Factors associated with smartphone addiction risk in preschool children

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Abstract

Background

This study aimed to identify the factors associated with smartphone addiction risk among preschool children. Thus far, little is known about these factors in younger children compared to older children or adolescents, although the age at first use of a smartphone is decreasing.

Methods

A cross-sectional study design was used. Data were obtained from the nationwide survey on smartphone overdependence conducted in 2017 in South Korea by the Ministry of Science and ICT and the National Information Society Agency. Data from 1,378 preschool children were analysed using binominal logistic regression analysis. This study complied with the Strengthening the Reporting of Observational Studies in Epidemiology.

Results

Of the samples, 17.1% showed a risk of smartphone addiction. The odds of high risk for smartphone addiction increased with the duration of smartphone use during the week and the frequency of smartphone use over the weekend. Using smartphones to watch TV shows and videos significantly increased the odds of smartphone addiction risk, whereas using smartphones for education and games did not.

Conclusions

The findings of the present study showed that, similar to children in other age groups, preschool children were also exposed to the risk of smartphone addiction. To reduce smartphone addiction risk in these children, parents should be aware of their risk of smartphone addiction and consider allowing their children less than 30 minutes of smartphone use during the week and more opportunities for physical activities especially over the weekend. Our findings also suggested that parent-centred education needs to be
provided to correct parents’ perceptions. Information on smartphone addiction should be provided to parents along with an explanation that children’s smartphone use for educational purposes is beneficial; however, its use for the parents’ convenience or other purposes was not.

Background

By the end of 2019, the population of smartphone users worldwide is expected to reach 2.71 billion, and the rate of smartphone users is forecasted to continue to grow at a rapid pace [1]. Smartphones are handheld computers with telephone, advanced computing, and connectivity capabilities built on an operating system [2, 3]. They are rapidly becoming a necessity for daily life, as they fulfil the following functions: they help people work, study, acquire or share information; they help people maintain social relationships; and they help people enjoy leisure activities. South Korea is a country with one of the largest smartphone penetration rates. 89.5% of the total population age three and older had a smartphone in 2018 [4].

The average age at first use of a smartphone is currently 3-4 years old [5-8] and is decreasing [8-10]. This period corresponds to the preschool stage of development. Preschool children still spend much of their time with their primary caregiver, mostly parents, many of whom around the world use smartphones as a part of their children’s education and play [5-8, 11]. Education is generally viewed as being one of the main benefits of using smartphones [12], and parents of young children also appreciate the ability to use it for their children’s education and safety from outside stranger dangers [13]. However, smartphones may disconnect children from actual social interaction, lead to poor eyesight, and harm brain development [12]. Moreover, many smartphone applications for children are designed to be used intuitively and appeal to them, which may lead to addictive behaviours when used excessively [12]. Smartphone addiction is a
crucial social issue worldwide. Even if one’s smartphone use does not meet the criteria of addiction, which is a disorder with severe effects on physical and psychological health [14], its problematic use or risks of addiction could influence people’s lives and have severe negative consequences [12]. In South Korea, the prevalence of smartphone addiction risk among children aged less than 10 rose from 17.9% in 2016 to 20.7% in 2018, which was the largest increase in any of the age groups [4]. Problematic smartphone use typically involves not the telephone but rather the device’s internet capability [15–23], which is an application capability designed for a particular purpose [24]. Problematic use of the applications for entertainment (gaming being one of its forms), instant messengers and social networking services (SNS) can be generally more likely to contribute to smartphone addiction [18, 19, 21–23, 25]. Smartphone addiction can negatively affect self-esteem, physical and mental health, and social relationships, especially among children or adolescents [12, 15, 25–27]. Its impact on younger children is expected to be more severe. New guidance is needed because smartphones are ubiquitous in children’s lives. However, the smartphone addiction risk factors for preschool children are not yet well known. The factors that affect children’s screen time have mainly been examined with respect to watching TV [10, 28, 29]. An understanding of the patterns of smartphone addiction risk in preschool children and the associated factors is critical to the development of appropriate preventive strategies. To this end, we compared preschool children at risk of smartphone addiction with those not at risk.

Methods

1. Design

A cross-sectional study design was used for the present study. The present study complied with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE)
2. Participants and data collection

All data were obtained from the 2017 nationwide Survey on Smartphone Overdependence conducted in South Korea by the Ministry of Science and ICT and the National Information Society Agency [31]. The survey is conducted annually to secure data for policymaking on appropriate smartphone use. The 2017 survey targeted smartphone users aged 3–69 in all households nationwide as of 1 September 2017. After stratifying the population into 17 cities/provinces, the enumeration district was derived as the first sampling unit using probability proportional to size systematic sampling in proportion to the number of households. The number of households was derived as the second sampling unit using systematic sampling. Complete enumeration of smartphone users aged 3–69 was conducted in 10,000 households nationwide. Smartphone users were defined as those who used the internet on a smartphone more than once in the past month. The number of participants was 29,712. All data were collected via interview surveys by trained investigators who visited participants’ households between September and November 2017. The collected data were verified first by the supervisor of a given enumeration district; a second verification was conducted via telephone with a random sample of over 30% of the collected questionnaires. As a third verification, statistics experts checked the range of responses, the divergence between questions, and the consistency of responses. If there was an error in the data, the participant was investigated again to collect the ancillary data, and the data were supplemented or re-examined to verify its validity. We analysed the data of 1,378 preschool children aged 3–6 who attended day-care centres or kindergartens. These data were collected by asking children’s primary caregivers to observe and report on their child’s behaviours or attitudes. Primary caregiver is operationally defined as a person who cares mainly for a child.
3. Measurements

3.1. Smartphone addiction risk scale

Smartphone addiction risk was measured with a Korean-language scale developed and standardized by the National Information Society Agency [31]. This scale comprised three subscales: self-control failure, salience and serious consequences. Self-control failure refers to a reduction in the users’ ability to exert self-control over their use of a smartphone when compared to their subjective intention. A sample item (reverse-scored) is “My child stops using the smartphone at an appointed time.” Salience refers to when use of the smartphone becomes more prominent and important than other activities in an individual’s life. A sample item is “My child wants to play with a smartphone more than anything else.” Serious consequences refer to the continued use of a smartphone in the same manner despite experiencing negative results in terms of their physical, psychological, and social conditions. A sample item is “There is little play or learning except for on the smartphone.” Each subscale has three items, and the scale contains nine items. The items are rated on a four-point scale (1 = strongly disagree, 4 = strongly agree). Participants who scored 24 or lower out of 36 were considered the healthy group; scores of 24-27 indicated low risk; and scores of 28 or higher indicated high risk. The low- and high-risk groups were reorganized into a smartphone addiction risk group. The Cronbach’s alpha of the overall scale was 0.80.

3.2. Smartphone use patterns of preschool children and primary caregivers’ awareness of children’s smartphone dependence

Smartphone use patterns included the frequency and duration of smartphone use on weekdays and weekends, the purposes of smartphone use, and the degree to which it was used for those purposes for the last month. Smartphones include tablet computers used on behalf of smartphones. The purpose of using the smartphone and the degree of such use
has been measured with applications. For the present study, the purpose of smartphone use was classified according to the methods used in prior studies on smartphone addiction to identify factors related to addiction risk: surfing the web, games, TV or video watching, music, web toon/fiction, messengers, SNS [16–23, 25], and education. We evaluated the use of smartphones for educational purposes because educational apps are widely developed and used but have received little investigation. We measured the degree of use of each purpose on a seven-point Likert scale (0 = do not use at all, 1 = use rarely, 7 = use very frequently).

Primary caregivers’ perceptions of their child’s dependence on smartphones were evaluated with the question, “How much do you think your child relies on a smartphone compared to other kids around him/her?’ They responded a scale of 1 (“is not dependent on it at all”) to 5 (“is very dependent on it”).

4. Ethical considerations

Ethical approval by the institutional review board of Korea National Institututer for Bioethics Policy was granted for human studies before the study commenced (P01–201905–21–011). The data were requested and obtained according to the standard procedures presented by the Ministry of Science and ICT and the National Information Society Agency [31]. These data were entered into a computer program using the key entry method. Respondents’ personal information was encoded into serial numbers or excluded from entry, making it impossible to identify individual respondents.

5. Data analysis

All the data were analysed using SPSS version 23.0 for Windows (IBM Corporation, U.S.). First, data cleaning was performed to bring the quality of data to a reliable level according to practice guidelines [32]. Descriptive statistics (frequencies, percentages, means and standard deviations) were used to examine sex, patterns of smartphone use and primary
caregivers’ awareness of children’s dependence on smartphones. Differences in the healthy and risk groups of smartphone addiction according to sex, smartphone use patterns and primary caregivers’ awareness were analysed by $\chi^2$ tests and independent samples $t$-tests. Correlations between the variables were analysed with Pearson’s correlation coefficients. Binary logistic regression was also used to identify factors associated with smartphone addiction risk.

Results

1. Differences between healthy group and risk group of smartphone addiction according to variables

Of the 1,378 samples, 1,142 (82.9%) were placed in the healthy group, and 236 (17.1%) belonged to the smartphone addiction risk group. Table 1 shows the differences in sex, the smartphone usage patterns, and primary caregivers’ perception of children’s dependence on smartphones for the two groups. The duration of smartphone use of risk group was significant about three times that of healthy group during the weekend ($t = -14.154$, $p < .001$) and weekdays ($t = -12.499$, $p < .001$). The frequency of smartphone use of risk group was significant more than six times that of healthy group during the weekend ($t = -13.680$, $p < .001$) and weekdays ($t = -10.741$, $p < .001$).

In terms of usage purposes, the degree of TV/video watching showed the biggest difference ($t = -8.004$, $p < .001$). The degree of smartphone use for educational purposes did not differ significantly between the two groups ($t = -0.018$, $p = .513$).

[Insert Table 1 here]

2. Correlations between the risk of smartphone addiction and variables

Table 2 shows that the variables with the strong correlations with the risk of smartphone addiction were the frequency ($r = .616$, $p < .001$) and duration of use ($r = .574$, $p < .001$)
over the weekend, as well as the frequency (r = .531, p < .001) and duration (r = .552, p < .001) of use during the week. The frequency of smartphone use over the weekend had an exceedingly strong positive correlation with the frequency of smartphone use during the week (r = .962, p < .001); similarly, the duration of use on the weekends had a positive correlation with the duration of use during the week (r = .807, p < .001). In other words, a higher frequency and duration of smartphone use during the week seems to lead to the same pattern over the weekend. For the purposes of smartphone use, TV/video watching had the strongest correlation with addiction risk (r = .198, p < .001), followed by playing games (r = .183, p < .001). Education was not significantly correlated with addiction risk (r = -.018, p = .513). Primary caregivers’ perceptions of their children’s dependence on smartphones was correlated with playing games (r = .537, p < .001), education (r = .282, p < .001) and TV/video watching (r = .229, p < .001).

[Insert Table 2 here]

3. Factors associated with smartphone addiction risk

A binominal logistic regression analysis was performed to determine the factors associated with smartphone addiction risk compared with the healthy group. The results are presented in Table 3. The increase in the duration of smartphone use during the week contributed the most to the increased odds of being in the smartphone addiction risk group (OR = 3.15, 95% CI = 1.33–7.43). Moreover, each increase in the frequency of use over the weekend raised the odds of smartphone addiction risk (OR = 1.24, 95% CI = 1.13–1.37). Using smartphones for TV/video watching significantly increased addiction risk (OR = 1.18, 95% CI = 1.04–1.33).

[Insert Table 3 here]

Discussion

The purpose of the present study was to investigate the factors associated with
smartphone addiction risk among preschool children, especially those related to smartphone usage patterns, which have not been explored in detail. Another contribution of the present study is the finding that a similar proportion of preschool children were at risk of smartphone addiction as children in other age groups. The risk group formed 17.1% of the sample of preschool children. Previous studies among elementary school students found that the prevalence of smartphone addiction risk was 15.2% in Taiwan [25] and 12–14.3% in South Korea [20, 27]; thus, the prevalence of smartphone addiction risk among preschool-age children was not lower than that among elementary school children, indicating a need to be aware of this risk as early as preschool.

The findings indicated that the excessive use of smartphones was most strongly associated with addiction risk, which was a finding similar to those of previous studies. However, the usage purposes associated with addiction risk differed from those of school-age children or adolescents. In terms of excessive use of smartphones, the strongest factor associated with smartphone addiction risk was the duration of smartphone use during the week. The healthy group spent an average of 0.6 hours per day using a smartphone during the week, whereas the risk group spent an average of 1.9 hours. Moreover, an increase in the duration of smartphone use increased the odds of being in the risk group by 3.15 times. Although there is a slight difference in the duration range of smartphone use, the risk of addiction was also significant in other studies [5, 6, 11]. In particular, using a smartphone for more than an average of 30 minutes per day significantly increased the risk of smartphone dependence or addiction, and the risk increased linearly with the duration of use [5, 11]. These findings show that an excessive increase in the duration of smartphone use in preschool-age children’s daily lives may be the most important variable for addiction risk. Thus, interventions aimed at lowering the
risk of smartphone addiction should first focus on limiting children’s duration of use. The present study also reported that an excessive increase in the frequency of smartphone use over the weekend increased the odds of being in the risk group. The average daily frequency of smartphone use in the healthy group over the weekend was 5.3 times per day, while that in the risk group was 32.4 times per day. Accordingly, children in the risk group seemed to rarely let go of smartphones during the weekend. These smartphone usage habits can increase screen time and the amount of sedentary time in children [7], as well as decrease children’s exposure to positive parenting activities [33]. We also found that the frequency of smartphone use over the weekend was highly correlated with the duration of use. Therefore, it seems necessary to keep children’s smartphone use an average of less than five times a day and less than one hour a day during the weekend. The American Academy of Paediatrics recommends limiting the total screen use for preschool children to only 1 hour per day of high-quality programming [34]. With respect to the total duration of screen use, it is recommended to limit the duration of smartphone use to less than 30 minutes a day on weekdays and to less than 60 minutes per day over the weekend.

In the present study, using smartphones to watch TV shows and videos significantly increased the odds of smartphone addiction risk, whereas using smartphones for education and games did not. This finding differs from the factors associated with smartphone addiction risk among school-age children or adolescents, which included games, SNS, instant messaging, and habitual use [16–23, 25]. The factors were also related to parental intervention, self-control, self-esteem, and friendship [25, 26, 35, 36]. For preschool children, the impact of watching TV shows and videos may be related to the behaviour or habits of parents or primary caregivers [28]. A study in Turkey showed that prevalent smartphone use by pre-schoolers is mainly for games and not for educational
purposes, which causes concern for parents [7]. Children of this age are likely to spend much of their time at home with their primary caregivers, mostly with their parents [5, 6, 13], and spend more time with them over the weekend than during the week. Parents, however, tended to give young children access to personal computers or smartphones on weekends, and the purpose was mainly to keep them quiet and prevent them from distracting parents while they worked, put them to sleep, or persuaded them to eat at mealtimes [7–9, 28]. Thus, the applications used by parents at that time may be the child’s favourite TV shows or videos. This finding indicates that when preparing strategies for preventing smartphone addiction in preschool children, the target of intervention should be parents who are primary caregivers instead of children, unlike in other age groups. Parents may be educated that the applications associated with smartphone addiction risk in preschool children are not for games or education but for watching TV shows or video.

The present study has some limitations. First, all data were collected by asking primary caregivers to observe and report on their child’s smartphone use. Therefore, it is possible that the results of the survey reflect only their viewpoints. Second, primary caregivers were not known in detail by Personal Information Protection Act of South Korea.

Conclusions

The present study explored associated factors that increase the risk of smartphone addiction among preschool-age children. The results indicated that the prevalence of such risk was not lower than that of children in other age groups, indicating the need to pay attention to smartphone use in preschool-age children. The most significant factor associated with smartphone addiction risk was the duration of smartphone use, indicating that children should spend an average of less than 30 minutes a day on smartphones to ensure healthy use. Moreover, children should minimize the frequency of smartphone use
and keep a total of less than one hour a day during the weekend. Parents should be
prompted to give children more opportunities for diverse physical activities, especially
play with other children, on weekends.

On the other hand, the purpose of smartphone use that is most relevant to smartphone
addiction risk in preschool-age children is watching TV shows or videos but not playing
games, using SNS or pursuing education. These findings may relate to parenting
behaviours or habits as well as the increased frequency of smartphone use over the
weekend. Therefore, strategies to reduce and prevent the risk of smartphone addiction in
preschool-age children should focus on educating parents to correct their perceptions and
responses regarding smartphone use and their children.

Smartphone use in the population is continually increasing, and the age at first use is
gradually decreasing. Countries that have not yet investigated or begun to manage
smartphone addiction risks in preschool-age children should consider assessing children’s
smartphone addiction risks and develop appropriate countermeasures.

Declarations

List of Abbreviations

SNS: social network services; STROBE: the strengthening the reporting of observational
studies in epidemiology

Ethics approval and consent to participate

Ethical approval by the institutional review board (IRB) of Korea National Institute for
Bioethics Policy was granted for human studies (approval number: P01-201905-21-011).
Consent to participate is not applicable.

Consent for publication

Not application.

Availability of data and material
The datasets analysed during the current study are available in the Ministry of Science and ICT and the National Information Society Agency [http://eng.nia.or.kr/site/nia_eng/main.do]. Please contact the corresponding author for further information.

Competing interests
There are no competing interests.

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Authors’ contributions
This manuscript was made by JHP. She is responsible for the reported research.

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Authors’ information
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Tables

Due to technical limitations, Tables 1-3 are only available for download from the Supplementary Files section.

Supplementary Files

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Table 1.png
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