

Smartphone Addiction: A Narrative Review

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Abstract

In recent literature on smartphone addiction, the prevalence has widely varied from 26% in females from Saudi Arabia to 84% mild smartphone addiction in medical students. It has had several negative effects including related problems like nomophobia (fear of losing your phone), mind wandering, ringing in the ears, myofascial trigger points, upper extremity pain, and decreased physical activity as well as comorbidities like depression and sleep disorders. The risk factors include fear of missing out, phubbing (phone snubbing), anxiety, depression, alexithymia, extroverted/neurotic personality, lack of self-esteem, lack of social support, work conflict, burnout and negative life events. Although interventions have not appeared in this literature, a couple buffers have been suggested. They include self-control and sense of security and increased physical activity which reduces stress and, in turn, reduces smartphone addiction. The literature, however, has been primarily based on samples of university and medical students, suggesting limited generalizability of the findings.

1. Introduction

Smartphone addiction is prevalent on average in 35% of the population worldwide. The prevalence of smartphone addiction is not surprising given that 6,567 billion people had smartphones in 2021 (Garcia et al, 2023). This prevalence is expected to increase to 7,690 billion by 2027. Half of the people with smartphones in the U.S. reported using them at least 5 to 6 hours per day on average.

Smartphone addiction has also been referred to as mobile phone addiction which has been measured by a scale called the Mobile Phone Addiction Type Scale (MAATS). This scale was developed on 1600 young adults and includes 26 items [1]. The items have been factor-analyzed and that analysis yielded 4 factors including mobile social networking addiction, mobile game addiction, mobile information acquisition addiction and mobile short-form video addiction.

Smartphone/mobile phone addiction has many negative effects. For example, social media addiction has resulted as well as poor job performance. Emotions have also been negatively affected including feelings of rejection in children, poor romantic relationships in young adults, poor life satisfaction, negative affect that can lead to psychological distress which, in turn, can lead to severe depression. Despite the prevalence and severity of these

problems, there is very limited research on smartphone addiction and although there are a couple buffers noted in the literature, no interventions could be found on reducing smartphone addiction and its negative effects. The purpose of this paper is to summarize the research on the negative effects of smartphone addiction and the risk factors for smartphone addiction that can inform future research and interventions.

2. Methodology

This narrative review summarizes 40 papers on smartphone addiction in adults that were derived from a search on PubMed and PsycINFO entering the terms smartphone addiction, mobile phone addiction and the years 2019-2024. Exclusion criteria for this review included papers on proposed protocols, case studies, and non-English language papers. The publications can be categorized as the negative effects of smartphone addiction in adults and predictors/risks factors for smartphone addiction. This review is accordingly divided into sections that correspond to those categories. Although some papers can be grouped in more than one category, 5 papers are included on the prevalence of smartphone addiction, 18 papers on the negative effects of smartphone addiction in adults, 16 papers on predictors/ risk factors for smartphone addiction and 2 papers on buffers for smartphone addiction. These sections are followed by a discussion on the methodological limitations of this literature.

3. Prevalence of Smartphone Addiction

The prevalence of smartphone addiction has widely ranged from 26% in females from Saudi Arabia to 84% mild smartphone addiction in medical students (see table 1) [2,3]. Otherwise, the

prevalence has been similar across countries from 34% in Rhode Island to 30% in China to 35% in Turkey and 42% in males in Saudi Arabia [1,4-6].

<u>Prevalence</u>	<u>First authors</u>
China-30%	Wang
Rhode Island-34%	Noel
Turkey-35%	Yagci Senturk
Saudi Arabia-females 26%, males 42%	Aftab
Medical students- 3% for severe and 84% for mild addiction	Nahidi

Table 1: Prevalence of Smartphone Addiction (and First Authors)

In the three countries that are similar on prevalence (averaging 33%), the samples have varied on negative effects and risk factors. In the sample from Turkey (N= 1000 young adults 18–45 years old), 86% were using smartphones for more than three years, and 77% were using them more than four hours per day [6]. The risk of smartphone addiction was greater in females, those who used them more than three years and more than four hours a day, and those with a sedentary lifestyle. In the Rhode Island sample, smartphone addiction was highly correlated with depression, anxiety, and suicide ideation [4]. In the sample on students in China (N=18,723 students from six universities), 11% expressed suicidal ideation and 2% made suicide attempts [5].

In the research from Saudi Arabia that distinguished the different prevalence rates for males and females, 42% of males had mobile phone addiction and 26% of females had that addiction [2]. In this sample, smartphone addiction was correlated with obesity, hypertension, and poor sleep quality. As many as 36% had smartphone addiction, and as many as 36% had hypertension.

Medical students have shown extreme prevalence rates including

3% of one sample (N= 355) who had severe mobile phone addiction while as many as 84% had mild mobile phone addiction [3]. Mobile phone addiction in this sample was also related to anxiety, depression, and sleep quality disorder, but only in those with severe mobile phone addiction.

4. Negative Effects of Smartphone Addiction

Smartphone addiction has been related to several other problems (see table 2). Different research groups have focused on different negative effects, likely depending on the different interests or concerns of the researchers. Most of the studies have involved mediation/moderation data analyses which depend on the researchers' theories. The mediators are selected by the researchers who predict an indirect effect of smartphone addiction on the negative effect that is mediated by another negative problem. The moderators that are selected, for example, loneliness and sleep problems, are often negative problems that typically increase or exacerbate the relationship between smartphone addiction and its negative effects. The selection of these may be considered arbitrary, just as the selection of the negative effects are related to the researchers' theories, interests and/or concerns.

<u>Negative Effects</u>	<u>First author</u>
<u>Smartphone related effects</u>	
Nomophobia	Cobanoglu
Mind wandering	Lian
<u>Negative Emotions</u>	
Lack of well-being	Su
Depression	Zhang, Shi, Ivanova, Feng
Suicidal ideation	Hu
Sleep problems	Chatterjee, Nahidi, Gong, Tian, Zhang
<u>Physical Problems</u>	
Phantom vibrations/ringing	Ramasubramani
Myofascial trigger points	Yasarer
Neck and upper limb pain	de Jesus Correia
Obesity and hypertension	Aftab
Low physical exercise	Han, Xiao

Table 2: Negative Effects of Smartphone Addiction (and First Authors)

4.1 Nomophobia and Mind Wandering

Not surprisingly, being addicted to using a phone would lead to worry about losing your phone, as in nomophobia. Smartphone addiction has been related to nomophobia as noted in a study on college students from Turkey (N=215) [7]. Mobile phone addiction has also been related to mind wandering in university students (N= 1811) [1]. The relationship between mobile phone addiction and mind wandering was mediated by fatigue and moderated or increased by rumination. Not surprisingly, both smartphone addiction and phubbing (phone snubbing) behaviors have been related to a lack of communication skills (Ayar et al, 2021). These problems may contribute to the negative emotions that have been frequently reported.

4.2 Negative Emotions

Smartphone addiction has been related to several negative emotions. They include the lack of well-being, depression and suicidal ideation [8]. In a large sample of students from 16

universities in China (N=1527), the lack of well-being was related to smartphone addiction [8]. In a mediation analysis by these researchers, loneliness mediated the relationship between smartphone addiction and the lack of well-being.

Depression has also been considered a negative effect in several studies on smartphone addiction. The relationship between smartphone addiction and depression is likely bi-directional or reciprocal. That reciprocal relationship was demonstrated in a longitudinal study that assessed smartphone addiction and depression at baseline and 12 months later [9]. In this sample (N= 1186 university students from China), smartphone addiction led to depression and depression led to smartphone addiction, especially in females. This bi-directional relationship was noted in an even longer longitudinal study (two years) and larger sample of university students (N=3827) [10]. In this study, loneliness again mediated the relationship between smartphone addiction and depression. The authors suggested that off-line interpersonal

communications could be enhanced as a potential intervention for smartphone addiction.

In a study entitled “Mobile phone addiction, phubbing and depression among men and women: a moderated mediation analysis”, mobile phone addiction led to depression that was mediated by phubbing (N=400 university students from Ukraine) [11]. Loneliness was a moderator that affected this relationship. In males, high loneliness increased the mediation effect but in females, high loneliness decreased the mediation effect. This differential gender effect is difficult to interpret.

In another study on medical students from China, mobile phone addiction led to depression [12]. In this sample, sleep problems played a mediating role and peer relationships played a moderating role (buffering the negative effects of mobile phone addiction on depression). In still another sample of students from China (N=1042), mobile phone addiction led to suicidal ideation that was mediated by depression [13]. This relationship was moderated (decreased or buffered) by online social support from chatting or posting online.

4.3 Sleep Problems

Sleep problems have been a negative effect in many studies on smart phone addiction. In a study already described on medical students, for example, as many as 63% of the sample (N=224) experienced a sleep disorder [14]. In another sample of medical students already described (N= 355), severe mobile phone addiction led to sleep quality disorder [3].

In a study entitled “Mobile phone addiction and sleep quality: the mediating role of anxiety and the moderating role of emotion regulation”, the results of the study are specified in the title [15]. In this sample (N= 1559), mobile phone addiction led to anxiety which, in turn, led to inferior sleep quality. The emotion regulation variables included cognitive reappraisal which negatively moderated (decreased) the relationship between mobile phone addiction and anxiety and expressive suppression which positively moderated (increased) that relationship. Analyzing a dataset for both positive and negative moderators is unusual but informative for determining risk factors as well as potential buffers.

In another paper, the results are again depicted in the title “Mobile phone addiction and sleep quality among older people: the mediating roles of depression and loneliness” [16]. In this sample, an unusual age sample of older adults in China (N= 459) had mobile phone addiction and inferior sleep quality. The relationship between mobile phone addiction and inferior sleep quality was mediated, not surprisingly, by both loneliness and depression.

In a systematic review and meta-analysis on the relationship between mobile phone addiction and sleep disorders, 29 studies were found in the PubMed, Embase, Scopus and Web of Science databases (N=20,041 adults) [17]. Although the studies included in

this analysis differed on geographic locations and the measures of mobile phone addiction, mobile phone addiction was consistently correlated with sleep disorders.

4.4 Physical Problems

Several physical problems have resulted from smartphone addiction. They include phantom vibrations/ringing, myofascial trigger points, neck and upper limb pain and hypertension.

Phantom vibrations and ringing syndrome (the false perception of vibration and ringing) are prevalent among those with smart phone addiction. In a study on medical students from India (N=380), the prevalence of this syndrome was as high as 45% [18]. The phantom vibrations were more prevalent than the ringing (28 vs 21%). In the data analysis smartphone addiction was directly related to vibration and ringing.

In a paper entitled “Associations between smartphone addiction and myofascial trigger points” (N=136), trigger points (hyperirritable knots in muscles) were related to smartphone addiction [19]. These were noted in the right elevator scapula and the right cervical erector muscles which was not surprising as these muscles would be involved in holding the phone between the shoulder and head on the right side (typically the dominant side).

Similarly, neck and upper limb pain was associated with smartphone addiction in another sample (N=165 university students) [20]. Of those with smartphone addiction, as many as 34% had neck and upper limb pain. Smartphone addiction and female gender were both risk factors for this pain.

Obesity and hypertension have also been associated with smartphone addiction in a study from Saudi Arabia [2]. In this sample, 36% had smartphone addiction and 36% had hypertension and both problems were more prevalent in men versus women (43 vs 26%). The greater prevalence of hypertension in men was predictable. The greater prevalence of smartphone addiction in men, however, was unique to this study as greater smartphone prevalence has typically been reported for women.

Mobile phone addiction has also had negative effects on physical exercise in university students (N=4959) [21]. In this sample, 88% engaged in low or medium intensity exercise. Mobile phone addiction led to decreased exercise. The relationship between mobile phone addiction and limited exercise was moderated (increased) by limited peer relationships. Similarly, in a meta-analysis on 22 studies, mobile phone addiction and physical activity were negatively correlated [22]. This negative correlation had a moderate effect size (strength of the relationship) for young adults.

5. Predictors/Risk Factors for Smartphone Addiction

Several predictors/risk factors have been the focus of studies in this literature on smartphone addiction (see table 3). They can

be categorized as related smartphone variables, psychological problems, personality variables, and lifestyle factors. The related smartphone variables include fear of missing out and phubbing. The psychological problems include anxiety, alexithymia and

depression. The personality variables include self-esteem, self-cohesion and extraversion/neuroticism. The lifestyle factors include negative life events, work conflict, burnout, and the lack of social support.

<u>Predictors/Risk factors</u>	<u>First author</u>
<u>Smartphone Related Risk Factors</u>	
Parental phubbing	Tang
Phubbing	Lai
Fear of missing out (FOMO)	Liu, Alinejad, Zhang
<u>Psychological Problems</u>	
Social anxiety	Lai
Anxiety	Zhang
Boredom proneness	Yue
Alexithymia	Gao
<u>Personality Variables</u>	
Lack of self-esteem	Chen
Lack of self-cohesion	El Keshky
Extroversion & Neuroticism	Huang
<u>Lifestyle Factors</u>	
Negative life events	Yang
Work conflict	Sun
Job burnout	Ma
Lack of social support	Yang

Table 3: Predictors/Risk Factors of Smartphone Addiction (and First Authors)

5.1 Related Smartphone Variables

Variables that could be classified as technically related to smartphone variables include parental phubbing, peer phubbing, and fear of missing out (FOMO). Parental phubbing has led to depression and, in turn, to smartphone addiction in Chinese students [23]. In this sample (N=742), a positive school climate was noted to moderate (decrease or buffer) the relationship between

parental phubbing and smart phone addiction. In another study on risk factors for smartphone addiction, phubbing, depression and social anxiety were risk factors for smartphone addiction (N= 866 university students from China) [24]. The relative significance of these risk factors was unfortunately not determined in this study, as, for example, by a stepwise regression or by structural equation modeling.

Fear of missing out (FOMO) has been the focus of at least three studies in this recent literature on smartphone addiction. The results of one FOMO study are depicted in its title “The relationship between FOMO and mobile phone addiction in college students: the mediating role of depression and the moderating role of loneliness” (Liu et al, 2024). In this sample (N=750) FOMO had an indirect effect on mobile phone addiction. FOMO led to depression which, in turn, led to mobile phone addiction. This relationship was moderated (increased or exacerbated) by loneliness.

In a sample of students from Iran, loneliness and academic performance mediated the relationship between FOMO and smart phone addiction (N=447) (Alinejad et al, 2022). Loneliness was a more significant mediator than academic performance in this data analysis. In a systematic review and meta-analysis of 85 studies on FOMO and mobile phone addiction, those two variables were consistently correlated (Zhang et al, 2023).

5.2 Psychological Problems

Psychological problems that are risk factors for smartphone addiction include social anxiety, anxiety, alexithymia and depression. Social anxiety has been a risk factor for smartphone addiction in at least one study in this literature [24]. In this sample (N=866 students from China), social anxiety along with depression and phubbing were risk factors, and protective factors were self-control and a sense of security.

In another sample of Chinese students (N=1526), a multiple mediation model analysis revealed a relationship between anxiety and smartphone addiction [27]. In this model, anxiety led to boredom proneness as a mediator and to self-control as a mediator which then predicted smartphone addiction. Clearly boredom proneness was a risk factor and self-control was a protective factor in this complex analysis. Boredom has also been linked to depression as risk factors for smartphone addiction [28]. In this sample, as well as many other samples, females were at greater risk than males for smartphone addiction.

Alexithymia has also been a risk factor for mobile phone addiction in a sample of university students (N=1105) [29]. Alexithymia has been called “emotional blindness”, as it involves difficulty experiencing, identifying and expressing emotions. In this sample, the relationship between alexithymia and mobile phone addiction was mediated by depression, anxiety and stress. Researchers may link these three mediators as depression, anxiety and stress are often comorbid.

5.3 Personality Variables

Risk factors for smartphone addiction that could be classified as personality variables include the lack of self-esteem and self-cohesion and the personality qualities of extroversion and neuroticism. In a paper entitled “The relationship between self-esteem and mobile phone addiction among college students: the chain mediating effects of social avoidance and peer relationships”,

the title reflects the results [30]. In this sample (N= 694), the relationship between low self-esteem and smartphone addiction was mediated by both poor peer relationships and social avoidance (as in a chain of mediators).

The lack of self-cohesion has also been a risk factor for smartphone addiction [31]. Self-cohesion has been defined as a stable sense of identity that remains intact even when faced with threats. In a sample of young adults (N = 910, mean age= 35), the lack of self-cohesion predicted smartphone addiction and that relationship was mediated by rejection sensitivity.

Both extroversion and neuroticism have been risk factors for smartphone addiction in a sample (N=972 medical students) that had a smartphone addiction prevalence rate of 24% [32]. Smartphone addiction was also more prevalent in those who were from a one-child family and those who were from an urban family. These demographic variables have rarely been included in databases or data analyses.

5.4 Lifestyle Factors

Lifestyle factors that have been predictors of smartphone addiction include negative life events, work conflict, burnout and lack of social support. Negative life events have led to mobile phone addiction (N = 584) [33]. In this database, the relationship between negative life events and mobile phone addiction was mediated by boredom proneness.

One of the negative life events that may relate to boredom proneness has been labeled work conflict. This problem has been noted as a trigger for smartphone addiction in corporate employees in China (N = 577) (Sun et al, 2023). The relationship between work conflict and smartphone addiction in these corporate employees was moderated (increased) by rumination, although it’s not clear whether the rumination was about work conflict. Job burnout, which could be considered more severe than work conflict or could result from work conflict, has also led to mobile phone addiction (N = 366) [24]. In this sample, 52% were experiencing job burnout which seems an unusually high prevalence of burnout.

These negative life events would likely be exacerbated by the lack of social support. In another sample of Chinese students (N=874), the lack of social support led to mobile phone addiction (Yang et al, 2023). This relationship was mediated by depression but was moderated (buffered) by self-compassion. Self-compassion would likely compensate for the lack of social support. Although it moderated or “buffered” the negative effects of the lack of social support in this sample, it has not been considered a buffer for smartphone addiction in this literature.

These relationships between various risk factors and smartphone addiction highlight the complexity of this literature. As already noted, the selection of risk factors, mediators and moderators have typically been arbitrarily selected by the researchers who have

primarily used mediation/moderation analyses which require a theoretical orientation.

6. Buffers for Smartphone Addiction

A couple studies could be categorized as having buffer effects on smart phone addiction (see table 4). In one study entitled “Effects of physical exercise on mobile phone addiction in college students: the chain mediation effect of psychological resilience and perceived stress”, increased physical activity had an indirect effect on mobile phone addiction [36]. As mediators, psychological resilience had a positive effect and perceived stress had a negative effect. In another study already described as having phubbing,

depression and social anxiety as risk factors for smartphone addiction, protective factors were also noted [24]. These were self-control and a sense of security.

These buffers were not classified as intervention effects in these studies. Intervention studies could not be found in this recent literature. The regency of the smartphone addiction literature may explain the lack of intervention research. The buffering effects studies highlight the need for intervention studies. Typically, the intervention studies follow the research on prevalence, negative effects and risk factors for addictions as those data inform the types of interventions that are needed.

<u>Buffers</u>	<u>First author</u>
Physical activity	Zhao
Self-control and sense of security	Lai

Table 4: Buffers for Smartphone Addiction (and First Authors)

7. Methodological Limitations of this Literature

This recent literature on smartphone addiction has several methodological limitations that relate to the sampling, variable selection and data analytic methods used by the different research groups. These limitations are highlighted by the relative absence of meta-analyses in this literature. The samples have been primarily convenience samples of university students and medical students and they are most frequently from China which has limited the generalizability of the data. The researchers have also focused on smartphone addiction in several different ways including having many different negative effects as well as having many different predictors/risk factors, and mediating/moderating variables, making it difficult to combine the data in meta-analyses.

Presumably there would be cross-cultural differences on the prevalence of smartphone addiction with some countries finding it more acceptable and others finding it more disturbing. However, most of the samples are from China which has not only limited the generalizability of the smartphone addiction data but has also limited the ability to make cross-cultural comparisons. Age differences would also be expected. However, the samples are mostly young adults with the exception of a couple studies on older adults.

The degree of smartphone use would also be expected to have differential effects. However, the research reviewed here did not measure the quantity or the quality of smartphone addiction except one study that gave prevalence data for mild versus severe smartphone use and indicated that the negative effects only occurred for the severe group. And no comparisons were made between smartphone addiction and other addictions, although multiple addictions are frequently comorbid.

Most of the studies have been cross-sectional rather than longitudinal. As a result, the directionality of the risk factors and negative effects could not be determined. The negative effects and risk factors have been very similar but only a few research groups have reported that the negative effects and risk factors were reciprocal. The same variables, for example, depression have been considered negative effects of smartphone addiction by some investigators and risk factors by others. And many of the same variables have been entered as mediators/moderators in mediation/moderation analyses, suggesting that several of these variables are interrelated.

The mediation/moderation analyses that have been conducted by most of the research groups have their limitations. Mediation/moderation analyses are conducted to test mechanisms based on theory making it necessary for researchers to have theories for the selection of the mediator and moderator variables. This type of data analysis also has low statistical power and it doesn't directly test the significance of a specific indirect effect or quantify the magnitude of the effects. Many of the research groups, not surprisingly, entered similar variables as potential mediator/moderator variables, for example, boredom, loneliness and depression. A stepwise regression analysis or structural equation modeling may have been more informative by determining the relative significance of these multiple risk factors. Determining the degree to which the mediating and moderating variables contribute to the variance in outcomes would also help inform intervention research. As one research group noted, the lack of personal relationships as a mediating variable was suggestive of facilitating relationships as an intervention. Only a couple research groups reported effective buffers, and no intervention research could be found in this literature [37].

8. Conclusion

Despite these methodological limitations, this literature has highlighted the prevalence of smartphone addiction, especially in young adults. The prevalence may have recently increased as the availability of smart phones has increased. The prevalence of smartphone addiction and its negative effects have highlighted the need for intervention research. The studies on predictors/risk factors would seemingly help identify those who may need therapy. However, intervention data are needed to inform clinicians on potential treatments for those who have smartphone addiction. Further research is also needed to specify the relative significance of the predictor/risk factor variables for identifying those who need intervention and the specific intervention techniques that are effective in reducing smartphone addiction.

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