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Lack of Parental Control Is Longitudinally Associated With Higher Smartphone Addiction Tendency in Young Children: A Population-Based Cohort Study

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ABSTRACT

The purpose of the current study was to examine the risk factors of young children's smartphone addiction in a longitudinal study design. Data collected from 313 participants (mean age, 4.5 ± 0.82 years; male, 49.8%) over 4 years for Kids Cohort for Understanding of Internet Addiction Risk Factors in Early Childhood were analyzed in this study. Mixed effect models were used to evaluate the influence of various variables on the repeated measures of smartphone addiction tendency in young children over time. The multi-level analysis showed that parents' lack of control over children's smartphone use ($t = -4.523$; 95% confidence interval [CI], $-7.32, -1.72$), and parents' higher smartphone addiction proneness ($t = 6.340$; 95% CI, $0.23, 0.440$) predicted higher smartphone addiction tendency in young children. The responsibility of the parents to prevent their children from becoming addicted to smartphones should start in a very early age when they start using the smartphones.

Keywords: Smartphone Addiction; Young Children; Preschooler; Problematic Smartphone Use; Parental Control; Parental Mediation

Excessive use and addictive behaviors of smartphone use have become public health problems, resulting in serious consequences for the psychological health of the individual as well as that of the families and the society.¹⁻⁴ The prevalence of problematic smartphone (PSU) use amongst children, adolescents, and young adults were reported as high as 30% globally.^{5,6} Recently, the age when children begin to use smartphones is continuously decreasing, and more younger children are using smartphones.⁷ For young children, excessive use of smartphones can have even more detrimental consequences for their cognitive and psychosocial development.^{2,8}

Although smartphone addiction is not yet acknowledged as a disease entity in fifth edition of the Diagnostic and Statistical Manual of Mental Disorders, extensive research has been done on smartphone addiction. Schmitgen et al.⁹ reported that smartphone addiction has the same negative effects on one's brain as a drug addiction. Adolescents, and older children are the mostly affected age group of smartphone addiction, and young children have not been the main focus in studies on smartphone addiction. However, as prevention

Author Contributions

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and early intervention of addictive disorders is most effective and important, risk factors of smartphone addiction in young children should be examined. Previous studies found that parental control is not only ineffective in reducing smartphone addiction in adolescents, but can have even worsen adolescents' smartphone addiction.¹⁰ Since parents have a more significant impact on young children, parental factors that contribute to smartphone addiction in young children should be explored.

The purpose of the current study was to examine the risk factors of young children's smartphone addiction in a longitudinal study design. Particularly, we hypothesized that parental control would be negatively related with children's smartphone addiction tendency over time.

Data for the current research were drawn from the Kids Cohort for Understanding of Internet Addiction Risk Factors in Early Childhood (K-CURE). K-CURE is the first long-term observational prospective cohort study in Korea, focused on the risk factors and effects of internet and related usage and problems in children. The K-CURE study, which is still ongoing every year, started in 2015 recruiting 400 children between the ages of 2 and 5 from the general population.

Parents completed self-questionnaires which included demographic information and information about children's smartphone use. Children's age at first smartphone use, frequency of smartphone use, and duration of smartphone use were asked. Parents also completed the Smartphone Addiction Proneness Scale (SAPS)¹¹ about themselves. Parents also answered the question "Do you control your children's smartphone use?" with a yes or no answer. The primary outcome was the children's addictive behaviors, measured by the Child Smartphone Addiction Observer Scale.¹² Child Smartphone Addiction Observer Scale is a parent-reported questionnaire with 27 items, comprised of 6 subdomains: salience, impulsive and compulsive use, withdrawal, tolerance, disturbance of daily life, conflict in relationships. The measurements besides demographic information were all collected every wave.

For statistical analyses, we employed mixed effect models to investigate the factors influencing children's smartphone addictive behaviors over time. This method is particularly adept at handling the intricacies of longitudinal data, as it allows for the adjustment of correlations within individual participants' repeated measures. The analysis was conducted using the lme4 package in R software. Our model was structured in two levels: The level-1 addressed the repeated measures of smartphone addiction in children over various time points, while the level-2 focused on individual differences. Key variables integrated into the analysis included the frequency and duration of smartphone use, age at first smartphone use, parental influences, and static factors like sex, age, and family income. To manage missing data, mean imputation was employed, enhancing the robustness of our dataset. The adoption of mixed effect models enabled us to maximize the utility of our longitudinal data and increase the statistical power of our findings.

The baseline characteristics of the 313 children (mean age, 4.5 ± 0.82 years; male, 49.8%) in wave 4 are presented in **Table 1**. The most common range of age the children first used smartphones was 12–23 months (32.3%), followed by 24–35 months (20.4%). The mean frequency of smartphone use per week was 4.4 days. The duration of smartphone usage per day varied between weekdays and weekend. 75.1% of the parents reported that they control their children's smartphone usage, and 23.0% of the parents reported that they do not control their children's smartphone usage.

Table 1. Characteristics of the participants at baseline (N = 313)

Variables	Values
Sociodemographic characteristics	
Age, mon	54.3 ± 9.79
Sex	
Male	156 (49.8)
Female	157 (50.2)
Monthly family income	
Less than \$765	2 (0.6)
\$765–\$1,530	9 (2.9)
\$1,530–\$3,060	87 (27.8)
\$3,060–\$4,590	130 (41.5)
\$4,590 or more	85 (27.2)
Characteristics related to smartphone use	
Age at first smartphone use	
0–11 mon	41 (13.1)
12–23 mon	101 (32.3)
24–35 mon	64 (20.4)
36–47 mon	32 (10.2)
48–59 mon	33 (10.5)
60 mon or later	42 (13.4)
Smartphone addiction observer scale	44.7 ± 13.1
Smartphone use frequency, day/wk	2.9 ± 2.5
Smartphone use duration, hr/day	
Weekdays	
No use	127 (40.6)
Less than 1 hr	113 (36.1)
1–2 hr	61 (19.5)
2–3 hr	11 (3.5)
3–4 hr	1 (0.3)
4 hr or more	0 (0.0)
Weekend	
No use	109 (34.8)
Less than 1 hr	95 (30.4)
1–2 hr	79 (25.2)
2–3 hr	24 (7.7)
3–4 hr	6 (1.9)
4 hr or more	0 (0.0)
Parents' characteristics related to smartphone use	
Smartphone addiction proneness score	27.1 ± 8.0
Parental control over children's smartphone use	
Control	235 (75.1)
No control	72 (23.0)
Not answered	6 (1.9)

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

The multi-level analysis showed that higher scores on parents' SAPS ($t = 6.340$; 95% confidence interval [CI], 0.23, 0.440), and parents' lack of control over children's smartphone use ($t = -4.523$; 95% CI, -7.32, -1.72) significantly predicted higher scores on children's smartphone addiction scale (**Table 2**). Also, children's duration of smartphone use ($t = 7.303$; 95% CI, 1.150, 1.990) was a significant predictor of children's smartphone addiction scores. Age which the children first used smartphones and frequency of smartphone use did not predict the children's smartphone addiction scores. Additionally, lower monthly family income showed significant statistical relationship with children's higher scores on smartphone addiction scale ($t = -3.312$; 95% CI, -2.50, -0.64).

The results of the present study which showed that the duration of smartphone was a predictor for smartphone addiction are in line with previous studies.^{13,14} Yet frequency of smartphone

Table 2. Longitudinal mixed effects model (fixed effects) predicting children's smartphone addictive behaviors

Variables	Estimate	SE	t value	95% CI	P value
Predictors					
Wave	0.420	0.750	0.560	-1.05, 1.890	0.576
Parent's smartphone addiction proneness	0.337	0.053	6.340	0.230, 0.440	< 0.001***
Parental control over children's smartphone use	-4.523	1.428	-3.166	-7.320, -1.720	0.002**
Smartphone use frequency	0.131	0.081	1.271	-0.300, 0.560	0.553
Smartphone use duration	1.573	0.215	7.303	1.150, 1.990	< 0.001***
Age at first smartphone use	-0.367	0.293	-1.252	-0.940, 0.210	0.211
Covariance					
Sex	-2.338	1.205	-1.940	-4.70, 0.020	0.053
Age	0.033	0.059	0.561	-0.080, 0.150	0.575
Income	-1.570	0.474	-3.312	-2.500, -0.640	< 0.001***

SE = standard error, CI = confidence interval.

** $P < 0.01$, *** $P < 0.001$.

use was not a predictor for smartphone addiction in this study. Previous studies demonstrated that frequency of checking behaviors was related to PSU and frequent checking behaviors are typical symptoms of smartphone addiction.^{15,16} Since young children usually don't use their smartphones for social networking, it would not be surprising if they didn't show frequent checking behaviors. This could explain the insignificant association between frequency of smartphone use and smartphone addiction tendency in young children in this study. In this context, female sex was also not a predictor factor for higher smartphone addiction tendency in this study. Previous studies have shown that female preadolescents and adolescents are more prone to be addicted to smartphone than males, because they are more consumed with social media such as social networking services.¹⁷ Accordingly, in young children who don't use social media, female sex was not a predictor for smartphone addiction.

In this study, parental control was a protective factor for smartphone addiction in young children. A previous cross-sectional study on mothers of preschoolers yielded similar results which reported that restrictive mediation predicted lower proneness to PSU use.¹⁸ In studies on elementary-school children, effectiveness of parental mediation on reducing excessive smartphone usage and smartphone addiction showed mixed results.^{19,20} In contrast, many studies on adolescents have reported that parental control was ineffective in decreasing the risk of PSU or other problematic media use such as internet and gaming.^{10,21,22} Moreover, it was reported that restrictive parental control can lead to more conflict between parents and adolescents with no effect on the prevention of smartphone addiction.²³ A study showed that even the smartphone parental-control software programs were ineffective in decreasing the risk of smartphone addiction in adolescents.²⁴ Therefore, it can be inferred that parental control is only effective in preventing smartphone addiction before adolescence, and preferably in younger children.

Mother's smartphone addiction proneness was a significant predictor for children's higher smartphone addiction tendency in this study. Parental smartphone addiction can result in less parent-child interaction, child neglect, and poor parent-child relationship.²⁵ Consequently, children may seek comfort and entertainment via smartphones. Also, children learn behaviors and social norms from their parents. Children with parents with excessive smartphone use may naturally model them thinking that it is socially acceptable.²⁶ A number of research demonstrated that parents who are constantly distracted by their smartphones when interacting with their adolescents were reliable predictor of adolescents' smartphone addiction.^{27,28}

There are some limitations of the current study. First, how the parents controlled the children's smartphone use was not investigated thoroughly. Second, there can be many other factors that may have an effect on smartphone addiction. Third, the longitudinal data only included 4 years. Further study should investigate whether the risk factors can predict smartphone addiction tendency until the young children become adolescents.

In conclusion, the present study demonstrated that lack of parental control, parent's higher smartphone addiction proneness, and longer duration of smartphone use are significantly associated with higher smartphone addiction tendency in young children over time. The strength of this study was the longitudinal design and the multilevel framework. To the best of our knowledge, this study is the first study to investigate the longitudinal association of risk factors of smartphone addiction in young children. The results of this study provide empirical evidence that parental control of smartphone use in young children can be effective in reducing smartphone addiction risks, unlike in adolescents. The responsibility of the parents to prevent their children from becoming addicted to smartphones should start in a very early age when children start using the smartphones, or it will be too late.

Ethics statement

The study procedures were carried out in accordance with the Declaration of Helsinki and written informed consents were obtained from the parents. Data collected at wave 4 to wave 7 of the K-CURE study, which included 313 participants, were analyzed in this study. This study was approved by the Institutional Review Board of the Ajou University School of Medicine (AJOURBSUR-2021-459).

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