SMARTPHONE ADDICTION AND BEHAVIORAL OUTCOMES IN SOUTH KOREA: A SYSTEMATIC REVIEW AND META-ANALYSIS

Asad Shahjehan^{1*}, Sajjad Ahmad Afridi², Maqsood Haider³, Amjad Iqbal⁴, Shahab Aziz⁵

^{1*,2,4} Assistant Professor, Department of Management Sciences, Hazara University Mansehra, Pakistan; ³ Assistant Professor, Department of Management Sciences, FATA University, Pakistan; ⁵ Assistant Professor, Department of Business Studies, Bahria University Islamabad, Pakistan.

Email: ^{1*}asadshahjehan@hotmail.com, ²mrafridi79@gmail.com, ³dr.haider@fu.edu.pk, ⁴amjadiqbal1987@yahoo.com, ⁵saziz.buic@bahria.edu.pk

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Abstract

Purpose of the study: There is considerable debate on smartphone addiction and its relationship with behavioral outcomes however in literature there is only one meta-analysis in the country-specific context and none in the South Korean context. Ranked 6th based on smartphone penetration in the world it is imperative to quantify the association.

Methodology: A systematic review was conducted to collect published sources about smartphone addiction and its relationships with behavioral outcomes. The identified sources were evaluated for appropriateness and inclusion in the meta-analysis was made. Thirty-one studies were included in the Meta-analysis providing data from 32 samples (n=11,002) and presented associations with 13 behavioral outcomes.

Main Findings: Meta-analytical tests presented a positive and significant relationship between smartphone addiction and the overall subject's behavioral outcomes. Among the behavioral outcomes identified through the systematic review, six had significant while seven had an insignificant association with smartphone addiction. Lastly, these behavioral outcomes were quantitatively classified into 6 groups based on direction, significance, and heterogeneity of their reported effects. Overall smartphone addiction has a significant role in modifying certain behaviors of an individual.

Applications of this study: The results of this study enforce the opinion that smartphone addiction tends to significantly enhance negative behavioral outcomes while limits positive outcomes in the South Korean population.

Novelty/Originality of this study: This is the first country-specific study conducted regarding smartphone addiction. This is also the first meta-analysis study conducted which evaluated the effects of smartphone addiction on multiple behavior outcomes.

Keywords: Smartphone Addiction, Behavioral Outcomes, Meta-analysis, South Korea.

INTRODUCTION

Since the emergence of smartphones, the abnormal use of these devices has raised a question: "Does its abuse or addiction lead to mental and behavioral problems?" There is scant literature referring use and abuse of smartphones as a form of behavioral addiction (Hadar et al., 2017; Kocyigit, Guzel, Acikel, & Cetinkaya, 2021; Kwon et al., 2013b; Spada, 2014) as similar to other forms of behavioral addictions, proving the existence of smartphone addiction is challenging. Smartphone addiction characterized as a form of behavioral addiction is defined as the inability of an individual to control the use of his or her smartphone which may lead to impairments in mental, psychological, social, and behavioral functioning (Bong, Won, & Choi, 2021; Kwon, Kim, Cho, & Yang, 2013a; Kwon et al., 2013b; Kwon & Paek, 2016). Some researchers have also proposed smartphone addiction as a manifestation of impulsivity disorders; however, among the manifestations of impulsivity disorders, only compulsive gambling has been recognized as a behavioral addiction while the rest are characterized as impulse disorders (De-Sola Gutiérrez, Rodríguez de Fonseca, & Rubio, 2016; Kocyigit et al., 2021; Manchiraju, 2018; Wu, Lin, & Lin, 2021). The clinical world though proclaims that majority of these manifestation leads to mental and behavioral problems, not much consideration has been given in their literature to the concept of addiction about smartphone use/abuse.

Before reviewing the dynamics of smartphone addiction, it is important to first describe behavioral addiction and then differentiate it from substance addiction. Addiction is described as abuse without control, alterations in mood, abstinence, tolerance, and personal harm or conflicts in the environment, with a tendency to relapse (Brown, 1993; Griffiths, 2005; Sabri & Jencius, 2020; Shytle, Silver, & Sanberg, 1996). Sussman and Sussman (2011) stated that addiction is the capacity of an individual to get hooked on to "reinforcing behaviors, excessive worry about consumption, or behaviors with high positive reinforcement, tolerance, loss of control, and difficulty in avoiding said behavior, despite its negative consequences" (p. 4026). Similarly, Cía (2018) highlights automatism as a central characteristic of addiction which leads to feelings of intense desire or irresistible need, the focalization of interests on behaviors or activities of interest, inattention to usual activities, irritability and malaise associated with abstinence, loss of control, persistence on behavior despite their negative effects, and most importantly uncontrollable use. Echeburua, Labrador, and Becoña (2009) present characteristics of behavioral addiction similar to that found in addiction literature as a loss of control, the creation of a dependent relationship, increased tolerance to abuse, progressive

increase in dedication and time, and disruption to daily life. Researchers also state that in the case of substance addiction, instances and moments can be observed that change and interfere with an individual's daily life and create behavioral problems ([Baharudin, Mohamad, & Karim, 2020](#); [Galifianakis, Byrd, Ostrem, Tanner, & Racine, 2017](#); [Mok et al., 2014](#)). However, it becomes difficult to assess whether the problems are instigated by problematic behavior, personality traits, or psychiatric comorbidities in the case of behavioral addictions. Ample research has been conducted on behavioral addictions like exercise, food, the internet, online sex, shopping, video games, and work before the emergence of smartphone addiction. Several authors have characterized behaviors as potentially addictive if they lead to the concurrence of negative physical and psychological consequences and reinforcements in a specific context.

Studies have identified the internet, video games, and smartphones as one of the most important behavior addictions of our times ([Faye, Gawande, Tadke, Kirpekar, & Bhawe, 2016](#)). In the history of technology-related addiction internet addiction was the first to be identified as a global addiction or an interaction with its addictive content and activities. [Young \(1999\)](#) in a pioneering study identified 5 forms of addictive behaviors associated with the use/abuse of the internet is the computer, cyber contacts, cyber-sexuality, information search, and interaction compulsions. With the emergence of cellphones, internet addiction was succeeded by cellphone addiction, and the recent drastic development of cellphone into smartphone has given rise to another potential source of addictive behaviors. Through the evolution of devices, the forms of addiction have also evolved from a global addiction to the differentiation of addictions by content and applications. It is debatable if the addiction is toward smartphones, the content it offers, or the functions it performs through its applications, yet this debate is similar to previous debates about the internet and cell phone addiction. Nonetheless, keeping in view this perspective smartphone provides activities with its breadth of applications and uses lead to problematic use, as researchers like [Taneja \(2014\)](#) state that smartphones, through their wide-ranging content support and applications, tend to induce greater misuse than any other historical technologies.

Similarly, [Shambare, Rugimbana, and Zhoua \(2012b\)](#) state that though smartphones have become the icon of the 21st century, they are possibly the biggest non-drug addiction of this century. By employing [Hanley and Wilhelm \(1992\)](#), [Hooper and Zhou \(2007\)](#), and [O'Guinn and Faber \(1989\)](#) criteria concerning motivations for use. They identified six classes of behavior outcomes associated with habitual smartphone usage (performed with little mental awareness), addictive (increased attention, uncontrollable, and involuntary use), mandatory (consequence driven obligatory behavior), voluntary (reasoned behavior is driven by specific motivations), dependent (attached to a social norm) and compulsive (repetitive, with a strong urge to continuously perform a behavior). They also posit that smartphone users can develop a behavioral state in which an individual progressively decreases attention to other daily life activities and in the process, causes oneself mental and social damage while constantly attempting to control their dysphoric feeling. In summary excessive attention and uncontrolled dedication to a smartphone is an addiction.

Regardless of the debate regarding behavioral addictions, research on smartphone addiction is ever increasing. Bibliographic studies regarding technology-related addiction show internet addiction as the most researched area followed by videogame addiction and then smartphone addiction. With the unification of the internet and video games with the smartphone, interest is bound to increase in its research. The contemporary nature of smartphone addiction and the lack of meta-analytical studies in technologically advanced country-specific contexts (like South Korea) that examine its relationships with behavioral outcomes provide the impetus for conducting this study.

Smartphone Addiction in South Korea

Smartphone addiction has emerged as a significant worldwide problem as smartphone penetration has increased ([Lin et al., 2015](#)). In 2016 an estimated 62.9% of the world population owns a mobile phone. The mobile phone penetration is expected to increase to 67% by 2019. This exponential growth in mobile phone penetration is primarily attributed to the popularity of smartphones. In 2014 38% of all mobile phones were smartphones, which increased to 50% by 2018. The number of smartphone users has grown by a billion in five years and is expected to reach 2.7 billion by 2019. South Koreans are among the world's biggest tech users with 100% mobile phone penetration ([Davey & Davey, 2014](#)) and ranked 6th in the world, in terms of smartphone penetration ("[\[Monitor\] Korea's smartphone penetration rate ranks world's 6th,](#)" 2017). The smartphone penetration rate in 2018 is expected to reach 78.61% for South Korea in terms of the number of smartphone users compared to the nation's population with a total of 47.4 million Koreans (figure includes those registered to more than one account) use smartphones ("[Smartphone penetration as share of the population in South Korea 2015-2022,](#)" 2018). With such high penetration rates, smartphone usage has the potential to develop behavioral problems and disorders in the South Korean population ([Davey & Davey, 2014](#)). This fact is particularly evident in South Korean communication studies which provide new pathologies such as "Nomophobia" No Mobile Phobia ([Han, Kim, & Kim, 2017](#)), "FOMO" Fear Of Missing Out, that is the fear to be without a smartphone ([Swar & Hameed, 2017](#)), "Textaphrenia" ([Verma, Rajiah, Cheang, & Barua, 2014](#)) and "Ringxiety" a false sensation of receiving a text or call ([Myung, 2015](#)), and "Textiety" the anxiety of receiving a text message and an urge to respond it immediately ([Siddiqi, Jahan, Moin, Al-Shehhi, & Al-Balushi, 2017](#)). Similarly, physical and psychological problems have also been reported in the South Korean context like neck muscle pains ([Lee, Lee, & Park, 2015](#)) Computer Vision Syndrome ([Barthakur, 2013](#)) smartphone activity leading to auditory and tactile illusions ([Parasuraman, Sam, Yee, Chuon, & Ren, 2017](#)),

and “*de Quervain’s tenosynovitis*” leading to pain and weakness in thumbs and wrists ([Kim, Chae, Jung, & Lee, 2014](#)). Researchers have frequently compared and collaborated on numerous behavioral addictions, including smartphone addiction, to the diagnostic criteria of the Diagnostic and Statistical Manual of Mental Disorders (DSM). [De-Sola Gutiérrez et al. \(2016\)](#) evaluated symptomatology of problematic cell-phone use and compared it with DSM-5 criteria for compulsive gambling and substance use and reported its problematic manifestation. Similarly, [Choliz \(2010\)](#) also supports this theory and presented four factors that are abstinence, tolerance and abuse, lack of control, and interference with other activities to define smartphone addiction and dependency. Results from a longitudinal study by [Tossell, Kortum, Shepard, Rahmati, and Zhong \(2015\)](#) show that smartphone addiction is related to the use of applications and content that is processed along with compulsive consultations and messaging. They also propose that addicted and non-addicted users spend an equal amount of time on the smartphone; however, the addicted user’s time is imbalanced, affects the daily tasks, focused on insubstantial activities, and is dispersed.

Researchers have taken a broad-spectrum position regarding smartphone addiction ranging from absolute addiction to behavioral possibilities beyond addiction like impulse control disorders, psychopathological problematic personality traits to a behavior congruent with a certain lifestyle ([Toda, Monden, Kubo, & Morimoto, 2006](#)). They still argue that delineation of this spectrum into abuse, misuse, dependence, and addictions needs to be defined and cleared ([Sansone & Sansone, 2013](#)). It is also evident from the literature that smartphone addiction is a breeding ground for negative behavioral outcomes like low self-esteem, struggling with conflict, impulsivity, sensation seeking, intolerance towards pain and sadness, a tendency toward depressive and dysphoric states ([Cfá, 2013](#)). Lastly, only one meta-analysis in a country-specific context has been conducted by [Davey and Davey \(2014\)](#) using Indian studies regarding smartphone addiction.

NEED OF THE STUDY AND OBJECTIVES

Keeping in view the general profile of smartphone addiction, symptoms, predicaments, and correspondence with substance addiction, frequent coexistence with problematic behaviors, traits, and psychiatric comorbidities, and lack of country-specific context is the motivation for this investigation; specifically, in the context of South Korean’s technologically advanced culture.

This study has three main objectives:

R₁: Through systematic review identifies studies conducted in South Korean sample that recognize associations between behavior outcomes and smartphone addiction meeting the behavior outcomes classes that are habitual behaviors, addictive behaviors, mandatory behaviors, voluntary behaviors, dependent behaviors, and compulsive behaviors presented by [Shambare et al. \(2012b\)](#).

R₂: Through meta-analytical analyses investigate the relationship between smartphone addiction and overall behavioral outcomes.

R₃: By executing a series of meta-analyses for assessing the relationship between smartphone addiction and each behavioral outcome identified through the systematic review.

METHODS

Literature Search

A comprehensive literature search was conducted to collect published sources both in English and Korean language about smartphone addiction and its relationships with behavioral constructs. In the first step, the sources were searched using Google scholar with keywords Smartphone addiction and South Korea. However, this search setting resulted in unlimited results. An alternative search of keywords in the form of phrases was conducted with phrases “Smartphone addiction” and “South Korea” that identified 1010 sources. Keeping into consideration the scope of the study all the identified sources were evaluated. Furthermore, studies based on similar terms like ‘*cellphone addiction*’, ‘*internet addiction*’, ‘*social network sites addiction*’, ‘*Facebook addiction*’, and ‘*videogames addiction*’ were removed resulting in the retainment of 114 published articles for further evaluation. In the second phase keywords in the form of phrases were searched the organizational studies databases with the search options of concurrent existence of keywords phrases “Smartphone addiction” and “South Korea”. These databases included Elsevier, Emerald, Informs, JSTOR, Springerlink, Taylor & Francis, Web of Knowledge, and Wiley-Blackwell. The results were compared to the search conducted in the first step that used the Google Scholar database to avoid duplication which resulted in no new sources. To complement the first two phases of electronic search references of key research articles on Smartphone addiction were also searched and results were compared to previous searches to avoid duplication, however, no new sources were identified.

Inclusion Criteria

Following these three steps, the sources were evaluated by an eight-member research team and a decision was made regarding the inclusion of the sources based on whether the sources are appropriate or not. The research team read the articles and selected articles

based on the inclusion criteria. The criteria consisted of five parts: first, those studies were included that studied the relationship between behavioral outcomes that come under the behavioral outcome classes identified by [Shambare, Rugimbana, and Zhoua \(2012a\)](#) and smartphone addiction. Second, the data presented in the studies should be primary data. Third provides information about correlations between the variables, sample size, Cronbach reliability statistic, and fourth the study must be conducted in South Korea. In the fifth part, the research team evaluated the quality of the sources based on the methodological rigor criteria developed by [Faragher, Cass, and Cooper \(2005\)](#). This rigor score consists of ten aspects of organizational psychology research methodological rigor. Each study was rated according to these criteria (0 = unacceptable; 1 = acceptable) and a summated 'rigor' score was computed (range 0–10). Studies having a rigor rating of more than 6 were retained for analysis.

Figure 1: Flowchart of inclusion and selection criteria of studies in the meta-analyses

Source: [Moher, Liberati, Tetzlaff, Altman, and Group \(2009\)](#)

Based on these inclusion criteria after the four steps, 59 studies were identified that reported the required statistics. While after evaluating the studies for methodological rigor 31 studies were selected for the Meta-analysis. The intraclass correlation coefficient was calculated to evaluate whether the research team presented similar rigor scored for the sources. A significant coefficient ($p < 0.001$) was reported for this study which was 0.782 (LBCI=0.643, UBCI 0.881) which is acceptable inter-rater reliability for meta-analytical studies. The selected studies provided data from 32 samples (one study provided data from 2 samples), with a combined

sample size of 11,002 subjects and 58 correlation values between smartphone addiction and behavioral outcomes. Among the subjects, 69% are adolescents 31% are adults. Furthermore 86% of the respondents are schools, colleges, nursing colleges, and university students.

Meta-Analysis Procedures

Schmidt–Hunter psychometric meta-analysis method (Hunter & Schmidt, 1990) was used in this study. Their method provides a formula that corrects the reported correlations from individual samples for measurement errors. Furthermore, they make these adjustments correlation either through reported reliability in the study or through reliability value of the scale prevailing in published material. “Meta-Essentials” spreadsheets were used for conducting the meta-analyses for this study. This study used the random effects generated by the software as it allows for the probability that the true effects underlying each study could be different thus providing an estimate which is the mean effects across all studies (Schulze, 2004). It further assumes the level of imperfection that we observe in a study is not only due to sampling error for the estimate (e.g. correlation) but because this particular study is random, and one study among any number of studies that could have been done. As the true effect across studies vary the calculated effect size wouldn't be the same and dispersion between them can be noticed. We thus presented the Q statistic and I-squared to assess the prevalent heterogeneity of our studies. Furthermore, the variance of dispersion is presented through τ (tau) and its standard deviation through τ^2 (tau-squared) (DeCoster, 2005). Funnel plot analysis proposed by (Duval and Tweedie (2000a), 2000b)) which assumes that observed effect sizes with similar precision (i.e., with similar standard error) should be more or less symmetrically distributed around the combined effect size was also used to indicate possible publication bias.

RESULTS

Based on the inclusion criteria the studies chosen for the meta-analysis are presented in Annexure 1. Several meta-analyses were executed on the data reported through the systematic review which presented us the combined estimates and the strength of each estimate. To assess publication biasness funnel plot analysis was also executed. As shown in figure 2, the observed effect sizes are more or less symmetrically distributed around the combined effect size. Furthermore, the Trim-and-Fill method had imputed three studies on the left side of the plot and therewith adjusted the combined effect size for the potentially missing studies. Lastly, it can also be observed that more results are far from the null than closer to it. the plot in figure 2 confirms that there is insignificant publication biasness for this study.

Figure 2: Funnel plot for publication bias

The results of meta-analytical tests on the correlation values between Smartphone addictions and behavioral outcomes of South Korean samples are as follows:

Table 1: Combine estimates for smartphone addiction with overall behavioral outcomes

Model	Effect size and 95% interval				Test of null (2-Tail)		Heterogeneity		τ^2		
	N	$\bar{r}$	LLCI	ULCI	Z	p	Q	p	I ²	τ^2	τ
Random effects	11002	0.13	0.04	0.21	3.04	0.002	2171.64	< 0.001	97.38	0.11	0.33

Based on the review of literature it is expected that the level of smartphone addiction would have a significant positive association with behavioral outcomes. As shown in table 1 there is a positive association between smartphone addiction and behavioral outcomes with $\bar{r} = 0.13$. The strength of this relationship is moderate (Cohen, 1992), yet it is significant with LLCI=0.04 & ULCI=0.21, Z=3.04, p=0.002. The table also provides statistics regarding the heterogeneity of the reported correlations. Q statistic for this meta-analysis is 2171.64 significant at $p < 0.001$ exhibiting that the effect size from each study is significantly heterogeneous. $I^2 = 97.38\%$ describes the proportion of observed variance that reflects real differences in the studies. Lastly, $\tau = 0.30$ reflects the dispersion of the fixed effects and $\tau^2 = 0.09$ is the standard deviation of this dispersion. In summary, there exists a significant moderate association between smartphone addiction and behavioral outcomes. The results are also significantly heterogeneous which can be attributed to the diverse nature of the behavioral outcome.

A series of meta-analytical tests were conducted on 13 behavior outcomes identified from the systematic review and their relationships with smartphone addiction. Each of these outcomes was subjected to meta-analytical tests. The results of these tests are shown in table 2:

Table 2: Combine estimates for Smartphone addiction and behavioral outcomes

Behavioral Outcomes	n	Effect size and 95% interval			Heterogeneity		τ^2			
		$\bar{r}$	LLCI	ULCI	Q	p	I ²	τ^2	τ	
Aggression	1194	0.40	-0.18	0.77	48.81	< 0.001	95.90	0.06	0.33	
Anxiety	914	0.28	0.22	0.35	0.51	0.775	0.00	0.00	0.25	
Attention control	1090	-0.31	-0.68	0.18	30.85	< 0.001	93.52	0.04	0.00	
Depression	3103	0.26	0.20	0.31	18.22	0.033	50.61	0.00	0.21	
Impulsivity	756	-0.22	-0.88	0.72	5.93	0.015	83.13	0.01	0.06	
Loneliness	1718	0.26	-0.14	0.59	20.37	< 0.001	90.18	0.02	0.11	
Mental health	2490	0.34	0.23	0.44	64.71	< 0.001	86.09	0.03	0.14	
Self-control	2067	-0.34	-0.48	-0.18	23.82	< 0.001	83.21	0.01	0.16	
Self-efficacy	847	-0.14	-0.72	0.56	41.52	< 0.001	95.18	0.07	0.12	
Self-esteem	1713	-0.28	-0.43	-0.12	20.09	< 0.001	80.09	0.01	0.27	
Self-regulation	672	0.40	-0.99	1.00	43.18	< 0.001	97.68	0.13	0.11	
Stress	2928	0.35	0.19	0.49	64.20	< 0.001	92.21	0.03	0.36	
Withdrawal	910	0.16	-0.10	0.39	5.18	0.075	61.37	0.01	0.16	

Among the thirteen behavioral outcomes identified by the systematic review, smartphone addiction had a positive association with aggression ($\bar{r}=0.40$), loneliness ($\bar{r}=0.26$), self-regulation ($\bar{r}=0.40$) and withdrawal ($\bar{r}=0.16$), and a negative association with an attention control ($\bar{r}=-0.31$), impulsivity ($\bar{r}=-0.22$) and self-efficacy ($\bar{r}=-0.14$), though these associations are not significant. Whereas smartphone addiction had a significant relationship with six behavior outcomes identified by the review. A positive and significant relationship was found with anxiety ($\bar{r}=0.28$), depression ($\bar{r}=0.26$), mental health problems ($\bar{r}=0.34$), and stress ($\bar{r}=0.35$) while a significant negative relationship is reported with Self-esteem ($\bar{r}=-0.28$) and Self-control ($\bar{r}=-0.34$). Only three behavioral outcomes Anxiety (Q=0.51, p=0.775), Depression (Q=18.22, p=0.033), and Withdrawal (Q=5.18, p=0.075) exhibit that effect size from each study is homogeneous. Finally, the results have identified Anxiety and Depression as two major behavior outcomes in a South Korean context having a significant positive relationship with smartphone addiction, and the effect size across studies evaluating this relationship is homogenous.

DISCUSSION

The objective of this study was to evaluate the frequent coexistence of smartphone addiction with problematic behaviors, traits, and psychiatric comorbidities in South Korea. The systematic review identified thirteen behavioral outcomes (Aggression, Anxiety, Attention control, Depression Impulsivity, Loneliness, Mental health, Self-control, Self-efficacy, Self-esteem, Self-regulation, Stress, and Withdrawal) which are commonly associated with smartphone addiction. The subsequent meta-analysis of smartphone addiction and overall behavior outcomes proposed a significant and positive relationship confirming that smartphone addiction has a significant role in modifying the overall behavior of an individual. Dunbar, Proeve, and Roberts (2017) support the assertions from the dynamics of the self-regulation model (Fishbach, Zhang, & Koo, 2009) that smartphone addiction is a mental representational framework that has significant behavioral outcomes. Similarly, multiple meta-analyses have also

proposed a significant relationship between smartphone addictions and behavioral outcomes (Davey & Davey, 2014; Lee & Kang, 2015).

The behavior outcomes were then characterized based on the direction and significance of their relationship with smartphone addiction and the heterogeneity of their reported effects in table 3.

Table 3: Classification of behavioral outcome based on Direction, Significance, and Heterogeneity of their reported effects

Direction, Significance, and Heterogeneity	Behavioral outcomes
Positive, Insignificant, and Heterogeneous	Aggression, Loneliness, Self-Regulation
Positive, Insignificant, and Homogenous	Withdrawal
Negative, Insignificant, and Heterogeneous	Attention control, Impulsivity, Self-efficacy
Positive, Significant, and Heterogeneous	Mental Health Problems, Stress
Negative, Significant, and Heterogeneous	Self-esteem, Self-control
Positive, Significant, and Homogenous	Anxiety, Depression

Among the identified behavioral outcomes six outcomes have significant while seven have a non-significant association with smartphone addiction. Four behavior outcomes, which are aggression, loneliness, self-regulation, and withdrawal, have a positive yet insignificant relationship with smartphone addiction. For all these behavioral outcomes both negative and positive association have been presented by the researchers, for example, Kim et al. (2015) present a negative relationship between aggression and smartphone addiction, and similarly for self-regulation (Lee & Park, 2014; Yildiz, 2017) and withdrawal (Baek, Shin, & Shin, 2014; Huang & Leung, 2009). Insignificant relationships, on the other hand, are presented by studies with loneliness (Jeong, Kim, Yum, & Hwang, 2016; Ok, 2016). Furthermore, only for withdrawal, the reported effect sizes are significantly homogeneous across studies. Positive yet insignificant relationships were also reported between attention control, impulsivity, and self-efficacy with smartphone addiction. Similar to previous insignificant relationships, literature identified either inverse or insignificant relationship between these two sets of variables (Choi, 2015; Kwon & Paek, 2016; Lee & Park, 2014; Ryu, 2014; Sim, Lee, & Kim, 2016). The aforementioned relationship, though insignificant, provides an overview of what kind of behavior outcomes can be expected in a South Korean population.

The study also reports a significant relationship between smartphone addiction and some behavioral outcomes. The series of meta-analyses confirm the results of previous studies that smartphone addiction tends to worsen mental health problems (Jang & Kwag, 2015; Kang, 2016) and stress levels (Cho, Kim, & Park, 2017; Sim et al., 2016). Furthermore, it could also significantly decrease the level of self-esteem (Choi & Yoo, 2015; Yang, 2016) and self-control (Cho, 2014; Lee & Park, 2014). Most importantly this study has established a significant, homogenous, and positive relationship between Anxiety and Depression with smartphone addiction across multiple samples. Based on these results it can be stated that smartphone addiction has a significant tendency to cause anxiety and depression in South Korean populations.

LIMITATIONS

One of the limitations of this research is that there are a diverse number of terms, criteria, and constructs available that are similar to or related to smartphone addiction and due to the prudent attitude of the researchers towards its classification; in literature, the terms like smartphone addiction, problematic use, and smartphone abuse are almost always used indistinguishably and are scantily differentiated. This meta-analysis has made an effort to reduce this confusion and has tried to explain the diversity of prevalent data and enhance its comparability. Second, due to the diversity of terms, criteria, constructs, and lack of conceptual definitions, the studies included in this meta-analysis consist of diverse methodologies, employ convenience sampling techniques (thus resulting in limited sample size), and typically use samples from adolescents or students. In extension to the aforementioned limitation, the majority of studies included in this meta-analysis focus on the adolescent (69%) or student (86%) population. This may create problems in extending its results to the Korean population as a whole. It is hereby recommended that future researchers should first address the lack of studies in adult populations so that future meta-analyses could have better generalizability. Lastly, despite the diversity of methodologies, self-reporting has been the most frequently used methodology administered either through the mail, email, or phone in diverse environments and locations such as classes, institutions, organizations, cafes, or universities. Though the context of application influences the results of a study the current meta-analysis hasn't considered these effects. It is therefore recommended that future studies may use broad and randomized samples with a controlled context of administration to validate and control the reliability of the results.

CONCLUSION

In effect, whether or not a smartphone is an addiction, it does give rise to problems and affects behavioral outcomes. Without the risk of uncontrolled spending, free Wi-Fi, flats rate for cellular internet, as well as their unlimited use have enhanced its tendency to take the shape of an epidemic in South Korean society. Some researchers are even convinced that in the form of smartphone addiction we are facing an addiction unlike any other (De-Sola Gutiérrez et al., 2016). The current meta-analyses provided

empirical evidence that enhances our understanding of smartphone addiction in a technologically advanced South Korean society. The results confirmed that smartphone addiction increases mental health problems, depression, anxiety, and stress while lowers self-esteem and self-control. Particularity, depression, and anxiety were identified as the most significant outcomes of smartphone addiction with effect sizes homogenous across multiple studies. It is hereby emphasized that future research may be conducted on smartphone addiction within a global context for a better understanding of the construct.

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AUTHOR'S CONTRIBUTION

All authors of this research paper have directly participated in the planning and execution of this study. Dr. Asad Shahjehan, Dr. Sajjad Ahmad Afridi, and Dr. Maqsood Haider wrote the research paper and design the organization of this paper. Dr. Asad Shahjehan, Dr. Amjad Iqbal, and Dr. Shahab Aziz did the methodological part of this paper including; statistical analysis, interpretations, and technical parts.

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Annexure 1: Studies included in the Meta-analysis

Sr No	Citation	Sample Size	Behavioral Outcome	Type of Measure	Type of Respondents
1.	G.-Y. Cho and Kim (2014)	351	Aggression	Self-reported	High school students
2.	M.-o. Kim et al. (2015)	353	Aggression	Self-reported	College students
3.	Jeewon Lee et al. (2018)	490	Aggression	Self-reported	Middle school students
4.	S.-W. Choi et al. (2015)	463	Anxiety	Self-reported	College students
5.	Elhai, Levine, Dvorak, and Hall (2016)	322	Anxiety	Self-reported	Adults
6.	Kang (2016)	129	Anxiety	Self-reported	College students
7.	S. Cho and Lee (2015)	528	Attentional control	Self-reported	Nursing students
8.	D. Choi (2015)	269	Attentional control	Self-reported	College students
9.	Kwon and Paek (2016)	293	Attentional control	Self-reported	College students
10.	G.-Y. Cho and Kim (2014)	351	Depression	Self-reported	High school students
11.	S.-W. Choi et al. (2015)	463	Depression	Self-reported	College students
12.	Elhai et al. (2016)	322	Depression	Self-reported	Adults
13.	Joo (2013)	250	Depression	Self-reported	Elementary school children
14.	Kang (2016)	129	Depression	Self-reported	College students
15.	M.-o. Kim et al. (2015)	353	Depression	Self-reported	College students
16.	Kwon and Paek (2016)	293	Depression	Self-reported	College students
17.	Sim, Lee, and Kim (2016)	215	Depression	Self-reported	College students
18.	Yang (2016)	349	Depression	Self-reported	University students
19.	Yoo and Kim (2015)	378	Depression	Self-reported	College students
20.	M.-o. Kim et al. (2015)	353	Impulsivity	Self-reported	College students
21.	Y.-J. Lee and Park (2014)	403	Impulsivity	Self-reported	Adolescents

22.	S.-H. Jeong, Kim, Yum, and Hwang (2016)	944	Loneliness	Self-reported	School students
23.	Lim, Lee, and Han (2016)	224	Loneliness	Self-reported	College students
24.	Ok (2016)	550	Loneliness	Self-reported	Adults
25.	Baek, Shin, and Shin (2014)	132	Mental health	Self-reported	Adolescents
26.	H.-S. Choi, Lee, and Ha (2012)	227	Mental health	Self-reported	University students
27.	Im, Hwang, Choi, Seo, and Byun (2013)	114	Mental health	Self-reported	College students
28.	H.-J. Jang and Kwag (2015)	246	Mental health	Self-reported	Students
29.	Joo (2013)	250	Mental health	Self-reported	Elementary school children
30.	D. Kim, Lee, Lee, Nam, and Chung (2014)	795	Mental health	Self-reported	School students
31.	K.-H. Kim and Roh (2016)	220	Mental health	Self-reported	Middle school students
32.	B. Lee et al. (2013)	320	Mental health	Self-reported	University students
33.	Jeongmin Lee and Cho (2015)	93	Mental health	Self-reported	School students
34.	Jeongmin Lee and Cho (2015)	93	Mental health	Self-reported	School students
35.	M. Cho (2014)	342	Self-control	Self-reported	Nursing students
36.	H.-J. Jang and Kwag (2015)	246	Self-control	Self-reported	Students
37.	I. S. Jang and Park (2015)	242	Self-control	Self-reported	Students
38.	S.-H. Jeong et al. (2016)	944	Self-control	Self-reported	School students
39.	M. S. Kim and Sohn (2014)	293	Self-control	Self-reported	Nursing students
40.	Lim et al. (2016)	224	Self-efficacy	Self-reported	College students
41.	Ryu (2014)	408	Self-efficacy	Self-reported	University students
42.	Sim et al. (2016)	215	Self-efficacy	Self-reported	College students
43.	G.-Y. Cho and Kim (2014)	351	Self-esteem	Self-reported	High school students
44.	H. J. Choi and Yoo (2015)	299	Self-esteem	Self-reported	College students
45.	Jeewon Lee et al. (2018)	490	Self-esteem	Self-reported	Middle school students
46.	Lim et al. (2016)	224	Self-esteem	Self-reported	College students
47.	Yang (2016)	349	Self-esteem	Self-reported	University students
48.	D. Choi (2015)	269	Self-regulation	Self-reported	College students
49.	Y.-J. Lee and Park (2014)	403	Self-regulation	Self-reported	Adolescents
50.	Ahn and Kim (2015)	723	Stress	Self-reported	Nursing students
51.	H. Jeong and Lee (2015)	598	Stress	Self-reported	Nursing students
52.	S.-H. Jeong et al. (2016)	944	Stress	Self-reported	School students
53.	Lim et al. (2016)	224	Stress	Self-reported	College students
54.	Lim et al. (2016)	224	Stress	Self-reported	College students
55.	Sim et al. (2016)	215	Stress	Self-reported	College students
56.	Baek et al. (2014)	156	Withdrawal	Self-reported	Adolescents
57.	G.-Y. Cho and Kim (2014)	351	Withdrawal	Self-reported	High school students
58.	Y.-J. Lee and Park (2014)	403	Withdrawal	Self-reported	Adolescents