association between children's screen time and behavioral problems. Our results are in line with reports on the excessive use of digital media among children and adolescents during the COVID-19 pandemic.

Our results showed that parental stress mediated the association between smartphone screen time and children's behavioral problems. Several studies have demonstrated an increase in the incidence of mental disorders among parents

during the COVID-19 pandemic period [28]. The COVID-19 pandemic has disrupted daily routines and support systems in many households, necessitating parents to assume additional roles and responsibilities. A previous study showed large deteriorations in parental depression and a moderate decline in parenting quality during the first months of the COVID-19 pandemic [29]. Concurrently, regulating children's smartphone use has become increasingly challenging, exacerbating the difficulties of parental supervision. Consequently, parents may experience reduced attention and coping capacities when dealing with their children's problem behaviors, potentially intensifying these behavioral issues. Consequently, effective stress management strategies and the implementation of suitable interventions by parents are pivotal in mitigating children's problem behaviors during this period.

There is a possibility that children's screen time may continue to increase even after the end of the COVID-19 pandemic. Therefore, it may be important to develop each family's media usage plan adjusted for the COVID-19 pandemic and to monitor children's screen time to mitigate potential adverse psychological effects.

Our study has some limitations. First, a selection bias could have influenced the results, as the data consisted of voluntary participants who received incentives for their participation. Second, this was a cross-sectional study; therefore, the prior relationships of each element may not be clear. In future studies, longitudinal data will be required for more significant inferences than are possible with cross-sectional data. Third, parental stress was measured using the PSS, which is a measure of general stress levels in adults. Therefore, parental stress and other general stress factors may have affected these results.

CONCLUSION

The results of our study suggest that parental education is needed regarding the potential impact of children's screen time on behavioral problems and that it is important to properly monitor children's digital media use. Further studies are needed to determine how parents can best monitor and guide their children's digital media use.

Availability of Data and Material

The datasets generated or analyzed during the study are not publicly available due to specific restrictions outlined in the informed consent agreements obtained from the research participants or data owners but are available from the corresponding author on reasonable request.

Conflicts of Interest

The authors have no potential conflicts of interest to disclose.

Author Contributions

Conceptualization: Yunmi Shin. Data curation: Donghee Kim, Hyojin Kim. Formal analysis: Sangha Lee. Funding acquisition: Yunmi Shin. Investigation: Donghee Kim, Hyojin Kim. Methodology: Iyeon Kim, Sangha Lee. Validation: Su-Jin Yang. Writing—original draft: Iyeon Kim. Writing—review & editing: Su-Jin Yang, Yunmi Shin.

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REFERENCES

- 1) Amsalem D, Dixon LB, Neria Y. The coronavirus disease 2019 (COVID-19) outbreak and mental health: current risks and recommended actions. *JAMA Psychiatry* 2021;78:9-10.
- 2) Cucinotta D, Vanelli M. WHO declares COVID-19 a pandemic. *Acta Biomed* 2020;91:157-160.
- 3) Neidhöfer G, Neidhöfer C. The effectiveness of school closures and other pre-lockdown COVID-19 mitigation strategies in Argentina, Italy, and South Korea. ZEW-Centre for European Economic Research Discussion Paper No. 20-034. 2020 Jul 21 [E-pub]. <https://doi.org/10.2139/ssrn.3649953>.
- 4) Chen Q, Liang M, Li Y, Guo J, Fei D, Wang L, et al. Mental health care for medical staff in China during the COVID-19 outbreak. *Lancet Psychiatry* 2020;7:e15-e16.
- 5) Seguin D, Kuenzel E, Morton JB, Duerden EG. School's out: parenting stress and screen time use in school-age children during the COVID-19 pandemic. *J Affect Disord Rep* 2021;6:100217.
- 6) Ten Veld G, Lubrecht J, Arayess L, van Loo C, Hesselink M, Reijnders D, et al. Physical activity behaviour and screen time in Dutch children during the COVID-19 pandemic: pre-, during- and post-school closures. *Pediatr Obes* 2021;16:e12779.
- 7) Schmidt SCE, Anedda B, Burchartz A, Eichsteller A, Kolb S, Nigg C, et al. Physical activity and screen time of children and adolescents before and during the COVID-19 lockdown in Germany: a natural experiment. *Sci Rep* 2020;10:21780.
- 8) Carroll N, Sadowski A, Laila A, Hruska V, Nixon M, Ma DWL, et al. The impact of COVID-19 on health behavior, stress, financial and food security among middle to high income Canadian families with young children. *Nutrients* 2020;12:2352.
- 9) Nagata JM, Abdel Magid HS, Pettee Gabriel K. Screen time for children and adolescents during the coronavirus disease 2019 pandemic. *Obesity (Silver Spring)* 2020;28:1582-1583.
- 10) Reid Chassiakos YL, Radesky J, Christakis D, Moreno MA, Cross C; Council on Communications and Media. Children and adolescents and digital media. *Pediatrics* 2016;138:e20162593.
- 11) Radesky JS, Schumacher J, Zuckerman B. Mobile and interactive media use by young children: the good, the bad, and the unknown. *Pediatrics* 2015;135:1-3.
- 12) Zashikhina A, Hagglof B. Mental health in adolescents with chronic physical illness versus controls in Northern Russia. *Acta Paediatr* 2007;96:890-896.
- 13) Layne CM, Olsen JA, Baker A, Legerski JP, Isakson B, Pasalic A, et al. Unpacking trauma exposure risk factors and differential pathways of influence: predicting postwar mental distress in Bosnian adolescents. *Child Dev* 2010;81:1053-1076.
- 14) Reiss F. Socioeconomic inequalities and mental health problems in children and adolescents: a systematic review. *Soc Sci Med* 2013; 90:24-31.
- 15) Benjet C. Childhood adversities of populations living in low-income countries: prevalence, characteristics, and mental health consequences. *Curr Opin Psychiatry* 2010;23:356-362.
- 16) Bordin IA, Duarte CS, Peres CA, Nascimento R, Curto BM, Paula CS. Severe physical punishment: risk of mental health problems for poor urban children in Brazil. *Bull World Health Organ* 2009; 87:336-344.
- 17) World Health Organization. Guidelines on physical activity, sedentary behaviour and sleep for children under 5 years of age. Geneva: World Health Organization;2019.
- 18) Crea K, Dissanayake C, Hudry K. Proband mental health difficulties and parental stress predict mental health in toddlers at high-risk for autism spectrum disorders. *J Autism Dev Disord* 2016;46: 3242-3257.
- 19) Mesman J, Koot HM. Common and specific correlates of preadolescent internalizing and externalizing psychopathology. *J Abnorm Psychol* 2000;109:428-437.
- 20) Peterson JL, Zill N. Marital disruption, parent-child relationships, and behavior problems in children. *J Marriage Fam* 1986;48:295-307.
- 21) Moore SA, Faulkner G, Rhodes RE, Brussoni M, Chulak-Bozzer T, Ferguson LJ, et al. Impact of the COVID-19 virus outbreak on movement and play behaviours of Canadian children and youth: a national survey. *Int J Behav Nutr Phys Act* 2020;17:85.
- 22) Lee S, Kim S, Suh S, Han H, Jung J, Yang S, et al. Relationship between screen time among children and lower economic status during elementary school closures due to the coronavirus disease 2019 pandemic. *BMC Public Health* 2022;22:160.
- 23) Korea Information Society Development Institute. Korea media

- panel survey 2021. Jincheon-gun: KISDI;2021. p.393-408.
- 24) Okely AD, Ghersi D, Hesketh KD, Santos R, Loughran SP, Cliff DP, et al. A collaborative approach to adopting/adapting guidelines - The Australian 24-Hour Movement Guidelines for the early years (Birth to 5 years): an integration of physical activity, sedentary behavior, and sleep. *BMC Public Health* 2017;17(Suppl 5): 869.
 - 25) Hinkley T, Verbestel V, Ahrens W, Lissner L, Molnár D, Moreno LA, et al. Early childhood electronic media use as a predictor of poorer well-being: a prospective cohort study. *JAMA Pediatr* 2014; 168:485-492.
 - 26) Tomopoulos S, Dreyer BP, Berkule S, Fierman AH, Brockmeyer C, Mendelsohn AL. Infant media exposure and toddler development. *Arch Pediatr Adolesc Med* 2010;164:1105-1111.
 - 27) Wu X, Tao S, Rutayisire E, Chen Y, Huang K, Tao F. The relationship between screen time, nighttime sleep duration, and behavioural problems in preschool children in China. *Eur Child Adolesc Psychiatry* 2017;26:541-548.
 - 28) Chung G, Lanier P, Wong PYJ. Mediating effects of parental stress on harsh parenting and parent-child relationship during coronavirus (COVID-19) pandemic in Singapore. *J Fam Violence* 2022;37: 801-812.
 - 29) Feinberg ME, A Mogle J, Lee JK, Tornello SL, Hostetler ML, Cife Ili JA, et al. Impact of the COVID-19 pandemic on parent, child, and family functioning. *Fam Process* 2022;61:361-374.