

Comparison of risk and protective factors associated with smartphone addiction and Internet addiction

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(Received: March 28, 2015; revised manuscript received: September 17, 2015; accepted: October 5, 2015)

Background and aims: Smartphone addiction is a recent concern that has resulted from the dramatic increase in worldwide smartphone use. This study assessed the risk and protective factors associated with smartphone addiction in college students and compared these factors to those linked to Internet addiction. *Methods:* College students ($N = 448$) in South Korea completed the Smartphone Addiction Scale, the Young's Internet Addiction Test, the Alcohol Use Disorders Identification Test, the Beck Depression Inventory I, the State-Trait Anxiety Inventory (Trait Version), the Character Strengths Test, and the Connor-Davidson Resilience Scale. The data were analyzed using multiple linear regression analyses. *Results:* The risk factors for smartphone addiction were female gender, Internet use, alcohol use, and anxiety, while the protective factors were depression and temperance. In contrast, the risk factors for Internet addiction were male gender, smartphone use, anxiety, and wisdom/knowledge, while the protective factor was courage. *Discussion:* These differences may result from unique features of smartphones, such as high availability and primary use as a tool for interpersonal relationships. *Conclusions:* Our findings will aid clinicians in distinguishing between predictive factors for smartphone and Internet addiction and can consequently be utilized in the prevention and treatment of smartphone addiction.

Keywords: smartphone addiction, Internet addiction, gender differences, character strengths, resilience

INTRODUCTION

Smartphone addiction

Smartphones are based on the Internet and have a wide range of functions. In addition to making phone calls, users are able to play games, chat with friends, use messenger systems, access web services (e.g., blogs, homepages, social networks), and search for information. Given their convenience and variety of functions, smartphones are widely popular, and the number of users is rapidly increasing, with more than 1.08 billion users across the globe in early 2012 (Mok et al., 2014). In South Korea, the number of smartphone users was estimated to be upwards of 39 million (Ministry of Science, Information and Communications Technology and Future Planning, 2014).

The increasing popularity of smartphones has led to many problems due to excessive use. Excessive smartphone use can interfere with concentration at school or work and can cause physical difficulties, such as neck stiffness, blurred vision, wrist or back pain, and sleep disturbances (Kim & Kang, 2013; Korea Internet & Security Agency, 2011; Kwon et al., 2013; Mok et al., 2014). It can also reduce in-person social interaction and academic achievement

and lead to relationship problems (Kim & Kang, 2013; Kuss & Griffiths, 2011; Mok et al., 2014).

Studies on smartphone use (Korea Internet & Security Agency, 2013a) have shown that among smartphone users, 45.8% feel anxiety when they are not holding their smartphone, 27.1% spend too much time using their smartphone, and 22.6% have repeatedly attempted to reduce their smartphone use but have always failed. Moreover, 21.0% of smartphone users reported difficulties with school or work due to excessive smartphone use. Further, these percentages were higher for individuals in their teens and twenties. Considering that addiction is a phenomenon characterized by tolerance, withdrawal symptoms, dependence, and social problems (Holden, 2001; Kim, 2006; Kwon et al., 2013; O'Brien, 2011), the research described above suggests the concept of "smartphone addiction." Although smartphone addiction is a relatively new concept and not included in the most recent version of the *Diagnostic and Statistical*

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Manual for Mental Disorders (DSM-5; American Psychiatric Association, 2013), research studies and social interventions have been conducted to address the adverse impact of smartphone addiction. In South Korea, the Smartphone Addiction Scale was developed to assess the severity of smartphone addiction (Kwon et al., 2013), and a number of public institutions (e.g., Ministry of Science, Information and Communications Technology and Future Planning; Korea Internet & Security Agency; Korea Communications Commission) have been frequently reporting research data on smartphone use (Kim et al., 2014; Kwon et al., 2013; Mok et al., 2014).

In order to understand smartphone addiction, knowledge of the risk and protective factors for such addiction is essential. Findings indicate that males are more vulnerable to Internet addiction than are females (Fattore, Melis, Fadda & Fratta, 2014; Heo, Oh, Subramanian, Kim & Kawachi, 2014). Moreover, a recent meta-analysis showed that Internet addiction was significantly associated with alcohol abuse, depression, and anxiety (Ho et al., 2014). Another study reported that depression, alcohol use, and smoking were important predictors of Internet addiction (Chang, Chiu, Lee, Chen & Miao, 2014). Given that smartphones are based on the Internet, we assumed that smartphone addiction might share many social or psychological properties with Internet addiction. Considering the findings described above, gender, alcohol use, smoking, anxiety, and depression were adopted as hypothesized risk variables in our study. As hypothesized protective factors, character strengths and resilience were selected. The concept of “character strength” is often used in positive psychology and includes virtues such as wisdom and courage (Kim, Yoon, Kwon & Ha, 2010). “Resilience” refers to a person’s ability to maintain psychological wellbeing and adapt successfully to acute stress, trauma, or more chronic forms of adversity (Jung et al., 2012). Resilience is a multidimensional construct that includes temperament, personality, and specific skills (Jung et al., 2012) and is negatively associated with the pathophysiology of addictive disorders (Russo, Murrough, Han, Charney & Nestler, 2012).

Objectives

The aim of this study was to assess the risk and protective factors associated with smartphone addiction and to compare these factors with those linked to Internet addiction.

METHODS

Participants and procedure

A total of 463 college students from Daejeon ($n = 155$; 33.5%), Sungnam ($n = 154$; 33.3%), Seoul ($n = 78$; 16.9%), and Nonsan ($n = 76$; 16.4%) participated in the study. Detailed research and instruction packages were sent to four colleges in each of these cities. This package requested the allocation of 60 to 70 minutes of in-class testing time to complete the questionnaires. Participants answered the questions anonymously. Of the 463 initial participants, 15 had more than 50% missing data and were therefore excluded.

Measures

All questionnaires were in self-report format. The beginning of the first questionnaire contained items assessing the following demographic characteristics: age, academic year, smoking (yes or no), and sex.

The Smartphone Addiction Scale (SAS; Kwon et al., 2013) was used to assess smartphone addiction. The SAS contains 33 items with a six-point response format ranging from “strongly disagree” (one) to “strongly agree” (six). The SAS covers the domains of daily-life disturbance, positive anticipation, withdrawal, cyberspace-oriented relationship, overuse, and tolerance.

Internet addiction was assessed with Young’s Internet Addiction Test (IAT; Young, 1998), which has been widely used to screen for Internet addiction. The IAT contains 20 items that are rated on a five-point scale ranging from “very rarely” (one) to “very frequently” (five). We used the Korean version of the IAT (Lee et al., 2013).

The Alcohol Use Disorders Identification Test (AUDIT; Saunders, Aasland, Babor, de la Fuente & Grant, 1993) has been widely used to measure the alcohol use. The AUDIT is a 10-item questionnaire covering the domains of alcohol consumption, drinking behavior, and alcohol-related problems. Responses to each question are scored from zero to four, giving a maximum possible score of 40. The Korean version of the AUDIT has confirmed reliability and validity (Lee, Lee, Lee, Choi & Namkoong, 2000) and was adapted in this study.

In addition, we assessed the severity of depression and anxiety using the Beck Depression Inventory (BDI-I; Beck, Ward, Mendelson, Mock & Erbaugh, 1961) and the State-Trait Anxiety Inventory, Trait Version (STAI-T; Spielberger, 1983), respectively. The BDI-I is composed of 21 items that inquire about the respondent’s symptoms and changes in mood over the past week, with a four-point scale (zero to three). The STAI-T contains 20 items that are rated from “not at all” (one) to “very much” (four). Both scales have been translated into Korean and have confirmed reliability and validity (Lim, Lee & Kim, 2005; Rhee et al., 1995).

To assess possible factors influencing smartphone addiction, we used the Character Strengths Test (CST; Kwon, You, Lim & Kim, 2010) and the Connor–Davidson Resilience Scale (CD-RISC; Connor & Davidson, 2003). The Korean version of the CST was developed with reference to the Values in Action Inventory of Strengths (VIA-IS; Kim et al., 2010; Peterson & Seligman, 2004). The CST is composed of 250 items that are rated on a four-point scale, ranging from “strongly disagree” (zero) to “strongly agree” (three). Means for each of the CST’s six virtues were calculated and used in the analyses described below. The CD-RISC contains 25 items using a five-point response format ranging from “strongly disagree” (zero) to “strongly agree” (four). The total score ranges from zero to 100, with higher scores reflecting greater resilience. We used the Korean version of the CD-RISC, which has been found to be reliable and valid (Jung et al., 2012).

Statistical analysis

Descriptive statistics were calculated for all variables (i.e., means and standard deviations for continuous variables

and percentages for categorical variables). Trends and associations among variables were evaluated using Pearson's correlation analyses. Stepwise multiple linear regressions were performed to determine the risk and protective factors for smartphone addiction and Internet addiction. A *p* value of less than 0.05 was considered to indicate statistical significance. All statistical analyses were performed using the Statistical Package for Social Sciences (Version 18.0 for Windows).

Ethics

The necessary ethical permissions were received from the Institutional Review Board at Eulji University Hospital prior to the initiation of the research. Before completing the questionnaires, participants were informed about the study protocol and gave their written informed consent.

RESULTS

Table 1 shows the sociodemographic and clinical characteristics of the study participants. A total of 448 college students were included (39.7% male, *n* = 178; 60.3%

Table 1. Sociodemographic and clinical characteristics of study participants

Variables	N (%)	Range	Mean (SD)
Gender			
Male	178 (39.7)		
Female	270 (60.3)		
Age, years			20.89 (3.09)
School year			
1 st grade	122 (27.2)		
2 nd grade	81 (18.4)		
3 rd grade	140 (31.8)		
4 th grade	97 (22.0)		
SAS		33–198	68.46 (24.95)
IAT		20–100	34.14 (11.23)
AUDIT		0–40	13.34 (7.99)
Smoking			
Yes	106 (23.8)		
No	339 (76.2)		
BDI-I		0–63	18.17 (12.49)
STAI-T		20–80	44.00 (9.77)
CD-RISC		0–100	55.41 (18.13)
CST			
Wisdom and knowledge		0–3	1.48 (0.49)
Humanity		0–3	2.01 (0.48)
Courage		0–3	1.66 (0.47)
Temperance		0–3	1.64 (0.58)
Justice		0–3	1.70 (0.43)
Transcendence		0–3	1.67 (0.48)

Notes: SAS = Smartphone Addiction Scale; IAT = Young's Internet Addiction Test; AUDIT = Alcohol Use Disorders Identification Test; BDI-I = Beck Depression Inventory I; STAI-T = State-Trait Anxiety Inventory, Trait Version; CD-RISC = Connor-Davidson Resilience Scale; CST = Character Strengths Test.

Table 2. Pearson correlation coefficients of smartphone addiction and Internet addiction with other variables

	SAS	IAT
SAS	1	
IAT	0.208**	1
Age, years	-0.177**	-0.031
AUDIT	0.101*	0.004
BDI-I	0.063	0.047
STAI-T	0.347**	0.258**
CD-RISC	-0.162**	-0.120*
CST-wisdom and knowledge	-0.177**	0.047
CST-humanity	-0.077	-0.161**
CST-courage	-0.184**	-0.175**
CST-temperance	-0.250**	-0.138**
CST-justice	-0.189**	-0.113*
CST-transcendence	-0.096*	-0.076

Notes: SAS = Smartphone Addiction Scale; IAT = Young's Internet Addiction Test; AUDIT = Alcohol Use Disorders Identification Test; BDI-I = Beck Depression Inventory I; STAI-T = State-Trait Anxiety Inventory, Trait Version; CD-RISC = Connor-Davidson Resilience Scale; CST = Character Strengths Test.

p* < 0.05. *p* < 0.01.

female, *n* = 270). The mean age of participants was 20.89 (*SD* = 3.09) years. The mean SAS score was 68.46 (*SD* = 24.95), and the mean IAT score was 34.14 (*SD* = 11.23).

Table 2 shows the Pearson correlation coefficients of smartphone addiction and Internet addiction with other variables. A significant correlation was found between SAS and IAT scores.

To identify the risk and protective factors for smartphone addiction and Internet addiction, stepwise multiple linear regression analyses were performed. In the case of smartphone addiction, the independent risk factors were higher IAT, AUDIT, and STAI-T scores, as well as female gender. Protective factors were higher BDI-I and CST-temperance scores. Complete results are shown in Table 3.

The risk factors for Internet addiction were higher SAS, STAI-T, and CST-wisdom and knowledge scores, as well as male gender. The protective factor was higher CST-courage scores. Complete results are presented in Table 4.

Table 3. Stepwise multiple regression analysis of smartphone addiction

Variable	B	Beta	<i>t</i>	<i>p</i>
Gender ^a	14.838	0.293	5.907	<0.001
IAT	0.404	0.184	3.838	<0.001
AUDIT	0.779	0.251	4.247	<0.001
BDI-I	-0.420	-0.215	-3.598	<0.001
STAI-T	0.562	0.224	4.426	<0.001
CST-temperance	-5.772	-0.143	-3.005	0.003

Notes: Dependent variable = Smartphone Addiction Scale total score. *R*² = 0.240, ΔR^2 = 0.228 for final step. IAT = Young's Internet Addiction Test; AUDIT = Alcohol Use Disorders Identification Test; BDI-I = Beck Depression Inventory I; STAI-T = State-Trait Anxiety Inventory, Trait Version; CST = Character Strengths Test.

^aMales were coded as one, and females were coded as two.

Table 4. Stepwise multiple regression analysis of Internet addiction

Variable	B	Beta	<i>t</i>	<i>P</i>
Gender ^a	-4.516	-0.196	-3.975	<0.001
SAS	0.096	0.211	4.150	<0.001
STAI-T	0.253	0.222	4.226	<0.001
CST-wisdom and knowledge	7.832	0.348	5.031	<0.001
CST-courage	-6.890	-0.297	-4.207	<0.001

Notes: Dependent variable = Young's Internet Addiction Test total score. $R^2 = 0.187$, $\Delta R^2 = 0.176$ for final step. SAS = Smartphone Addiction Scale; STAI-T = State-Trait Anxiety Inventory, Trait Version; CST = Character Strengths Test. ^aMales were coded as one, and females were coded as two.

DISCUSSION

In our study, higher levels of smartphone addiction were positively associated with female gender, Internet addiction, anxiety, and alcohol use, while negative associations were found with depression and with character strength-temperance. Higher levels of Internet addiction were positively associated with male gender, smartphone addiction, anxiety, and character strength-wisdom/knowledge but negatively associated with character strength-courage. We had originally hypothesized that smartphone addiction would share many social or psychological properties with Internet addiction, but several findings were inconsistent with this assumption. Thus, we considered unique features of smartphones (e.g., availability for easy and frequent access) in discussing our results below.

Consistent with our assumption, our regression analyses revealed that increased Internet addiction scores were associated with higher levels of smartphone addiction. Moreover, increased smartphone addiction scores were associated with higher levels of Internet addiction. In addition, increased anxiety was associated with higher levels of both smartphone and Internet addiction. As mentioned above, a number of previous studies showed that anxiety is a risk factor for Internet addiction (Dalbudak, Evren, Aldemir & Evren, 2014; Floros, Siomos, Stogiannidou, Giouzevas & Garyfallos, 2014; Ho et al., 2014). According to another recent study, anxiousness is one of the behavioural addiction-prone personality traits (Davis & Loxton, 2013). We believe that these findings may also apply to smartphone addiction. Further, the possibility of interacting with smartphones easily and frequently may make these devices especially attractive for individuals with high anxiety.

Beyond these similarities, however, we also found a number of differences between the predictive factors for smartphone and Internet addiction. In our regression analyses, increased smartphone addiction scores were associated with female gender, while increased Internet addiction scores were associated with male gender. To explore these gender differences, we focused on the purposes of smartphone and Internet use. Previous studies reported that males have a greater interest in games, cybersex, and gambling than do females (Cooper, Morahan-Martin, Mathy & Maheu, 2002; Fattore et al., 2014; Johansson & Gotestam, 2004). A study on Internet addiction among South Korean adolescents

showed that – except for academic purposes – males tend to use the Internet for online gaming and searching for information, while females tend to use the Internet for chatting, sending messages, blogging, updating personal homepages, and searching for information (Heo et al., 2014). On the other hand, regardless of gender, the primary purposes of smartphone use were chatting and using messenger systems, with making phone calls and searching for information as other major uses (Kim et al., 2014; Korea Internet & Security Agency, 2013a). These results indicate that female Internet users can engage in their favorite Internet-based activities (e.g., chatting, using messenger systems, blogging) more conveniently via smartphone because of these devices' easy availability. By contrast, male Internet users do not typically use smartphones to engage in their favorite Internet activities, such as online gaming, because the gaming capability of smartphones has traditionally been inferior to that of computers. One study of smartphone use in South Korea reported that women, but not men, were less likely to use their computers after obtaining a smartphone (Korea Internet & Security Agency, 2013b). This pattern of findings across studies may account for our finding that female gender was associated with higher levels of smartphone addiction.

We also found that increased alcohol use scores were associated with higher levels of smartphone addiction. A study on the culture of drinking among South Korean university students reported that the major purpose of drinking was facilitating social relationships (Chung, 2006). Similarly, one of the major uses of smartphones is to facilitate interpersonal relationships. Considering that the participants of our study were not alcohol-dependence patients, but college students, it appears that increased alcohol use may be associated with smartphone addiction because of the role of smartphones in interpersonal relationships. In addition, smartphones are readily accessible, which allows people to use their smartphones in pubs or bars. This also may have influenced our results.

Increased depression scores were associated with lower levels of smartphone addiction in our study. By contrast, a recent study on smartphone addiction revealed that depression was significantly more prevalent in the risk-user group (Kim et al., 2014). These diverging results may be partly attributable to the fact that our participants were college students rather than patients. In addition, our study used the SAS to assess smartphone addiction, and the cutoff score of the SAS has not been determined yet (Kwon et al., 2013). Thus, we had difficulties with separately analyzing the risk group. If we had divided the group based on risk, the results may have been different. Further, social withdrawal is a symptom of depression (Sue, Sue & Sue, 2010), while smartphones are frequently used for the opposite process, social connection. This may also have contributed to the current results.

In the present study, increased character strength-temperance scores were independently associated with lower levels of smartphone addiction. A previous study showed that impulsivity is a significant risk factor for smartphone addiction in university students (Kim et al., 2014). Because temperance implies self-regulation (Kim et al., 2010), this previous finding is consistent with our result. We also think

that smartphone addicts can easily satisfy their urge because smartphones are almost always available. Regarding other character strengths, higher levels of Internet addiction were positively associated with wisdom/knowledge and negatively associated with courage. Wisdom and knowledge encompass curiosity and a love of learning (Kim et al., 2010). College students are unable to avoid using the Internet to complete their research, reports, and homework. Moreover, Internet-based learning and lectures have recently become very popular among South Korean students. These academic Internet uses may be a factor in our results. In addition, evidence suggests that introverted personality characteristics and a passive coping style are risk factors for Internet addiction (Xie, Zhou, Xu & Peng, 2010; Zamani, Abedini & Kheradmand, 2011). This may have been why decreased character strength–courage scores were associated with higher levels of Internet addiction in our study, as courage encompasses vitality and bravery (Kim et al., 2010).

The patterns revealed in this study indicate the necessity of considering individuals' purposes for smartphone and Internet use when analyzing risk and protective factors for addiction. Furthermore, the features of smartphone devices, such as high availability, played a role in almost all findings. These findings have important implications for future studies because as the purposes, contents, and functions of smartphones change, the risk and protective factors will change as well. For example, if the gaming performance of smartphones is improved with technological advances, female gender may no longer be associated with higher levels of smartphone addiction. Thus, we believe it is necessary to place a greater emphasis on users' purposes than on the devices themselves because the former represent the core of these addictions. For example, recent reports have framed Internet gambling as an addiction to gambling, rather than as an addiction to the Internet (d'Astous & Di Gaspero, 2015; LaPlante, Nelson & Gray, 2014). In the present study, smartphone addiction was similar to "interpersonal relationship" or "not face-to-face communication" addiction. This is because the primary uses for smartphones are chatting, using messenger services, placing phone calls, blogging, and accessing social networking services (Kim et al., 2014; Korea Internet & Security Agency, 2013a). Moreover, the differences between smartphone and Internet addiction reflected the differences in purpose, contents, and functions between the two media. From this perspective, smartphone addiction is a complex concept that includes various smartphone-accessible behavioral addictions such as gaming, chatting, shopping and gambling.

There are several limitations to this study. First, the participants were all college students, which may reduce the generalizability of the present results to other at-risk age groups. For example, considering that excessive smartphone use is highly prevalent in teens (Korea Internet & Security Agency, 2013a), it might have been appropriate to include teens in our sample. Second, the participants did not exhibit significant functional impairments, though we cannot completely exclude the possibility of such impairments, as they were not specifically addressed in this study. Therefore, generalizing these results to a clinical setting might prove difficult. Third, the questionnaire did not assess information such as hours of use, purpose of use, or contents most used.

To obtain this information, we referred to other reports (Heo et al., 2014; Kim et al., 2014; Korea Internet & Security Agency, 2013a); however, we believe that an investigation of this additional information is necessary to enhance clinical validity. Fourth, smartphones are based on the Internet, and their functions are mostly operated via Internet access. Thus, there must be overlap between smartphone use and Internet use. We believe that dividing the groups more clearly would be helpful in future studies (e.g., comparing "Internet use via smartphones" with "Internet use via computers"). Lastly, there can be risk and protective factors beyond those measured in the present study, some of which may drive the overlap between the measured variables (Demirci, Akgonul & Akpinar, 2015; Karadag et al., 2015). Until now, there have been few studies on smartphone addiction. As studies in this field progress, predictive factors for smartphone addiction will become more and more apparent.

CONCLUSIONS

The present findings will aid clinicians in distinguishing between predictive factors for smartphone and Internet addiction and can consequently be utilized in the prevention and treatment of smartphone addiction. Moreover, the present report discusses the potential reasons underlying the differences between smartphone and Internet addiction.

In addition, the present study suggests the possibility that smartphone use is not an objective in and of itself but instead is a means of engaging in addictive activities that are accessible on these devices. Consequently, future studies should focus on the purposes and contents of smartphone use.

Funding sources: Funding for this study was provided by a grant from the Korea Health Technology R&D Project, Ministry of Health and Welfare, Republic of Korea (A120157). The funders had no role in the study design, collection, analysis or interpretation of data, writing of the manuscript, and the decision to submit the paper for publication.

Authors' contribution: All the authors contributed to the design of the study. DJK and JSC contributed to study planning and advised to the course of study. HJA, SWC, EJC and WYS conducted the data collection from the participants in colleges. All authors conducted literature searches and provided summaries of previous research studies. SWC and HCY conducted the statistical analysis and wrote the first draft of the manuscript. All authors contributed to development of the manuscript, revised it critically and have approved the final manuscript.

Conflict of interest: All authors declare that they have no conflicts of interest.

Acknowledgements: The authors wish to thank Ji-Young Hwang for data collection assistance.

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