A META-ANALYSIS OF SMARTPHONE ADDITION AND BEHAVIORAL OUTCOMES

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ABSTRACT

Though smartphones have become the icon of the 21st century, they are possibly the biggest source of non-drug addiction. The purpose of this meta-analysis was to identify behavioral outcomes associated with smartphone addiction, and to evaluate their overall and individual relationships with smartphone addiction. This meta-analysis conducted a preliminary review of 6115 studies which investigated the relationships between smartphone addiction and behavioral outcomes. Fifty-three studies fulfilled the inclusion criteria developed for this study and their review identified thirteen behavioral outcomes of smartphone addiction. Meta-analytical tests confirmed a positive and significant relationship between smartphone addition

and overall behavioral outcome. However, the combined effects were significantly heterogeneous and this could be attributed to the diverse nature of behavioral outcomes, dispersion of studies across the globe, and varying demographics of samples. The results showed the prevalence of the following eight behavioral outcomes: anxiety, depression, loneliness, mental health, self-control, self-regulation, stress; and withdrawal that had a significant and positive relationship with smartphone addiction, while only self-esteem had a significant and negative relationship with smartphone addiction. Finally, depression was identified as the behavioral outcome that has a significant and positive relationship with smartphone addiction irrespective of global geographic and demographic variations. This article has elaborated on smartphone addiction criteria similar to that established for researches in substance abuse and addiction. Furthermore, the study has been able to demonstrate that smartphone addiction and its problematic use has become an emerging problem with grave consequences.

Keywords: Smartphone addiction, meta-analysis, systematic review, behavioral outcomes.

INTRODUCTION

The rapid rise in the use of smartphones has resulted in significant changes in the behavioral patterns of its users, so much so that experts are worried about its negative impact on user behaviors. Smartphone addiction can be categorized more as behavior addiction. However, this categorization of use and misuse of smartphones as addiction, rather than as a disorder of impulse, needs much more study (Ryding & Kaye, 2018). In the past, smartphone researches have been categorized as behavior addiction studies on videogames (Griffiths et al., 2012), exercise (Berczik et al., 2012), food (Rogers & Smit, 2000), work (Burke, 2006), shopping (Sohn & Choi, 2014), and use of the internet (Beard & Wolf, 2001). Behavior addiction has been defined as the undesirable or damaging consequences of the behavior occurring simultaneously with the physical and/or psychological satisfaction from the said behavior (Billieux et al., 2015). However, there is a difference between substance addiction and behavioral addiction. In substance addiction, the effect of the use of the substance on changes/interferences in daily life can be more easily observed.

However, in behavioral addiction it is difficult to identify whether it is the behavior or personality traits that result in problematic behavior patterns (Ibrahim et al., 2020). In either case, the basic biological process of repetition of addictive dopamine-releasing behaviors is the same, for example as in eating, shopping, and gambling etc.

With the advent of technology, new addictive behaviors have emerged such as that relating to the internet, videogames, and now smartphones. Young (2004) identified the following five addictive forms of behavior relating to the use of the internet: the use of the computer itself, the ever-increasing need to search for information, the compulsive need for interacting with people, playing games online and online shopping, browsing sexual content, and establishing online contacts/relationships. Smartphone use has augmented these potentially addictive behaviors related to the internet. In this study, the issue of whether these behavioral addictions become manifest either due to the smartphone itself or through its content will be examined. In either case it is clear that the use of a smartphone can lead to problematic behavior patterns. With its greater range of contents and uses, the smartphone has enabled its users access to unlimited online content compared to regular cellphones, thus drastically increasing its potential for abuse (Taneja, 2014).

Generally, addiction is the lack of control in the use of substances, along with mood alterations and the lack of abstinence. There was also the accompanying tendency to relapse, thus resulting in personal harm and/or conflicts (Brown,1993 & Griffiths, 2005). Similarly, according to Sussman and Sussman (2011), addiction was the tendency to compulsively repeat behaviors with high positive reinforcements and there would be a lack of control over such behavior despite its negative consequences. Moreover, it has become evident that such repeated behaviors and loss of control were often accompanied by a progressive increase in time, and the end result being extreme daily life interference. Another defining characteristic of addiction was the irritability and psychological distress resulting from disruption of the said behavior or abstinence from it. A notable study by Mok (2014) documented the defining elements of behavioral addictions, such as the loss of control, the establishment of a dependent relationship, tolerance, the need for progressively more time dedication, and a severe interference with daily life.

Shambare et al. (2012) were of the view that smartphone addiction had become one of the greatest addictions of the current century. Their conclusions were based on the criteria developed by Hooper and Zhou (2007), O'Guinn and Faber (1989), and Hanley and Wilhelm (1992). They highlighted six types of addiction behavior, namely habitual (habits performed with little mental awareness), mandatory (officially required or parentally mandated), voluntary (reasoned and conducted for specific motivations), dependent (motivated by the attached importance of social norms), compulsive (strong urge to continuously perform the behavior), and addictive, or behavior defined by the user's progressive exclusion of other activities, causing physical, mental, and social harm. In conclusion, unwarranted fascination towards and unrestrained usage of the smartphone is an addiction. Recently, research on the internet, videogames, and smartphone use has increased resulting in a notable increase in the body of literature on the subject matter.

With the increase in the body of knowledge on smartphone usage, there has also been a concomitant increase in the effort of researchers to explain the dynamics of smartphone addiction. The objective of the meta-analysis in this present study was to identify the behavioral consequences of smartphone addiction based on the theoretical considerations highlighted and discussed in the literature. The focus of the meta-analysis was on examining the phenomenon of smartphone addiction and its behavioral outcomes.

LITERATURE REVIEW

Smartphone Addiction and Behavioral Outcomes

The number of mobile phone users all over the world is expected to exceed five billion by 2019. The number of mobile phones in 2018 was 2.53 billion and was expected to reach 2.87 billion by 2020. The rise in new pathologies such as Nomophobia "No-Mobile- Phobia" (Bychkov & Young, 2018), "Fear Of Missing Out" (FOMO) (Wolniewicz et al., 2018), Textiety, Textaphrenia (Verma et al., 2014), and Ringxiety (Kruger & Djerf, 2016) might be attributed to the exponential increase in smartphone usage. In addition to the increase in psychological problems, the increase in smartphone use might give rise to physical problems such as muscle pain and stiffness (Lee et al., 2015; So & Woo, 2014), ocular issues (Kim et al., 2016), auditory illusions (Tanis et al., 2015), and ergonomic issues related to wrists and thumbs (İNal et al., 2015; Xie et al., 2018)

Problematic smartphone use has also led to other negative behavior patterns as well, such as the intentional use of smartphones in dangerous and/or prohibited situations. The looming social crisis can already be seen in such undesirable behavioral outcomes as texting while driving, or being engrossed in using the phone instead of engaging with family members during family time, or interacting with others in other social situations (Atwood et al., 2018; Rozgonjuk & Elhai, 2018). Preferring smartphone use to personal contact has become another problematic manifestation of its use (Panova & Carbonell, 2018). There is also another related health problem, excessive use could lead to issues with insomnia. For such obsessive users, problems arise not only from the use of smartphones, but also its abstinence; the latter will give rise to issues such as irritability, mood swings (Hussain et al., 2017), unease when unable to view messages, feeling lost without a smartphone (Cheever et al., 2014; Fullwood et al., 2017), and feeling lonely or anxious when not being able to send messages or receive a response (Aktürk et al., 2018). These psychological issues often lead to more mental stress or mood changes (Samaha & Hawi, 2016).

Researchers have distinguished between the addictive versus the non-addictive use of a smartphone by highlighting that non-addictive users might spend a similar amount of time using a smartphone as addictive users, but their smartphone usage time was constant, less scattered, and more focused (Tossell et al., 2015a). On the other hand, the addictive users, who use smartphones compulsively showed just the opposite behavior manifestations. Therefore, researchers in the field of addiction advocated differentiating addictive behavior from other similar patterns of misuse, abuse, and dependence (Sansone & Sansone, 2013), as the lines between these patterns were currently not clear.

Based on this understanding, Tossell et al. (2015b) state that such behaviors can be explained through the time-inconsistent preferences and automaticity theories. The automaticity theory posits that peoples unconscious actions can be classified into three categories a) actions that occur when subjects are in an unconscious state or have no conscious process before its transpiration; b) actions that are influenced by stimuli outside the awareness of the subject and finally c) actions prompted by consciously experienced stimuli that influence consciously-mediated responses that the subject is unaware of (Morsella & Bargh, 2011). Smartphone addiction, thus comes

under the second and third categories of unconscious behaviors that a subject performs. Similarly, the time-inconsistent choice theory states that consumers are not primarily rational rather the choices represent a transient alteration in tastes which is not a reevaluation of an alternative due to receipt of new information (Hoch & Loewenstein, 1991).

On the other hand, some argue that smartphone addiction can be evaluated by drawing parallels with the established generic addiction profiles. Substance addiction and behavior addiction are catalyzed by certain characteristics such as low self-esteem, difficulty in dealing with conflicts, impulsive behavior, seeking sensation, pain intolerance, sadness, or depressive tendencies (Kwon et al., 2013). Therefore pathological behavior theories are also used to explain smartphone addiction (Elhai et al., 2017). For example, the incentive sensitization theory Robinson and Berridge (2008) postulates that addiction develops as a process of mood enhancement where individuals initially enjoy and later crave for the positive aspects of the compulsory behavior. In the case of smartphone addiction, such addictive behavior may become part of positive reinforcement. For example, notification checking may start as positive reinforcement, but later individuals experience negative moods when not engaging in the behavior (i.e., withdrawal). Therefore, keeping in view the general profile of smartphone addiction, symptoms, predicaments, and correspondence with substance addiction, it is important to explain its frequent coexistence with problematic behaviors, traits, and psychiatric comorbidities which is the purpose of this meta-analysis.

Similar to the pathological theories, the causal theories of internet addiction provide models have also been used to understand smartphone addiction (Elhai et al., 2017). Various broad pathways have been discussed in the literature in this regard. For example, problematic smartphone behavior through habit arises from features such as notification alerts as cues for automatic checking of ones' phone. Similarly, such phone checking may also lead towards seeking reassurance from family and friends. This might occur as a response to low self-esteem, anxiety, and depression (Billieux et al., 2015). This seeking reassurance also highlights another pathway where the consumer fears missing out on new information. This might include social information. People with a fear of missing out (FOMO) need to know what others in his/her network are doing. Research reveals

that along with other technology FOMO also used to the overuse of smartphones as well (Clayton et al., 2015). Keeping in view the general profile of smartphone addiction, symptoms, predicaments, and correspondence with substance addiction, it is important to explain its frequent coexistence with problematic behaviors, traits, and psychiatric comorbidities, which is the purpose of this meta-analysis.

METHODOLOGY

Literature Search

A comprehensive literature search to gather published and unpublished studies from multiple sources in Korean and the English language related to smartphone and behavioral outcomes was conducted in this study. This literature search was a three-step process. In the first step, a general search using *Google Scholar* with the keywords "smartphone" and "addiction" was conducted and this resulted in a discovery of almost unlimited sources. As the keywords used in the first google scholar search were generic, it was changed to the phrase "Smartphone Addiction" which identified 6104 sources. The sources were evaluated based on the scope of the study, which was to examine the nature of the effects of "smartphone addiction" on various behavioral outcomes. Some filtering was carried out by removing studies having terms like *'cellphone addiction', 'internet addiction', 'social network sites addiction', 'Facebook addiction',* and *'videogames addiction'*. This additional screening step identified 398 sources that were deemed suitable for further analysis.

In the second step of the literature search, identical scope of the study and removal of the similar term were used. However, in this step, major publisher databases i.e. *Elsevier, JSTOR, Springerlink, Taylor & Francis Journals, Wiley-Blackwell Journals, Emerald, Informs),* and the *ISI Web of Knowledge* were searched for the key phrase "smartphone addiction". The search settings in these databases were slightly modified which were previously appearance of the keyword "smartphone addiction" anywhere in the source, to the presence of the keyword phrase in the title/abstract/keywords of the sources. The identified sources from the second step were compared to the results of the search in the first step to remove sources previously assessed both

for scope and similar terms and this resulted in 11 unique sources. In the final step, key research articles and books on smartphone addiction were also evaluated for unique sources, however no new source was identified.
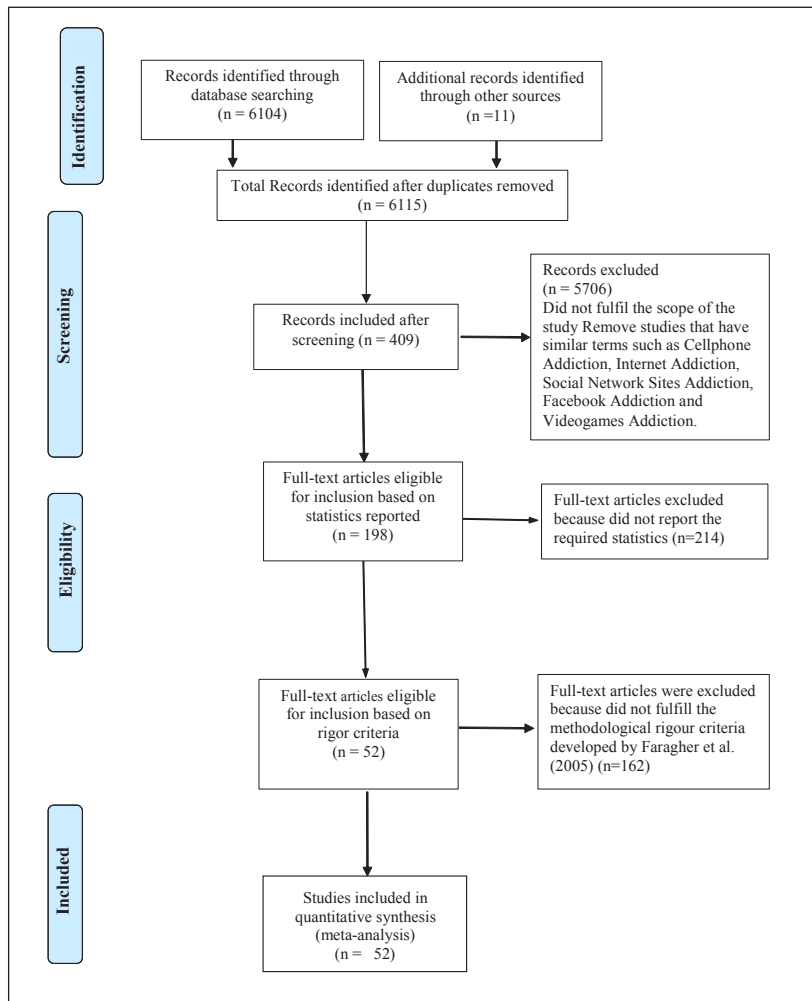
Inclusion Criteria

Subsequent to the literature search, the remaining 409 sources were evaluated for appropriateness of content and a decision for inclusion in the meta-analysis was made. There were four criteria in the selection for inclusion. First, those studies that analyzed the relationship between behavioral outcomes that came under the behavioral outcomes categories identified by Shambare et al. (2012) and smartphone addiction. Second, the data presented in the studies should be primary data. Third, the sources provide information about correlations between the variables, sample size, and the Cronbach reliability. The fourth criteria was whether these studies fulfilled the quality standard under the methodological rigor criteria developed by Faragher et al. (2005) for organizational psychology research. There were 10 aspects of methodological rigor and they were as follows:

1. Representative sample.
2. Sample stratified for gender, age, level of seniority, ethnic origin, or degree level.
3. Summary statistics for gender, degree level, occupation, industry, country, age.
4. Adequate response rate.
5. Acceptable sample size.
6. Acceptable smartphone addiction and behavioral outcome measures (that is, validated, reliable, internally consistent, and either continuous or ordinal).
7. Usable effect size statistics reported (or obtainable from authors).
8. Appropriate statistical analysis of study findings.
9. Adjustments made for important confounding factors.
10. Adequate attrition rate (if longitudinal design used).

Each study was rated according to these criteria (0 = unacceptable; 1 = acceptable) and a summated 'rigor' score was computed (range 0–10). Studies that had a methodological rigor rating of more than 6 assigned by the research team were retained for analysis.

Figure 1

Flowchart of Inclusion and Selection Criteria of Studies in the Meta-Analyses

Based on the inclusion criteria, 195 studies reported the required statistics. These 195 sources were evaluated based on the methodological rigor standards and 52 studies were identified for inclusion in the meta-analyses. To evaluate the degree to which the research team provided consistent methodological rigor estimates for the studies the intraclass correlation coefficient was calculated and

this was 0.715 (LBCI=0.543, UBCI 0.807) with p < 0.001 displaying acceptable inter-rater reliability. The selected studies provided data from 53 samples, with a total of 21,755 subjects and 93 correlation values between smartphone addiction and behavioral outcomes. Based on regional research sites, 78.5 percent of the studies were conducted in Asia, 16.1 percent in Europe, 3.2 percent in the USA, and 2.2 percent in Australia.

Meta-Analysis Procedures

The Schmidt–Hunter's psychometric meta-analysis method (Hunter & Schmidt, 1990) was used in this study. The correlation reported from individual samples was corrected for measurement error by employing the Schmidt and Hunter correction formula, that is by adjusting the correlations for the reliability of measure where reported and otherwise using norm value of reliability from published material. The corrected correlation values for each meta-analysis were analyzed through the meta-analysis software "Meta-Essentials" spreadsheets. To evaluate the level of dispersion among the reported results of the studies heterogeneity of the effect sizes is also presented. Q statistic and I-squared helped decide the level of heterogeneity in the studies, while τ (tau) presents the variance of dispersion and τ^2 (tau-squared) presents the standard deviation of dispersion (DeCoster, 2000). Funnel plot analysis proposed by (Duval & Tweedie (2000a; 2000b) which assumed 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.
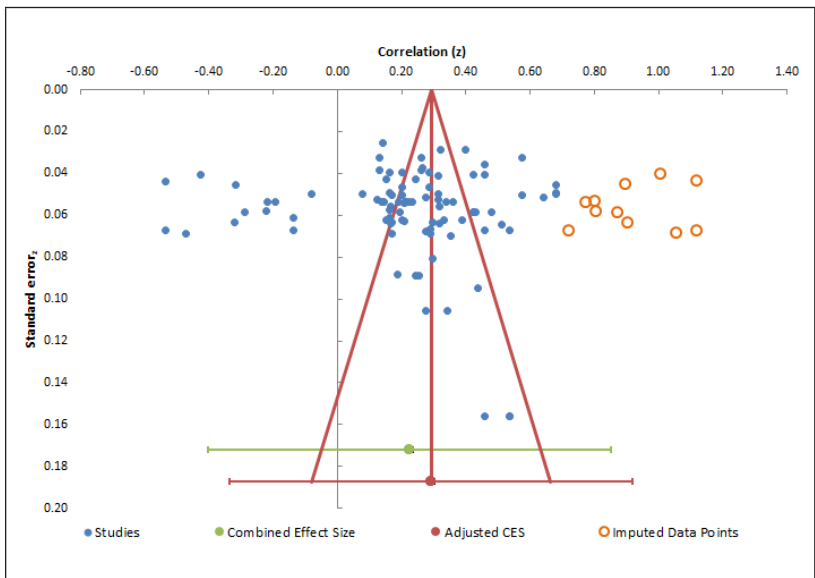
RESULTS

The sources included in the meta-analyses, which was based on the study inclusion criteria are presented in the supplementary material. A series of meta-analyses were performed on the statistics extracted from sources to generate combined estimates and the respective strengths of the reported source estimates. Funnel plot analysis was used to evaluate possible publication bias. It could be noticed from the funnel plot in Figure 2 that the observed effect sizes were symmetrically distributed around the combined effect size. Furthermore, the Trim-and-Fill method had imputed eleven studies on the right 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 were far from the null than closer to it. As the assumptions of funnel plot analyses were confirmed, it indicated that there were insignificant publication biases.

Figure 2

Funnel Plot for Publication Bias

The results of the meta-analytical tests on corrected correlation values between smartphone addiction and behavioral outcomes are as follows:

Table 1

Combined Estimates

Model		Effect size and 95% interval			Test of null (2-Tail)		Heterogeneity			τ^2	
	N	ř	LLCI	ULCI	Z	p	Q	p	I^2	τ^2	τ
Random effects	21755	0.214	0.163	0.263	8.24	<0.001	2637.25	<0.001	0.961	0.06	0.25

The systematic literature review carried out in this study seemed to suggest that there could exist a positive and significant relationship between smartphone addiction and behavioral outcomes. The results shown in Table 1 has confirmed this positive relationship with ř = 0.214. According to Cohen et al. (2003) this could be regarded as a strong relationship between the two meta-analytical constructs. The relationship was also significant with LLCI = 0.163 & ULCI = 0.263, Z = 8.24, p < 0.001. Heterogeneity statistics for the reported correlations are as presented in Table 1. Q statistic for this meta-analysis was 2637.25 at p < 0.001 exhibiting that the effect size from each study was significantly heterogeneous from each other. Moreover, I^2 = 0.961 indicating that 96.1 percent of the observed variance reflected real differences in the studies. Lastly, τ = 0.25 reflected the dispersion of the random effects and τ^2 = 0.06 was the standard deviation of this dispersion. From the meta-analytical statistics, it can be deduced that across the globe, smartphone addiction significantly influenced the overall behaviors of an individual. However, these results were significantly heterogeneous which could be attributed to the diverse nature of behavioral outcomes.

The systematic review conducted in this study identified 13 behavioral outcomes, and these were as follows: aggression, anxiety, attentional control, depression, impulsivity, loneliness, mental health, self-control, self-efficacy, self-esteem, self-regulation, stress, and withdrawal. These behavioral outcomes have been commonly studied in association with smartphone addiction. Each behavioral outcome was subjected to meta-analytical tests. The results of these multiple meta-analyses are as depicted in Table 2.

The relationship between smartphone addiction and individual behavioral outcomes was evaluated based on the direction, significance, and heterogeneity of the reported effects. The meta-analysis statistics showed a positive relationship between smartphone addiction and the following behavioral outcomes, namely aggression (ř=0.396), anxiety (ř=0.257), depression (ř=0.254), impulsivity (ř=0.185), loneliness (ř=0.315), mental health (ř=0.295), self-control (ř=0.372), self-regulation (ř=0.342), stress (ř=0.279) and withdrawal (ř=0.264). However, the positive associations of aggression (LLCI=-0.177 & ULCI=0.769) and impulsivity (LLCI=-0.092 & ULCI=0.435) with smartphone addiction were not significant.

Table 2

Combined Estimates for Smartphone Addiction and Behavioral Outcomes

Subgroup nameed	ř	LLCI	ULCI	Weight	Q	P_Q	I^2	τ^2	T	N
Aggression	0.396	-0.177	0.769	0.056	48.810	0.000	0.959	0.060	0.245	1194
Anxiety	0.257	0.184	0.327	0.087	32.775	0.000	0.725	0.007	0.085	3247
Attentional control	-0.313	-0.678	0.177	0.063	30.848	0.000	0.935	0.042	0.206	1090
Depression	0.254	0.210	0.298	0.089	21.814	0.040	0.450	0.002	0.050	4469
Impulsivity	0.185	-0.092	0.435	0.079	10.158	0.006	0.803	0.010	0.102	756
Loneliness	0.315	0.028	0.554	0.066	104.267	0.000	0.962	0.054	0.232	2499
Mental health	0.295	0.214	0.372	0.085	216.698	0.000	0.903	0.026	0.161	6747
Self-control	0.372	0.229	0.500	0.080	45.716	0.000	0.891	0.021	0.147	2467
Self-efficacy	-0.271	-0.532	0.037	0.069	40.967	0.000	0.927	0.037	0.194	1461
Self-esteem	-0.289	-0.405	-0.164	0.082	40.578	0.000	0.827	0.016	0.126	1713
Self-regulation	0.342	0.199	0.470	0.079	110.992	0.000	0.928	0.038	0.195	3112
Stress	0.279	0.183	0.370	0.084	146.730	0.000	0.932	0.027	0.165	5897
Withdrawal	0.264	0.131	0.388	0.082	66.673	0.000	0.910	0.024	0.156	1940

The results also reported a negative association of attentional control (ř=-0.313), self-efficacy (ř=-0.271), and self-esteem (ř=-0.289) with smartphone addiction. However, among these three behavioral outcomes, only self-esteem had a significant and negative relationship (LLCI= -0.289 & ULCI= -0.405) with smartphone addiction.

Finally, among the 13 behavioral outcomes, the results from 12 were significantly heterogeneous across multiple samples. The meta-analysis has identified depression as the only behavioral outcome that a positive relationship was significant and homogenous (Q=21.814, p=0.04) across multiple samples. The Q statistic reported for this relationship was not significant at p>0.01.

In summary, the multiple meta-analyses have confirmed that smartphone addiction significantly influenced the majority of behavioral outcomes either positively or negatively. However, it also showed that the majority of the reported significant associations was heterogeneous, an outcome which could be attributed to the samples from different geographical parts of the world and various types of subjects. Finally, the most important result provided by these meta-analyses was the identification of depression as a behavioral outcome that has been homogenously and positively affected by smartphone addiction, regardless of geographical areas and types of subjects.

DISCUSSIONS

The aim of this meta-analysis was, first to identify major behavioral outcomes that were normally associated with smartphone addiction, second to evaluate the relationship of the smartphone addiction with overall behavioral outcomes, and finally to assess the relationship between smartphone addiction and each of behavioral outcomes identified.

The systematic review carried out in this study identified thirteen behavioral outcomes that were normally associated with smartphone addiction. Smartphone addiction has a positive and significant relationship with overall behavioral outcomes. However, the results also showed that these effects were significantly heterogeneous across the studies reviewed. The reason for the heterogeneity of combined

effect size was, first because of the diverse nature of behavioral outcome. There were adjusted correlations ranging between -0.49 to 0.62, including insignificant values. Second, the study has taken a global perspective by reporting statistics from samples taken from different countries such as Australia, China, Italy, Japan, Korea, Lebanon, Norway, Taiwan, Turkey, England and USA. Lasty, demographically there were major differences among the samples which has also contributed towards the heterogeneity of the results. Meta-analytical tests were also performed to evaluate the smartphone addiction relationship with each of the identified behavioral outcomes. Results reported in this study have shown that smartphone addiction has the tendency to increase anxiety, depression, loneliness, mental health, self-control, self-regulation, stress, and withdrawal among individuals in the global sample. The results also showed a significant negative relationship between smartphone addiction and self-esteem. From these findings, it can be deduced that globally, subjects with established or the propensity for smartphone addiction will display low levels of self-esteem.

This study has for the first-time established depression as a behavioral outcome of smartphone addiction. The effects were significant and homogenous across multiple samples. This finding has provided further corroborating empirical evidence in support of the results of previous studies (Steers et al., 2014) that have used causal theory to state a strong correlation between these constructs. Smartphone addiction can increase depression irrespective of one's geographic location, contextualization, and demographics. Furthermore, as the results present smartphone addiction as one of the potential causes of depression in today's networked mobile using world, future researchers must focus on this relationship. Smartphone addiction as this study has revealed is prevalent in many populations across the globe. However, identifying and measuring the phenomenon is affected by diverse factors like demographics, cultures, research methodologies, and assessment procedures. However, there is some consensus that smartphone addiction can result in harmful behavior, especially depression.

The results of this study have shown that smartphone addiction may be responsible for some undesirable behaviors and adverse effects on society. Most importantly, smartphone addiction does lead to depression and thus, measures should be adopted to restrict the

overuse of smartphones among people. The policymakers should frame effective policies to guide smartphone usage and prevent its abuse, overuse and misuse. Furthermore, policymakers should also think of regulatory censorship on some undesirable smartphone applications, however this form of intervention should best be based on users' own self-control and disciplined behavior. The relevant authorities should also conduct further studies on the applicability, viability, and feasibility of the self-control factor in smartphone usage. Such an effort can perhaps provide solutions in helping to curtail the negative, but enhance the positive effects of smartphone usage.

CONCLUSION AND IMPLICATIONS

This article has elaborated on smartphone addiction criteria similar to that established in researches on substance abuse and addiction. Furthermore, this article also established that smartphone addiction and its problematic use have become an emerging problem with severe consequences. It also asserted that although this emerging issue was linked to technological development, scant research in the area has resulted in a lack of uniform, well-articulated, and established standards for researching it. Thus, the present study has but to advocate cautious acceptance and application of the conclusions drawn.

In addition to the lack of established criteria in the field of concern in this study, the diversified terms (and their usage) could be seen as acting as hindrances to conducting research in this area. This has led to some degree of speculation on the part of researchers and thus, their somewhat diverse findings: some advocating that the resulting addiction from smartphone abuse was dissimilar to any other, while others were drawing parallels with and classifying it as similar to other behavioral and substance addictions. This has added to the confusion in the field, resulting from divergent data gathered using disparate methodologies. It became an arduous task to compare results from different studies.

Regardless of whether smartphone addiction is similar or dissimilar to other addictions, this addiction does culminate in behavioral issues affecting the quality of one's daily life. This has a strong implication for theory and is aligned with the results of previous studies (Steers et al., 2014) that have used causal theory to state a strong correlation

between these constructs. Therefore, support for causal theories was identified through this study. Previous studies have suggested, amongst other causes, pathological theories as being able to account for smartphone addiction. The present study by proposing that depression was an outcome of smartphone addiction has subscribed to the causal theory perspective on smartphone addiction literature. The evidence from all over the world seemed to suggest that smartphone addiction could increase depression irrespective of one's geographic location, contextualization, and demographics. Furthermore, as the results have made the link that smartphone addiction was one of the potential causes of depression in today's global perspective, future researchers must focus on determining the strength of this causal relationship. The dominance of theories providing causal explanations was also evident in the relationship found between self-esteem and smartphone addiction. Furthermore, based on the similarity of behavioral patterns observed, employing the same criteria of addiction, one could be led to drawing strong parallels between smartphone addiction and substance addiction. It is advocated here that there is a need for the standardized conceptualization of the relevant terms found in the current research area of concern.

On the practical level, the present research has been able to provide valuable insights to counsellors and other mental health professionals who want to counter the negative behavioral effects of smartphone addiction. This can be done by helping them to recognize depression as an outcome and low self-esteem as a strong correlate. Therefore, managers can use self-esteem as a predictor of smartphone addiction to segment consumers. Such segmentation can be useful in developing communication and product development strategies. Additionally, the field could also benefit from drawing limitations and establish boundaries between abuse and addiction in both these areas. Similarly, studies on smartphone addiction have largely dedicated themselves to researching the phenomenon in students and/or youth populations. These vulnerable groups are experiencing a transitional period in their lives which could be characterized as being impulsive, and swayed by exploratory and sensation-seeking behaviors. Thus, findings on smartphone addictions cannot be generalized to the adult population at large.

As for the methodological prowess of the field, it has little to boast of. The most frequently used method is the self-reporting instrument with all its advantages and disadvantages entailed. As it is known that

the context of the study influences its results, it makes sense therefore, to diversify the context of the studies, such as broadening the study target populations and with better sampling options. It is also a known fact that the context of the application influences a study's results. Also, longitudinal studies in this area are lacking, as well as suffering from the insufficient sample size. Additionally, there is a need for establishing strong identifiers for profiling smartphone users. These can include socioeconomic status/conditions, parenting, and social circles. Other important factors could be cultural and geographic differences, institutional effects, facilities available (e.g. bandwidth availability in different regions of the world), and technological advancement, etc.

In short, much work and effort are still needed for the field to progress further, more specifically in establishing the concepts, criteria, and methodologies that should be developed. Furthermore, there is a pressing need to broaden the scope of the target population for study, mainly to include the adult population, as well as samples from diversified populations in terms of differences in culture, economic status, and technological savviness. Doing this will ensure obtaining a broader view of the issues and challenges in the field and be in a better position to generalize the findings of the research on the use and abuse of smartphones.

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