Computers in Human Behavior Reports 4 (2021) 100108

Contents lists available at ScienceDirect

Computers in Human Behavior Reports

journal homepage: www.journals.elsevier.com/computers-in-human-behavior-reports

Measuring smartphone dependency and exploration of consequences and comorbidities

Sarah Fryman *, William Romine

Wright State University, Department of Biological Sciences, Dayton, OH, USA

ARTICLE INFO

Keywords:
Smartphones
Smartphone addiction
Smartphone dependency
Technology addiction
Social anxiety
Self-esteem
Nomophobia

ABSTRACT

"Nomophobia" is the fear of not being able to use your smartphone and has been noted to be associated with excessive levels of smartphone dependency. For many, these devices have become an extension of ourselves, which raises hesitation on whether or not society has become addicted to smartphones. Specific diagnostic criteria for smartphone addiction have yet to be settled, and even use of the word "addiction" when describing excessive usage of smartphones is controversial. We therefore utilize current measures to explore the symptoms of smartphone dependency and their hierarchy, as well as comorbidities including social anxiety, self-esteem, and distracted driving. A total of 159 adults from a research-intensive university in the Midwestern United States completed an anonymous online survey. Through factor analytic and Rasch modeling methods, it was found that based on a single measure for one's level of nomophobia, the degree to which smartphone use interferes with daily life can be qualified. The relationship between nomophobia and social anxiety supports the hypothesis that smartphone addiction can be magnified by personality traits and other psychiatric comorbidities. Both multiple linear regression and binary logistic regression analyses found that phone usage while driving and being female were found to be significant positive predictors of smartphone dependency. It is apparent that technology addiction and smartphone addiction need to be studied among a greater population, especially among women and those who use their smartphones while driving.

1. Introduction

"Nomophobia" is the fear of not being able to use your smartphone and has been noted to be associated with excessive dependency on smartphones. For many, these devices have become an extension of ourselves, which raises hesitation on whether or not society has become addicted to smartphones. Specific diagnostic criteria for smartphone addiction and nomophobia have yet to be settled, and even use of the word "addiction" when describing excessive usage of smartphones is controversial. We therefore utilize current measures to explore the symptoms of nomophobia and their hierarchy, as well as comorbidities including social anxiety, self-esteem, and distracted driving. In this study, we take a holistic approach to understanding the structure and validity of current quantitative instrumentation for measuring smartphone dependency, along with its extreme levels, nomophobia and smartphone addiction, and then use this to explore potential psychological comorbidities. Current instrumentation enables measurement of dimensions of nomophobia as specific subscales. For example, the Nomophobia Questionnaire (NMP-Q) measures not being able to communicate, losing connectedness, not being able to access information and giving up convenience (Yildrim et al., 2015). Towards diagnosis of addictive or phobic tendencies however, a measure of smartphone dependency would be more useful if defined as a set of key traits and addictive symptoms embedded within a single hierarchy. Given that several instruments have been developed and validated, we address the following question:

(RQ.1) What is the efficacy of currently available survey items measuring smartphone dependency toward helping us draw a valid inference regarding a person's level of dependency?

Assuming such a measure can be drawn from current items, a second question was:

(RQ.2) What demographic and psychological comorbidities and outcomes accompany a person's level of dependency?

We addressed the following sub-questions:

(RQ.2.1) What is the relationship between level of dependency and self-esteem, depression, social anxiety, and sense of social responsibility?

(RQ.2.2) What is the relationship between dependency and gender?

(RQ.2.3) What is the relationship between level of dependency and the tendency to use a smartphone while driving?

* Corresponding author. 3640 Colonel Glenn Hwy, Dayton, OH, 45435, USA.
E-mail addresses: fryman.16@wright.edu, william.romine@wright.edu (S. Fryman), william.romine@wright.edu (W. Romine).

https://doi.org/10.1016/j.chbr.2021.100108
Received 12 May 2020; Received in revised form 20 May 2021; Accepted 27 May 2021
Available online 4 June 2021

2. Background

2.1. Development of smartphone addiction

As of 2018, the majority of Americans reported owning some type of smartphone. It is estimated that 95% of Americans use some sort of cellular device, while 77% of Americans use smartphones (Mobile fact sheet, 2018). Smartphones are so present in people's lives that a new phobia has been presented in research: "nomophobia" is the fear of being detached from one's smartphone, shortened from the phrase "NO MObile PHOBIA". These devices have, in part, become an extension of ourselves and a main part of our lives—which raises hesitation on whether or not society has become addicted to smartphones (Clayton, 2015; Emanuel, 2015). It is apparent, from the literature and research being published within the last decade, that excessive dependency on mobile devices has not only affected our personal lives—but also our physical and psychological health (De-Sola, 2017).

2.2. Nomophobia in multiple dimensions

There is currently a lack of agreement in the field as to a specific set of diagnostic criteria for smartphone addiction. However, the term "nomophobia" has been used to describe a form of behavioral addiction toward smartphones (Anshari, 2019). Although they are often measured separately, Nomophobia and smartphone addiction have been found to have a significantly strong positive relationship, due to their overlapping dimensions (Buctot, 2020). While the diagnostic criteria for nomophobia are also not fixed, research has supported the dimensions composed by Yildrim et al. (2014) particularly well (Adawi, 2018; Ali, 2017; González-Cabrera, 2017; Lee, 2018). Yildrim et al. were able to validate four different dimensions of nomophobia, including fear of: (1) not being able to communicate, (2) losing connectedness, (3) not being able to access information and (4) giving up convenience (2014). Not being able to communicate resonates with the loss of instant communication and the feeling to not being able to use devices for instant communication. Losing connectedness refers to the fear of losing the link that smartphones provide with the social/virtual world. As for not being able to access information, the discomfort with losing the ease of access to constant information is a major dimension to consider when labeling someone with nomophobia. Last, the feeling of not wanting to give up the conveniences that smartphones provide reflects the addictive behavior that is so overwhelmingly present in our society (Yildirim, 2014).

While the various traits associated with smartphone dependency have been found to positively correlate, researchers have found it troublesome to differentiate whether a patient has developed nomophobic symptoms due to excessive mobile phone dependency, or if a patient simply has other mental disorders that cause the manifestation of nomophobia (Bhattacharya, 2019). Further, it has proven difficult thus far to delineate between what constitutes normal levels of dependency and what constitutes a level that is sufficiently problematic as to be labeled with terms like "nomophobia" and "addiction". This highlights the need to work toward representing smartphone dependency as a spectrum of symptoms so that we have the foundation to make informed inferences regarding what constitutes problematic dependency.

2.3. Comorbidity with other disorders

Research has shown that both smartphone addiction and nomophobia have a high presence of comorbidity with other disorders. This includes eating disorders, obsessive-compulsive disorder, depression, other behavioral addiction disorders (gambling, compulsive shopping, etc.) and also other forms of phobias or anxieties (Tran, 2016). Social anxiety, in particular, has been closely studied for its association with smartphone addiction. Those with social anxiety want to make friends and have social contact with others, but their anxiety prevents them from doing so (Richards, 2013). Hence, the comfort of being physically alone but socially active on the internet is appealing. Observational studies have shown that people with social phobia developed a dependency on communication through their mobile device or computer in an effort to avoid direct social relations (King, Valença, Silva, Baczynski & Carvalho, 2013; Uysal, 2016). Social anxiety has also been found to be highly comorbid with depression, and is often high in depressed people who might not meet the criteria for diagnosis (Gilbert, 2000).

Another case study found that the presence of nomophobia in some persons could very well mask a root cause disorder (King, 2012). In this case, social phobia disorder was masked by nomophobic behaviors (excessive amount of time on the cellular device in efforts to communicate as a means of escape from social/personal relations) (King, 2012). Those with social anxiety have also reported more insecure attachment behaviors (McCarty, 2005). Specifically, those with a fearful or anxious attachment classification were significantly more socially anxious. This can be used to explain attachment theory when it comes to smartphone devices, especially among those who have some sort of social phobia. Individuals who are more emotionally dependent and desire attention or closeness in a relationship tend to show significantly higher levels of discomfort or fear when they are unable to access their mobile devices (Arpaci, 2017).

Along with comorbidities, there have also been numerous psychological predictors reported in regards to diagnosing smartphone addiction. Problematic mobile usage may be predicted by: self-negative views, low self-esteem and self-efficacy, high extroversion or introversion, impulsivity and a sense of urgency (Bragazzi, 2014). Overall personality traits such as attention impulsiveness and emotional instability have also been positively associated with smartphone addiction while introversion was found to be negatively associated phone addiction (Roberts, Pullig, & Manolis, 2015; Kim et al., 2016).

2.4. Smartphone addiction in DSM-V

While smartphone addiction is not clinically established, there has been wide discussion on its pathology (Lin, 2016; Panova & Carbonell, 2018). In addition, smartphone addiction has been difficult to establish in the DSM-V, similarly to many behavioral addictions (Alavi et al., 2012). This could possibly be due to the barriers in establishing a behavioral addiction, compared to drug or substance addiction where there is a precise time at which the abuse interferes with daily life. Behavioral addiction does not possess such clear circumstances due to the common overpathologization of "interference of daily life" by researchers (Billieux, Schimmenti, Khazaal, Maurage, & Heeren, 2015). Therefore, it is in some ways more difficult to diagnose an addiction that can be clouded by personality traits and other psychiatric comorbidities (Coyne, Stockdale, & Summers, 2019). However, behavioral and substance addiction are similar in their pharmacology. The administration of specific dopamine agonists has the ability to activate previously non-existent behaviors—such as compulsive gambling, eating, shopping and in this case, compulsive usage of smartphones (De-Sola Gutiérrez, Rodríguez de Fonseca, & Rubio, 2016).

It has also been shown that symptom criteria for smartphone addiction has similar psychopathology with the traditional model of substance use disorders (Lin, 2016). The core symptoms of impaired control in smartphone addiction aligned with excessive usage, repeated attempts to quit use, excess time spent using and craving. However, the craving symptom of smartphone usage does not often fit into the symptom criteria because of the implication that smartphones are deeply relied on in current lifestyles and that a non-use period becomes very limited (Lin, 2016).

Smartphone addiction has the appearance of a modern-day addiction which is edging its way closer to being worthy of classification in ICD XI and DSM-V (Bhatia, 2008). It fulfills all four diagnostic components needed to be classified as an addiction. Excessive use, withdrawal, tolerance and negative repercussions are all factors that many who are addicted to their smartphones may experience. Being preoccupied with

their mobile device, needing to use the mobile device for longer periods of time to be satisfied, and losing track of time spent on one's phone can explain excessive use (Ha, Chin, Park, Ryu, & Yu, 2008). For withdrawal, many experience impatience, anxiety, or intolerance when their phone is inaccessible. Some people even reported the inability to enjoy meals without using their smartphone (Kwon Lee, Won, Park, Min, Hahn … & Kim, 2013; Lin, Chang, Lee, Tsen, Kuo, & Chen, 2014). Smartphones may have an abundance of positive effects on our society, but overuse can cause negative repercussions including poor achievement, social isolation, fatigue, social conflict and avoidance (Bhatia, 2008). While tolerance is a main component of substance-related physiological dependence, it is not as widely accurate in diagnosing smartphone addiction. (Lin et al., 2016) With increasing updates and constantly changing technology, it is easy for smartphone users to achieve high levels of satisfaction in their devices. Therefore, the usage of the term 'tolerance' is not completely applicable when diagnosing addictive behavior with smartphones.

Additionally, there has also been some discussion as to what the appropriate method is to determine a cutoff point for smartphone addiction and nomophobia. Ballestar-Tarí n et al. (2020) found an optimal cutoff point (44 out of 88 on the Smartphone Addiction Inventory [SAI]) for smartphone addiction by carrying out a receiver operating characteristics (ROC) analysis, which established an optimal cut-off point that presented a higher value of Youden J statistic (0.416), suggestive of its sensitivity and specificity. Another study done on the Chen Internet Addiction Sale (CIAS) used a ROC analysis to determine a diagnosis of internet addiction with a balance of accuracy (89.6%) and high sensitivity (85.6%) (Ko et al., 2005). The balance between sensitivity and specificity led to an optimal cutoff which classified 87.6% of respondents correctly. In order to establish an optimal cutoff point for possible cases of mobile dependency, Mohammadi et al. (2015) also used a ROC curve to determine a high sensitivity (93%) an acceptable specificity (89%) in regard to scoring the Persian Version Test of Mobile Phone Dependency (TMD).

2.5. Smartphone Addiction and gender

In addition to psychological comorbidities, smartphone addiction has also been studied based on differences between genders. Koo (2012) found that smartphone addictions of middle school aged female students were significantly higher than their male counterparts. This finding is consistent with others which found women to be significantly more addicted to their smartphones than men (Roberts, Yaya, & Manolis, 2014; De-Sola Gutiérrez et al., 2016). In contrast, some studies found that the prevalence of smartphone addiction among males and females were roughly similar (Chen et al., 2017) or in some cases, males were more addicted to their smartphones than females (Mazaheri & Najarkolaei, 2014). Regardless of significant difference in levels of smartphone addiction, these studies note that there was still a significant difference in motives or factors for using smartphones, with females using phones more for social measures and males tending to use smartphones for more practical and entertainment measures (Chen et al., 2017; Roberts et al., 2014). This possibly implies that the use of different smartphone addiction diagnostic tools may include more or less social and practical items, causing the fluctuation from significant differences between genders to no significant differences.

2.6. Behavioral outcomes

Smartphone addiction is extremely prevalent on our roadways. The usage of smartphones, particularly texting and driving, is extremely dangerous and has cost society many lives. Studies have found that not only is driving affected by the rise of mobile technology, but walking and bicycling activities have also been prone to the distractions (Stavrinos, Pope, Shen, & Schwebel, 2018). According to the National Highway Transportation Safety Administration, 3166 people were killed in America due to distracted driving in 2017.

While it has been quite difficult for researchers to put an exact number on distracted driving due to electronic devices, a study done by the California Office of Traffic Safety observed 4.52% of drivers being distracted over a one-month period at 204 road sites (Bommer, 2018). However, this study speculates that the actual percentage of drivers who engage in smartphone behavior across their time on a given trip is much higher. For example, the CDC's 2017 national Youth Risk Behavior Surveillance System (Centers for Disease Control and Prevention, 2017) reported that 42% of high school students who drove in the past 30 days admitted to sending an email or text message while driving. These studies are just a few that have found that those who text and drive may not be honestly reporting their behavior, and that attempting to observe texting and driving behavior is quite difficult. A meta-analysis done by Stavrinos et al. (2018) described mobile technology's impacts on crash risk, particularly in youth, in two ways: smartphones draw resources from our vision, mind, hands and our ears, and individuals' frequency of multitasking is correlated with safety. While national attempts to combat distracted driving are currently being exercised, such as the "Don't Text and Drive", it is apparent that drivers of all ages are finding themselves to have less self-control regarding abstinence from using their smartphones behind the wheel—a recent report from TeenSafe published that 69% of U.S. drivers between 18 and 64 years of age admitted to using smartphones while driving within the previous month (TeenSafe, 2019). In addition to distracted driving, other behavioral outcomes of smartphone addiction have included interference with school, personal activities, an increase in phone usage to obtain the same level of satisfaction, and the need to use a smartphone more frequently (Choliz, 2010).

2.7. Instrumentation

The most widely used instrument for measuring nomophobia is the Nomophobia Questionnaire (NMP-Q), created by Yildrim and Correia (2015) (Rodríguez-García et al., 2020). The NMP-Q assesses the four dimensions previously found by Yildrim: (1) not being able to communicate, (2) losing connectedness, (3) not being able to access information and (4) giving up convenience.

In addition to the NMP-Q, there are also instruments that focus on quantifying cognitive and behavioral elements of smartphone addiction. The Mobile Phone Involvement Questionnaire (MPIQ), developed by Walsh, White, and Young (2010), not only measures addictive components of smartphone usage but has also given insight to nomophobia when correlated with other psychiatric components, including self-esteem, extraversion, conscientiousness and emotional stability (Argumosa-Villar, Boada-Grau, & Vigil-Colet, 2017). The MPIQ measures smartphone behavior in dimensions different than the NMP-Q: relapse, cognitive salience, behavioral salience, conflict with others, interpersonal conflict, withdrawal, and euphoria/relief. These aspects are very similar to the common addiction components that Brown, (1988) found in the study of machine gamblers and have been widely used in other technology addiction research (Griffiths, 1995).

Another aspect of smartphone addiction to be considered resonates to the attachment to these devices. In order to understand phone attachment, Trub and Barbot (2016) developed an instrument that measures feelings of safety, uncomfortableness, or relief when put into a perspective of separation and unification with one's mobile device. The findings from this 6-item instrument, titled the Young Adult Attachment to Phones Scale (YAPS), have reflected strong psychometric properties and are consistent with avoidant attachment theories of technology (Morey, Gentzler, Creasy, Oberhauser, & Westernman, 2013).

Along with attachment, other authors discuss the cravings of smartphone usage as opposed to framing it as a dependency. The Mobile Phone Addiction Craving Scale (MPACS), developed by De-Sola, Talledo, Rubio, and Rodriguez de Fonseca (2017) was developed to measure cravings that accompany smartphone addiction. The MPACS results in a unidimensional score for each individual, varying from casual users to problematic users. This craving dimension exists with other general

addictions, and in particular, gambling and drug addictions (De-Sola, Talledo, Rubio, & de Fonseca, 2017). The cognitive concept of cravings has demonstrated even more need for smartphone addiction to be placed among other behavioral addictions within the DSM-5.

The previously discussed instruments inform researchers' understanding on the wide variation in how we look at smartphone addiction. For one, there seems to be an overlap of the terms "smartphone addiction," "smartphone craving," and "nomophobia", given that many smartphone addiction instruments include fear and anxiety of not having or being able to use a smartphone—the definition of nomophobia. To further reinstate the similarity between these, prior research (Argumosa-Villar, Boada-Grau & Vigil-Colet, 2017) has shown that the MPIQ was used to validate the construction of the NMP-Q (Argumosa-Villar et al., 2017). This may lead to the explanation that nomophobia and its fear-based reasoning is simply a facet of smartphone addiction itself, such as being a withdrawal symptom (Tran, 2016).

3. Methods

3.1. Sample and procedure

A total of 159 participants (82.3% students, 16.6% faculty) from a research university in the Midwestern United States completed an anonymous survey through Qualtrics web-based survey software. The survey was shared on multiple faculty and student-involved email listserves at the university. The survey link was also shared with professors of multiple large undergraduate courses at the university, with the intention that the link would be shared to students in the course. Researchers only know of one large (n = 100+) course that the link was actually shared within. Participants were asked to anonymously fill out the survey for a study on cellphone involvement and mental health. The majority of respondents identified female (125, 71.4%), however, 32 males (18.3%) and 2 Non-Binary/Third Gender (1.1%) individuals were included. Individuals were majority white (72.6%). Respondents were 57.1% aged 18–29 years old, 25.7% aged 30–49, and the rest were aged 50+.

3.2. Measures

3.2.1. Nomophobia

Nomophobia was measured in this study using items drawn from three different validated surveys: Nomophobia Questionnaire (NMP-Q) (Yildirim and Correia, 2015a), Mobile Phone Involvement Questionnaire (MPIQ) (Walsh et al., 2010), Young Adult Attachment to Phone Scale (YAPS) (Trub and Barbot, 2016) and the Smartphone Addiction Craving Scale (MPACS) (De-Sola et al., 2017).

3.2.1.1. Nomophobia Questionnaire (NMP-Q). The Nomophobia Questionnaire (NMP-Q), developed by Yildrim and Correia (2015), consists of 20 items (α = 0.92), each scored on a 7-point Likert scale. Researchers have used this instrument in studying the prevalence of nomophobia among Turkish college students (Yildirim, Sumumer, Adnan, & Yildirim, 2016). For this study, the Likert scale was reduced to 5-points in order to streamline responses for participants. The NMP-Q measures nomophobia given four different dimensions: not being able to communicate, losing connectedness, not being able to access information, and giving up convenience. Items for the NMP-Q are shown in Appendix B.

3.2.1.2. Mobile Phone Involvement Questionnaire (MPIQ). The Mobile Phone Involvement Questionnaire (MPIQ), developed by Walsh et al. (2010), consists of 8 items (α = 0.82), also measured via a 5-point Likert scale in this study. The MPIQ was validated in a study done on a mixture of Spanish high school and university students (Argumosa-Villar et al., 2017). The MPIQ was developed in correlation with Brown's (1993, 1997) behavioral addiction components: cognitive salience, behavioral salience, interpersonal conflict, conflict with other activities, loss of control, withdrawal, and relapse. MPIQ items are shown in Appendix C.

3.2.1.3. Smartphone Addiction Craving Scale (MPACS). In order to assess desire and craving associated with smartphone addiction, the Mobile Phone Addition Craving Scale (MPACS) (De-Sola, Talledo, Rubio, Rodriquez de Fonseca, 2017) was used. This instrument consists of 8 items (α = 0.87), also adapted from a 10-point to a 5-point Likert scale for this study. The MPACS was originally validated as a measurement of smartphone cravings within a Spanish adult population (De-Sola et al., 2017). These items used to measure smartphone craving can be seen in Appendix D.

3.2.1.4. Young Adult Attachment to Phones Scale (YAPS). The Young Adult Attachment to Phones Scale (YAPS), developed by Trub and Barbot (2016), gave interesting insight to the factors of attachment anxiety (refuge) and attachment avoidance (burden) of smartphone addiction among 955 participants aged 18–29. This instrument consists of 6 items, 3 measuring refuge (α = 0.76) and 3 measuring burden (α = 0.67), on a 5-point Likert scale. YAPS items are shown in Appendix E.

3.2.2. Instrumentation for measuring comorbidities

3.2.2.1. Self-esteem. The degree of self-esteem was measured in this study by Rosenberg's Self-Esteem Scale (RSE) (Rosenberg, 1965). The instrument consists of 10 statements (α = 0.91) which pertain to self-acceptance and self-worth which have been validated in multiple studies, including the measurement of global self-esteem (Robins, Hendin, & Trzesniewski, 2001). Items were graded on a 5 point Likert Scale (1 = strongly disagree, 5 = strongly agree) and then summed for each participant. The SES items are shown in Appendix F.

3.2.2.2. Social anxiety. The Social Interaction Anxiety Scale (SIAS), developed by Mattick and Clarke (1989), consists of 20 items (α = 0.88) which ranged in our study from 0 "Not at all" characteristic of the participant to 5 "Extremely" characteristic. The SIAS was first developed and validated on a sample of over 1000 adults, including those with previously diagnosed social phobias (Mattick, Peters, & Clarke, 1989). SIAS items can be seen in Appendix G.

3.2.2.3. Distracted driving. In order to assess phone usage while driving, the Distracted Driving Survey (DDS) developed by Bergmark, Gliklich, and Guo (2016) was used. The assessment consists of 11 multiple choice items (α = 0.79) that measure smartphone-related distracted driving risk, including the viewing and writing of messages. The DDS was originally created to assess risk score among young U.S. adults, but has been validated in studies with older drivers as well (Gliklich, Maurer, & Bergmark, 2019). All items were scored on a 5 point Likert scale. All were reverse coded at the end of the study to measure distractedness as the most positive value. DDS items are shown in Appendix H.

3.2.2.4. Overall personality. Items from the Overall Personality Assessment Scale (OPERAS), developed by Vigil-Colet, Morales-Vives, Camps, Tous, and Lorenzo-Seva (2013), were used to assess emotional stability and extraversion in participants. The OPERAS was developed as a short measure for the big five personality traits: agreeableness, extraversion, emotional stability, conscientiousness and openness to experience. It has been previously validated in research on workaholism in adults (Serrano-Fernández, Boada-Grau, Gil-Ripoll, & Vigil-Colet, 2016). Seven Emotional Stability items (α = 0.74) and 7 Extraversion items (α = 0.85) were used in this study from the OPERAS. These items were scored on a 5 point Likert scale. OPERAS items are shown in Appendix I.

3.3. Strategy of analyses

Using the Statistical Package for the Social Sciences, (IBM SPSS, 2015), an exploratory factor analysis (EFA) was conducted to find dimensions of nomophobia and to explore any other factors in which psychological items might overlap. The factor scores derived by EFA were then run through a bivariate Pearson correlation test in order to measure the strength and direction of linear relationships between the multiple factors. A multivariate linear regression analysis was carried out to examine if demographic variables or psychological assessments were significantly associated with smartphone addiction. The 42 items measuring nomophobia were fitted to the Rasch rating scale model (with the WINSTEPS software package) in order to give a unidimensional hierarchical scaling model of smartphone addiction.

3.3.1. (RQ.1) what is the efficacy of currently available survey items measuring nomophobia toward helping us draw a valid inference regarding a person's level of dependency?

In order to generate a theory based on our collected data, an exploratory factor analysis (EFA) was done. EFA is a technique that clusters observed variables onto continuous latent factors (Collins & Lanza, 2013). Before beginning the EFA, all 3 of YAPS burden items were reverse coded due to their reversed nature of measuring the burden of smartphones. After reverse coding was implemented, all variables, aside from the demographic variables, measuring latent variables were put into an exploratory factor analysis with a maximum likelihood extraction in SPSS. Mean imputation was implemented within this extraction, given that the amount of missing data comprised only a small proportion of the total data (9.1%). This allowed the usage of all data collected. Among these variables were all four of the nomophobia instruments' items. Although the NMP-Q has validated four different dimensions of nomophobia, one leading curiosity in this study was whether other factors were present when all nomophobia items were combined into one survey and in accompaniment with distracted driving, self-esteem and social anxiety variables. Following the reporting guidelines of Henson and Roberts (2001), factors were initially extracted using the most commonly employed retention rule of an eigenvalue greater than 1 (Kaiser, 1960). However, it was found that excessive factors were extracted from this method, due to the common over-extraction resulting from the EV $>$ 1 rule (Zwick & Velicer, 1986). Therefore, the cutoff for the number of factors extracted was then determined by using the scree plot, Fig. 1, along with the maximum likelihood extraction which has been found by multiple researchers (Cattell, 1966, Osborne et al., 2008) to be the most optimal method. We then analyzed the factors found in this model and named them after reviewing which items weighed heaviest on each factor, given the promax rotated pattern matrix. Nomophobia and OPERAS items, along with the psychological measures of self-esteem and social anxiety, were inputted into this EFA to analyze if the measurement of nomophobia was unidimensional among all four assessments or whether other multiple factors could be derived from these various instruments. The factors were saved within SPSS as regression factor scores.

3.3.2. Rasch analysis

An overall nomophobia score was calculated by summing the NMPQ, MPIQ, MPACS, and YAPS item scores. The highest raw score possible was 210, which is the sum of the 42 items measured by 5 point Likert scales, and the lowest raw score possible was 42. After the summation of the overall nomophobia score, Rasch analysis was done with WINSTEPS in order to convert the raw scores into linear log-odds (logit) measures, and to explain the qualitative meaning of participants' measures by mapping item response difficulty onto the same scale. In order to facilitate a qualitative prediction of a person's behavior based on a single score, the Wright map was constructed. The Wright map entails a plot of the items according to their level of difficulty (highest difficulty on top) overlain by the distribution of participants' logit measures. Toward qualitative interpretation, we were tasked with the consideration of what qualitative features make one item more difficult than another so that we gain understanding of the types of behaviors that accompany different levels of dependency.

3.3.3. (RQ.2) what demographic and psychological comorbidities and outcomes accompany a person's level of dependency?

Items were first extensively reviewed in order to assure correct coding. Through this, Rosenberg's Self-Esteem items 2, 5, 6, 8, and 9 were

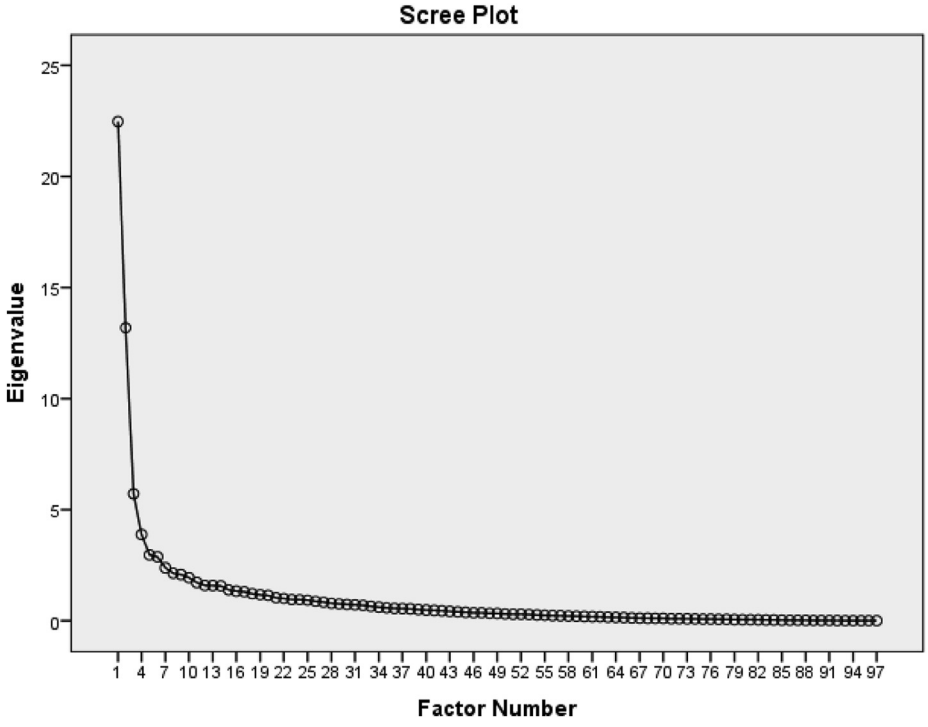

Fig. 1. Scree plot for Exploratory Factor Analysis (EFA). From the scree plot, we determined that 6 factors were sufficient to represent the collection of items.

reverse coded in order to have the higher Likert score correlate with higher self-esteem. In order to understand what associations could be derived between each of the 6 factors extracted by the EFA, a Pearson correlation test was run. The 6 extracted factors were entered into a correlation model to see to what extent the factors were linearly related.

From the Rasch analysis, each subject's logit score was measured. Logits represent the log odds of a person's collection of responses on the nomophobia items (Wright & Stone, 1979). The logit measures from the Rasch model give more weight to the extreme measures which better models the nomophobia phenomenon probabilistically. These logit measures were used in a multivariate linear regression. The variables used to predict a person's nomophobia score were Female (0/1), Student (0/1), and Factors 2–6 regression variables derived from the EFA. The purpose of this step was not to find a correlation with these variables, like the factor analysis mentioned above, but to examine whether social anxiety, gender, self-esteem, phone usage while driving, emailing while driving, or the feeling of personal/social responsibility could be accurate predictors of participants' nomophobia measures.

3.3.4. Logistic Regression

By looking at the boxplot dispersion of all logit scores within the Wright map, we needed to determine a cutoff at which a person could potentially be diagnosed with nomophobia. Similarly to characteristics of other behavioral addictions, we found the measure at which people begin to display behaviors that indicate negative interference with daily life. Participants with a Rasch logit measure greater or equal to this measure were considered nomophobic in this study (labeled a 1), and those with measures below this cutoff were considered non-nomophobic (labeled a 0). A binary logistic regression was carried out to assess the efficacy of being female, being a student, and EFA Factors 2–6 in predicting nomophobia. Model predictions were then compared with the observed outcome variables (those who were originally counted as nomophobic due to exceeding the logit threshold) to create a receiver operating characteristic (ROC) curve. The ROC curve compared the predicted nomophobic individuals from the regression to individuals that were identified as nomophobic from the Rasch logit measures. Unlike the multivariate linear regression, this regression explored the predictability of having nomophobia rather than the predictability of the overall continuous nomophobia measure.

4. Results

4.1. (RQ1): What is the efficacy of currently-available survey items measuring smartphone dependency toward helping us draw a valid inference regarding a person's level of dependency?

4.1.1. Exploratory factor analysis

The 6 factors derived via maximum likelihood extraction from the EFA included [1] Nomophobia, [2] Social Anxiety, [3] Social/Self Responsibility, [4] Usage While Driving, [5] Self-Esteem and [6] Email While Driving. The pattern matrix showed that every nomophobia item had a strong loading onto factor 1. This is evidence that a single measure can be used to examine nomophobia. There was not a presence of other items loading onto this factor, although a few Social Interaction Anxiety Scale items (SIAS-1,5,9) had their second highest loadings onto Factor 1. Each factor was found reliable with Cronbach's $\alpha > 0.850$. All factors were saved as regression factor scores and then used to determine Pearson correlations (Table 1). Total percent of variance explained in the data was 51.43% with the 6 factors derived from the EFA. Each factor's percent variance explained can be seen in Table 2.

4.1.2. Item hierarchy, misfit, and departure from unidimensionality with respect to the Rasch Model

From the Rasch model, shown in Fig. 2, we were able to predict for participants of any measure what responses they would likely make on the questionnaire.

Table 1
Average scores on smartphone dependency scales (n = 159).

Instrument	Average	Minimum	Maximum	SD.
Nomophobia Questionnaire (NMP-Q) [a]	55	20	94	16.14
Mobile Phone Involvement Questionnaire (MPIQ) [b]	21	8	40	6.38
Smartphone Addiction Craving Scale (MPACS) [c]	21	8	40	7.77
Young Adult Attachment to Phones Scale (YAPS) – Refuge [d]	9	3	15	3.12
Young Adult Attachment to Phones Scale (YAPS) – Burden [e]	9	3	15	3.05

[a] Possible score range 20–100.
[b] Possible score range 8–40.
[c] Possible score range 8–40.
[d] Possible score range 3–15.
[e] Possible score range 3–15.

Table 2
Factors derived from EFA and their % of variance explained within the data.

Factor		Total % Variance in Data	Reliability	N of items
1	Nomophobia	20.47	0.956	42
2	Social Anxiety	13.45	0.799	23
3	Personal/Social Responsibility	6.35	0.826	13
4	Phone Usage While Driving	5.37	0.900	6
5	Self-Esteem	3.09	0.881	7
6	Email While Driving	2.71	0.852	4

*% Total Variance = 51.43%.

The most difficult item in the nomophobia survey included NMPQLos1, which regarded the loss of connectedness when participants were without their phone because the loss of their online identity. Another difficult item on the scale was the MPACS3, which assessed the craving for smartphones when participants were given the scenario to turn their phones off during a movie or work. The third most difficult item was another loss of connectedness item, NMPQLos3, which addressed the feeling of "awkwardness" from not being able to check phone notifications. In contrast, some items were much easier to agree with for those who expressed lower levels of dependency. There were items within the surveys with which the majority of people (irrespective of their level of dependency) were predicted to agree or strongly agree. The most agreeable of these items was YAPSref2, which assessed participants feeling safe with their phone on them. Other examples included the importance of accessing information (NMPQ2 and 4), and the craving of smartphone usage if their smartphone was accidently left at home.

Using item INFIT and OUTFIT statistics (Fig. 2), the Rasch model shows whether an item fits with its expectations, namely that the probability of agreeing with an item is proportional only to the difference between the item's agreeability and the participant's level of nomophobia. The following items were found to have extreme misfit values (INFIT or OUTFIT > 1.3), which means that participants with low nomophobia tended to agree with the item, or those with high nomophobia tended to disagree. Losing track of smartphone usage (MPIQlc) and participants dropping everything to answer their phone (MPIQca) were among these items. Those with less dependency tended to agree with hiding their phone during activities and having a sense of relief when their phones were not with them (YAPSBur 1 and 2). Participants' answers also did not fit the model in regard to losing connectedness by not being able to check their email messages (NMPQlos4) and giving up the convenience of their phone if they were to get stranded somewhere (NMPQconv4). Those with high nomophobia tended to disagree that they felt that they have lost control with regards to their cell usage, which

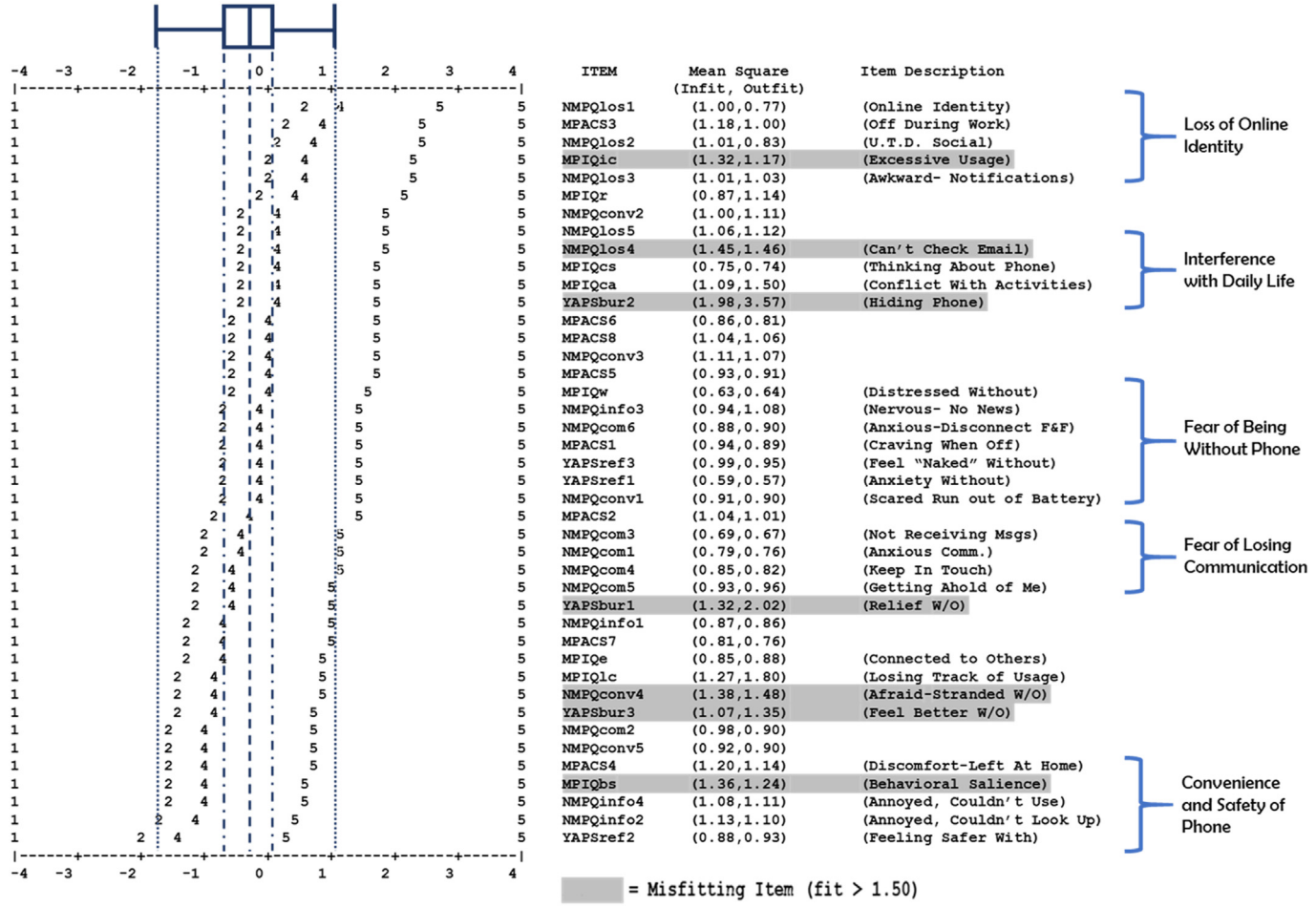

Fig. 2. Rasch Model for smartphone dependency.

may point to a denial aspect of the extreme dependency that characterizes nomophobia (MPIQlc). Another item that did not fit the Rasch model was MPIQbs, which assessed behavioral salience when playing with a phone for no particular reason.

In addition to providing interesting qualitative information about how behavioral traits change as level of nomophobia increases, we found that the collection of items (Fig. 2) yields a reliable measure of a person's position along the spectrum of dependency that can be used for quantitative analyses. Reliability of participants' measures with respect to the Rasch model was found to be 0.96 (Cronbach's $\alpha = 0.95$). This translates to a separation of 4.87, meaning that the measures are sufficiently precise to allow us to distinguish between approximately 5 levels of dependency. This matches the 5 qualitative levels derived from the item hierarchy (Fig. 2). Item measurement reliability, or the precision of the item measures along the scale, was found to be 0.98. This translates to a separation reliability of 7.18, which means that the items measures are precise enough to meaningfully divide the scale into 7 partitions. Collectively, these reliability values serve as evidence that the scale can meaningfully differentiate between the respective qualitative categories along the dependency spectrum outlined in Fig. 2.

Although the scale shows excellent reliability, some of the items nonetheless fell outside of the main dimension. Principal components analysis (PCA) on the residuals with respect to the model indicated that there was a cluster of items measuring something important peripheral to the main scale of dependency. The largest contrast (eigenvalue = 4.27) from this main scale showed that several items had unique characteristics that fell out of the dimension. NMPQinfo2 (loading = −0.34), NMPQlos5 (loading = −0.34), MPIQr (loading = −0.34), and MPIQbs (loading = −0.31) had negative loadings onto this residual component. These items all measure the interpersonal conflict of excessive phone usage, such as feeling weird when not able to use a cellular phone, losing track of how much the phone is used, and being unable to reduce smartphone usage. These items read as "confessions" for those with high levels of dependency, such as feeling better when their phone isn't on them. These represent comparatively personal feelings as opposed to the other items which focus on specific observable behaviors. NMPQcom items 1–6 (loadings between 0.66 and 0.81) had positive loadings on this residual component. These items measure worry or anxiety around not being able to communicate (Yildrim et al., 2016) which may be expressed differently by participants than reports of actual behaviors. Presence of these more emotion-focused items does not necessarily harm the scale in terms of reliability. However, removal of these items may result in a purer scale in research aimed at exploring nomophobia exclusively in terms of behavior.

4.2. (RQ.2) What demographic and psychological comorbidities, and outcomes accompany a person's level of dependency? (RQ.2.1) What is the relationship between level of smartphone dependency and self-esteem, depression, social anxiety, and sense of social responsibility?

4.2.1. Correlational analysis. With the factors from the EFA saved as regression variables, correlation tests were run to determine that [1] Nomophobia positively correlated with [2] social anxiety r = 0.178 and [4] Cell Usage While Driving r = 0.379. Factor [3] Personal/Social Responsibility, was found to be negatively correlated with social anxiety r = −0.410. [2] Social Anxiety also negatively correlated with [5] Self-esteem at r = −0.445. [5] Self-Esteem positively correlated with [3]

Personal/Social Responsibility r = .411 and negatively correlated with [4] Smartphone Usage while Driving r = −0.217. [6] Emails While Driving correlated positively with [4] Smartphone Usage While Driving (r = 0.351) and negatively with [5] Self-esteem (r = −0.151). Using the p-value method, the above correlations were found to be statistically significant at a 2-tailed 95% confidence level.

4.3. (RQ.2.2) What is the relationship between smartphone dependency and gender? (RQ.2.3) What is the relationship between level of smartphone dependency and the tendency to use a smartphone while driving?

4.3.1. Multivariate linear regression model for level of nomophobia. The seven predictors (Table 3) explained 22.1% of the variance in level of dependency ($R^2 = 0.221$, $F(7, 151) = 6.135$, $p < .0001$). Factor 3, Phone Usage While Driving, was found to be a significant and positive predictor of dependency (B = 0.314, SE = 0.071, $r_{partial} = 0.341$), indicating that distracted driving provides a useful diagnostic indicator for higher levels of dependency. However, Factor 6, Email While Driving, was found to be non-significant in predicting level of dependency. As for gender, females were found to have significantly higher levels of dependency on average than males (B = 0.424, SE = 0.158, $r_{partial} = 0.214$). In regard to psychological comorbidities, our model provided no evidence that social anxiety, self-esteem, or personal/social responsibility factors predict dependency. Students and faculty were found to have similar levels of dependency.

4.3.2. Binary logistic regression model for diagnosis of nomophobia. It was determined that a tentative diagnosis of nomophobia could be determined with respect to the logit cutoff of 0.05, representing the 3rd quartile of participants' dependency distribution (Fig. 2). This cutoff was chosen Table 4 based on the Rasch model prediction (Fig. 2) that participants with this level of dependency will likely choose a "4" (agree) response on the items associated with fear of being without one's phone. Those who had a Rasch logit measure greater or equal to 0.05 were considered to be nomophobic in this study.

Based on the binary logistic model, only Factor 3: Phone Usage While Driving (OR = 2.571, p = .037) and being female (OR = 3.826, p < .0001) were significant predictors of having nomophobia. The other factors nor being a student as opposed to a faculty member were significant predictors of having nomophobia. When all seven covariates are used, the model significantly predicts having nomophobia, $\chi^2 = 38.750$, df = 7, N = 159, p < .001, significantly better than using the sample mode as a predictor. Using the empirical approach for the ROC curve (AUC = 0.783, SE = 0.042), the best balance between specificity/sensitivity appeared to be a classification cutoff probability of 0.25. Results on the true and false positives and negatives yielded from this model are in Table 5. The specificity, or those who were predicted as not having nomophobia and actually do not have nomophobia, was 73.3%. Out of all of those who were identified as nomophobic in the model, 76.9% were actually nomophobic according to our 3rd quartile cutoff for diagnosis.

Table 4
Multivariate linear regression model for level of mobile phone dependency. $F_{(7,151)} = 6.135$, $p < .0001$, $r^2 = 0.221$, $r^2_{adj} = 0.185$.

Variable	B	SE	T	$r_{partial}$
(Constant)	-.620	.206	−3.004	
Student	-.024	.177	-.133	-.011
Female	.424[a]	.158	2.690	.214
Factor 2: Social Anxiety	.077	.081	.949	.077
Factor 3: Personal/Social Responsibility	-.232	.155	−1.502	-.121
Factor 4: Phone Usage While Driving	.314[a]	.071	4.450	.341
Factor 5: Self-Esteem	.067	.083	.810	.066
Factor 6: Email While Driving	-.037	.069	-.537	-.044

[a] Parameter is significant at the 0.01 level (2-tailed).

Table 5
Binary logistic regression showing true positives and true negatives on nomophobia cutoff score.

Predicted			
Observed	No Nomophobia	Has Nomophobia	Percentage Correct
No Nomophobia	88	32	73.3
Has Nomophobia	9	30	76.9
Overall Percentage			74.2

*Cutoff value 0.250.

5. Discussion

With drug and substance addiction, there is often a defined point where the abuse starts to affect daily life. However, studies have shown that smartphone addiction does not possess such clear criteria. Current surveys and their respective items measure a variety of traits inherent in smartphone dependency. However, what specific traits are sufficiently indicative of extreme dependency to warrant labels such as "nomophobia" or "smartphone addiction", and what quantitative level of dependency one must attain in order to manifest these extreme behaviors, needed further investigation. This begs the question: by defining dependency as a hierarchical spectrum, can we use a single measure to qualify the degree to which smartphone use interferes with daily life (Fig. 2)? This study illustrates the feasibility and usefulness of developing this type of qualitative ruler. Overall, it illustrates that nomophobia is a disease of virtual society and brings with it feelings of anxiety, discomfort and nervousness when out of contact with a smartphone (Kuss & Griffiths, 2011). While the Rasch model produced in this study gives meaningful insight to what possible levels of smartphone addiction may be present in society, it suggests the need for a validated instrument to be developed that can measure these respective categories in more detail, and in particular those traits that sit at the demarcation of the disorder: fear of being without the phone, interference with daily life, and loss of online identity.

Since a "phobia" indicates fear, in order to clinically diagnose nomophobia, it is recommended that an individual exhibits symptoms

Table 3
Pearson correlations for 6-factor model.

	Nomophobia	Social Anxiety	Personal/Social Responsibility	Smartphone Usage While Driving	Self-Esteem	Email While Driving
Nomophobia	–	.178[a]	-.137	.379[b]	−0.119	-.083
Social Anxiety	–	–	-.410[b]	0.120	-.445[b]	0.117
Personal/Social Responsibility	–	–	–	−0.049	.411[b]	0.014
Smartphone Usage While Driving	–	–	–	–	-.217[b]	.351[b]
Self-Esteem	–	–	–	–	–	-.151[a]
Email While Driving	–	–	–	–	–	–

N = 175.
[a] Correlation is significant at the 0.05 level (2-tailed).
[b] Correlation is significant at the 0.01 level (2-tailed).

indicative of fear. Further, given the prevalence of smartphones, we also expect to see a pattern of fear lead to significant interference with daily life. The recommended items for a cutoff point in a new survey would be the items regarding the interference in an individual's daily life including conflict in work, social life, school/academia or leisure (Bragazzi & Del Puente, 2014). This study supports the idea that nomophobia or smartphone addiction have the appearance of a behavioral addiction worthy of classification in ICD XI and DSM-V. Excessive use, withdrawal, tolerance, negative repercussions, and cravings were covered within this study and also address the four diagnostic components needed to be included in the DSM-V as a behavioral addiction (Bhatia, 2008).

Furthermore, Fig. 2 represents a spectrum from normal, mild, to severe levels of dependency assessed through the four previously validated smartphone addiction assessments pulled into the model. The separation from mild to severe levels of dependency in our model depends on whether or not subjects fear a loss of online identity or find discomfort in not staying up to date socially, which is consistent with the Rasch model of solely NMPQ items created by Rangka et al. (2018). In contrast, our model included 42 items representing different qualitative aspects of dependency drawn from four separate assessments. Supervisors, psychologists, counselors, and various others who are interested in distinguishing nomophobia or smartphone addiction in their peers—or even for people who wish to determine whether or not they themselves are addicted to their mobile devices, can use this model to aid in their diagnoses (Fig. 2). This finding may also push those responsible for creating DSM-V criteria toward analyzing whether or not smartphone addiction should be included with other behavioral addictions, considering there were items which represented interference with daily life which provided a cutoff point for nomophobia in this study.

Additionally, it is worth noting the items that fell outside of the main nomophobia dimension. The largest contrast included items with negative loadings which measure the interpersonal feelings of conflict of excessive phone usage, such as feeling weird when not able to use a cellular phone, losing track of how much the phone is used, and being unable to reduce smartphone usage. These items read as confessions for those with high nomophobia, considering they are fairly negative outcomes of one's own phone addiction. NMPQcom 1–6, which measure the nomophobic dimension of not being able to communicate (Yildrim et al., 2016), have positive loadings onto the residual dimension. In addition with YAPSbur, which also loaded positively on this residual factor, these NMPQcom items could together measure a participant's need to keep tabs on others, but distance when others want to keep tabs on the participants themselves. This might point to the human nature of nosiness (Whitfield, 2002), due to wanting to know what everyone else is up to but not wanting anyone to be in one's own personal business. Although these items do not necessarily harm the reliability of the scale, they do invoke a different construct than items focused exclusively on observable behavioral traits related to nomophobia. Research positioning nomophobia as a behavioral outcome may warrant removal or rewording of these items. On the other hand, efforts to explore the more emotional expressions of nomophobia may warrant retention of these items either within the same survey or as a separate subscale.

The EFA done in this study shows that assessments for nomophobia (NMP-Q), mobile phone addiction and cravings (MPACS, YAPS), and mobile phone involvement (MPIQ) all loaded on the same factor. Based on this, it is our recommendation, after this analysis of 4 validated smartphone addiction-related assessments, that the terms nomophobia and smartphone addiction be used interchangeably to support an extreme level of smartphone dependency based on the presence of behaviors indicating fear of being without the phone and observed interference with activities of daily living and productive social relationships. This is supported by other research which has called for nomophobia to be classified as a smartphone addiction disorder (Tran, 2016).

Although the correlation was weak, it is still interesting that low self-esteem negatively correlated with smartphone usage while driving. One way to rationalize this is the act of optimism bias when people use their mobile devices while driving. This bias can be described as the overestimation of the likelihood of positive events, and the underestimation of the likelihood of negative events (Sharot, 2011). This may especially apply to those with higher self-esteem and perception of low risk. This is an extremely dangerous combination when it comes to the hazards of distracted driving and is just one social consequence of smartphone addiction within our society. The correlational analysis also found a significant association between social anxiety and nomophobia, much like what Uysal, Özen, and Madenoğlu (2016) found in Turkish university students. Pierce (2009) also assessed the relationship between social anxiety and technology in teenagers, and found a significant positive relationship between discomfort in talking face-to-face with others and comfort in talking to others online and through text messaging. In order to better understand nomophobia and its measurement, future research may need to implement aspects of social anxiety or social phobias into their smartphone addiction studies. This would give a more rounded explanation of the driving factors in an individual's level of smartphone dependency.

There is some speculation as to why being female was a significant positive predictor for dependency. As mentioned previously, multiple studies have also found that smartphone addictions of middle school aged female students were significantly higher than their male counterparts. This finding is consistent with others which found women to be significantly more addicted to their smartphones than men (Koo, 2012; Roberts et al., 2014; De-Sola Gutiérrez et al., 2016). One proposed explanation relates to the safety that smartphones provide. Women have been found to report feeling unsafe in public spaces more than men (Condon, Lieber, & Maillochon, 2007). Smartphones are able to curb this feeling by providing an “out” or a way to call for help if they need it. In our study, which was done in a university setting, this feeling of vulnerability can also relate to college campuses. Women have to walk to their cars in parking lots which are often long distances away from their classes, and often at night. This is where the act of “communifaking” comes into play (Bhatia, 2008), where women have the option of faking a phone call to avoid strangers or dissuade possible prowlers. Aside from safety, an explanation for women's higher correlation with smartphone addiction could be social in nature—such as making more phone calls to family and friends or keeping their social media profiles up-to-date more than men (Chen et al., 2017; Roberts et al., 2014). This is not a new idea in society, as Junco, Merson, and Salter (2010) also found that college students that were female sent significantly more text messages and made longer phone calls than male college students.

5.1. Limitations

Limitations of this study include its self-report nature and its focus on a university context. Psychology professionals often rely on self-report questionnaires or interviews to assess and diagnose behavioral addictions; however, they have certain biases, especially with respect to smartphone usage. One study (Montag, Blaszkiewicz, Lachmann, Sariyska, Andone, Trendafilov, & Markowetz, 2015) gave participants a smartphone usage questionnaire and then installed an application to record actual phone usage for multiple weeks. They found that participants overestimated their weekly phone usage and that associations between actual usage and nomophobia could be better derived from the recorded behavior instead of the self-reported questionnaire. While actual usage may be a better variable than self-reported usage, it neglects the aspects of anxiousness or discomfort of being without a smartphone which is measured by the instruments used in this study. A recommendation for future studies would include being able to measure smartphone usage by recording it, and then coupling these data with self-report data.

Another limitation in this study dealt with using a college campus and therefore, individuals only over the age of 18. There is a large concern over smartphone addiction in youth and children, and the future consequences that this rise in technology may have on younger individuals

(Lin, 2010). Our study neglects to assess nomophobia and its consequences/comorbidities in these younger populations. Future studies may look into studying smartphone addiction among different aged populations in order to see the variation in levels of nomophobia among different age groups. In addition, the YAPS questionnaire used in this study has only been previously validated in young adults, even though 42.9% of our respondents were adults over the age of 30.

Even though the current average level of nomophobia in society is unknown, it is safe to say that a behavioral addiction has humanistic implications. One specific to smartphone dependency includes distracted driving (see Table 3, Table 6), which society has taken note of considering the mass campaigning to reduce the use of smartphones while driving (Cismaru & Nimegeers, 2017). Researchers are also attempting to understand enabling factors of distracted driving, even including the actions of smartphone distributors. One study done by Galitz (2017) titled "Killer Cell Phones and Complacent Companies" targeted a major cellular phone company's refusal to implement a distracted-driving mobile application. Even the World Health Organization has teamed up with the United States National Highway Traffic Safety Administration to create a report on the growing problem of driver distraction (World Health Organization & NHTSA U.S., 2011). Best practices for combatting phone addiction in regard to distracted driving is a topic of current debate. A behaviorist might say that more severe penalties will reduce distracted driving, since they may reject the prevalent notion that mobile phones themselves are responsible for the development of nomophobia and that nomophobia is a disorder that can't be separated from existing reinforcement (Winger, Woods, Galuska, Wade-Galuska, 2005). A liberal humanist might say that if nomophobia is a mental illness and that using mobile phones is a priority over driving, then the key to reducing distracted driving would be to identify and treat the patient without attaching a stigma to the behavior (like depression, anxiety, and alcoholism) (Kennett, Matthews, & Snoek, 2013). The findings in this study suggest a mix of these two practices. Not only do negative repercussions need to be increased for those who drive distracted, but it is also important to treat smartphone addiction for what it is—a mental disorder (King et al., 2013).

5.2. Interventions and Implications for practice

With an addiction comes recommendations for intervention. This is complex in that phones provide a variety of positive, and many times lifesaving, uses and it has been difficult to assess when phone usage becomes problematic. Physical effects like eye strain and hand cramping, and social consequences such as conflicts with others and feeling of fear without a mobile device, can take a toll on a person's body and mind (Acharya, Acharya, & Waghrey, 2013; Aggarwal, 2013). Some studies have proposed interventions one can take to combat their phone addiction (Ugur & Koc, 2015). One way to do this is to go on a mobile detox. This detoxification could be effective for those who seem to be inseparable from their mobiles and is described "a period of time during which a person refrains from using electronic devices such as smartphones or computers, regarded as an opportunity to reduce stress or focus on social interaction in the physical world" (Digital detox, 2014; Emek, 2014). King et al. (2013) found that the use of medication, cognitive-behavioral therapy and re-evaluation tools were successful in reducing time a nomophobic patient spent on his device, and significantly increased his exposure to real-life circumstances. This therapeutic approach may be successful in patients who were found to be extremely addicted to their smartphones, or in this study, those who score highly on the top few items in Fig. 2 regarding loss of online identity and online social networks.

To address more moderate levels of dependency, downloading an application to help track usage could be an easy step in reducing one's addiction (Bychkov & Young, 2018, pp. 161–171). This way, individuals could set limits for the number of hours or minutes they spend on their device each day and can reward themselves for their behavior. One may also find effectiveness in practicing mindfulness or relaxation, which even museums have incorporated into their programming (Duncan, 2014). During digital detoxes, some may find themselves practicing mindfulness unconsciously (Stanovsek, 2019). Relaxation without using a mobile device might reduce craving for a device when you are wanting to relax and could possibly reduce the anxiety/fear that accompanies nomophobia. We believe that setting boundaries for oneself is an important part of an effective intervention for nomophobia. The types of boundaries we ask a patient to set will depend on the level of nomophobia indicated in Fig. 2. Whether that be putting a phone away while interacting with family/friends, during activities such as sporting events or study groups, or making an effort to find other outlets to attach one's identify and self-worth, teaching a patient to set limits gives more personal control over behavior. At a minimum, we should encourage patients to set boundaries with respect to extremely dangerous circumstances, especially during driving.

Representing smartphone dependency as a hierarchical spectrum of symptoms (Fig. 2) may be useful for professionals needing help determining where a patient's level of dependency falls, and whether it is sufficiently problematic to warrant a diagnosis and treatment. In order to draw accurate qualitative measures, it is our recommendation that an interview with a patient should be done in addition to completing a questionnaire representing the symptoms along the spectrum. The qualitative interview portion should focus on how a patient's smartphone may interfere with their daily lives, considering that is a common threshold for behavioral addictions. Without qualitative data, professionals may struggle in treating a patient suffering from nomophobia successfully, considering smartphones can be used for interpersonal activities but also serve as intrapersonal devices in which use varies from person to person. Quantitative items, such as the four nomophobia assessments, have large importance in accordance with the validity and reliability that is needed in diagnosing individuals with nomophobia. It is up to us as a society to recognize smartphone addiction within ourselves and our peers, and the assessments used in this study can be an important first step in determining a person's level of dependency.

Table 6
Binary Logistic Regression done to predict nomophobic individuals (0/1) based on the 3rd quartile Rasch logit measure cutoff (Fig. 2).

Predictor	B	S.E.	W	sig.	OR	95% CI
Constant	−3.083	.928	11.039	.001		
Female	1.342	.645	4.331	.037	3.826*	1.08–13.54
Student	.746	.719	1.077	.299	2.109	.52–8.64
Factor 2: Social Anxiety	.490	.254	3.735	.053	1.633	.99–2.69
Factor 3: Personal/ Social Responsibility	-.630	.556	1.284	.257	.532	.18–1.58
Factor 4: Phone Usage While Driving	.944	.239	15.579	.000	2.571*	1.61–4.11
Factor 5: Self-Esteem	.461	.318	2.095	.148	1.585	.85–2.96
Factor 6: Email While Driving	-.027	.209	.017	.896	.973	.65–1.47

*Significant at the 0.05 level.

6. Conclusion

It is apparent that nomophobia is present in our society, and our data indicate that this represents a level of smartphone dependency where symptoms of fear and interference with daily life begin manifesting. Although there may be more work to be done before nomophobia or smartphone addiction can be considered a treatable disease, understanding specific types of symptoms that constitute different discrete levels of dependency takes brings us one step closer to understanding and treating nomophobia as a mental illness. Whether or not we ultimately

decide to include nomophobia or smartphone addiction in the DSM V, the fact remains that over attachment to smartphones can reduce one's quality of life dramatically. Our relationships with our mobile devices not only affect us, but also affect others who depend on us to make responsible decisions. When we text or send emails on our phones while driving, we are not only putting ourselves at great risk—but also every other driver or innocent pedestrian on the roadway. When we can't put our phones away during our children's sporting events or during family dinner, we affect our relationship with those who are closest to us. Phones have not only become an extension of our life, but in some cases, verge on interfering with our daily life.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A

Structure Matrix from Exploratory Factor Analysis.

Factors							
Variable	Description	Factor 1: Nomophobia	Factor 2: Social Anxiety	Factor 3: Personal/ Social Responsibility	Factor 4: Phone Usage While Driving	Factor 5: Self-Esteem	Factor 6: Email While Driving
NMPQinfo1	I would feel uncomfortable without constant access to information through my smartphone	**0.630**	0.009	−0.055	0.279	−0.008	0.121
NMPQinfo2	I would be annoyed if I could not look information up on my smartphone when I wanted to do so	**0.482**	0.060	0.008	0.206	0.002	0.008
NMPQinfo3	Being unable to get the news (e.g., happenings, weather, etc.) on my smartphone would make me nervous	**0.553**	0.154	−0.111	0.320	−0.156	0.066
NMPQinfo4	I would be annoyed if I could not use my smartphone and/or its capabilities when I wanted to do so	**0.497**	0.001	−0.045	0.359	−0.039	−0.005
NMPQconv1	Running out of battery in my smartphone would scare me	**0.663**	0.161	−0.057	0.225	−0.047	0.174
NMPQconv2	If I were to run out of credits or hit my monthly data limit, I would panic	**0.627**	0.183	−0.144	0.231	−0.144	0.011
NMPQconv3	If I did not have a data signal or could not connect to Wi-Fi, then I would constantly check to see if I had a signal or could find a Wi-Fi network	**0.570**	0.087	−0.130	0.281	−0.153	0.033
NMPQconv4	If I could not use my smartphone, I would be afraid of getting stranded somewhere	**0.535**	0.233	−0.086	0.190	−0.085	0.066
NMPQconv5	If I could not check my smartphone for a while, I would feel a desire to check it	**0.595**	0.047	−0.033	0.200	0.025	0.008
NMPQcom1	If I did not have my smartphone with me, I would feel anxious because I could not instantly communicate with my family and/or friends.	**0.717**	0.012	−0.083	0.226	−0.076	0.035
NMPQcom2	If I did not have my smartphone with me, I would be worried because my family and/or friends could not reach me	**0.648**	0.005	−0.023	0.094	−0.028	0.024
NMPQcom3	If I did not have my smartphone with me, I would feel nervous because I would not be able to receive text messages and calls	**0.762**	0.031	−0.044	0.216	−0.123	0.085
NMPQcom4	If I did not have my smartphone with me, I would be anxious because I could not keep in touch with my family and/or friends.	**0.726**	0.085	−0.059	0.175	−0.079	0.020
NMPQcom5	If I did not have my smartphone with me, I would be nervous because I could not know if someone had tried to get a hold of me	**0.679**	0.035	−0.043	0.153	−0.114	0.022
NMPQcom6	If I did not have my smartphone with me, I would feel anxious because my constant connection to my family and friends would be broken.	**0.698**	0.005	−0.060	0.213	−0.112	0.041
NMPQLosCon1	If I did not have my smartphone with me, I would be nervous because I would be disconnected from my online identity	**0.580**	0.090	−0.170	0.316	−0.268	0.095
NMPQLosCon2	If I did not have my smartphone with me, I would be uncomfortable because I could not stay up-to-date with social media and online networks	**0.606**	0.104	−0.160	0.342	−0.225	−0.009
NMPQLosCon3	If I did not have my smartphone with me, I would feel awkward because I could not check my notifications for updates from my connections and online networks	**0.538**	0.228	−0.133	0.316	−0.150	−0.042
NMPQLosCon4	If I did not have my smartphone with me, I would feel anxious because I could not check my email messages	**0.432**	0.004	−0.008	0.111	0.108	−0.007
NMPQLosCon5		**0.522**	0.330	−0.148	0.312	−0.105	0.052

(*continued on next column*)

(*continued*)

Factors							
Variable	Description	Factor 1: Nomophobia	Factor 2: Social Anxiety	Factor 3: Personal/ Social Responsibility	Factor 4: Phone Usage While Driving	Factor 5: Self-Esteem	Factor 6: Email While Driving
	If I did not have my smartphone, I would feel weird because I would not know what to do						
MPIQCogSal	I often think about my smartphone when I am not using it.	**0.647**	0.112	−0.109	0.379	−0.067	0.044
MPIQBehSal	I often use my smartphone for no particular reason.	**0.464**	0.192	−0.138	0.412	−0.158	0.136
MPIQIntConf	Arguments have arisen with others because of my smartphone use.	**0.493**	0.094	−0.109	0.477	−0.091	0.258
MPIQConfw/ Act	I interrupt whatever else I am doing when I am contacted on my smartphone.	**0.426**	0.073	−0.110	0.254	−0.022	0.011
MPIQEuph	I feel connected to others when I use my smartphone.	**0.598**	−0.003	−0.036	0.102	0.043	0.008
MPIQLosCont	I lose track of how much I am using my smartphone.	**0.507**	0.099	−0.099	0.317	0.111	0.045
MPIQWthdr	The thought of being without my smartphone makes me feel distressed.	**0.729**	0.273	−0.095	0.262	−0.017	0.111
MPIQRelpse	I have been unable to reduce my smartphone use.	**0.484**	0.238	−0.237	0.388	−0.121	0.012
MPACS1	I would feel uncomfortable if I wanted to turn my phone on right now and could not or would not be allowed to.	**0.693**	0.153	−0.102	0.252	−0.076	0.016
MPACS2	I would feel uncomfortable if, at this very moment, I found myself out of battery or without coverage.	**0.625**	0.125	−0.086	0.142	−0.023	−0.059
MPACS3	I would feel uncomfortable if, at this very moment, I should be forced to turn my smartphone off because I was at the movies or work.	**0.575**	0.115	−0.088	0.266	−0.123	0.004
MPACS4	I would feel uncomfortable if, at this very moment, I realized that I left my phone at home.	**0.630**	0.120	−0.092	0.112	−0.050	0.024
MPACS5	I would feel uncomfortable if, at this very moment, I could not or if they did not let me reply to a message.	**0.663**	0.201	−0.195	0.243	−0.258	0.038
MPACS6	I would feel uncomfortable if I was with people and my phone was not working.	**0.633**	0.229	−0.145	0.247	−0.155	0.097
MPACS7	I would feel uncomfortable if I was in a place or situation in which I always used my phone, and no longer could.	**0.711**	0.193	−0.169	0.376	−0.185	0.107
MPACS8	I would feel uncomfortable if, at this very moment, I was restless and needed to relax and did not have my phone available.	**0.587**	0.154	−0.134	0.198	−0.158	0.158
SIAS1	I get nervous if I have to speak with someone in authority	0.374	**0.649**	−0.288	0.141	−0.298	0.103
SIAS2	I have difficulty making eye contact with others	0.233	**0.692**	−0.330	0.088	−0.412	0.078
SIAS3	I become tense if I have to talk about myself or my feelings	0.030	**0.708**	−0.322	0.018	−0.422	0.032
SIAS4	I find it difficult to mix comfortably with the people I work with	0.181	**0.737**	−0.279	0.196	−0.296	0.112
SIAS5	I find it easy to make friends my own age	0.102	**−0.500**	0.198	−0.058	0.254	−0.018
SIAS6	I tense up if I meet an acquaintance in the street	0.130	**0.736**	−0.298	0.172	−0.275	0.133
SIAS7	When mixing socially, I am uncomfortable	0.078	**0.807**	−0.283	0.116	−0.292	0.099
SIAS8	I feel tense if I am alone with just one other person	0.247	**0.588**	−0.194	0.157	−0.268	0.231
SIAS9	I am at ease meeting people at parties, etc.	0.105	**−0.603**	0.241	0.041	0.379	0.039
SIAS10	I have difficulty talking with other people	0.119	**0.856**	−0.317	0.048	−0.318	0.092
SIAS11	I find it easy to think of things to talk about	−0.090	**−0.496**	0.228	−0.112	0.422	−0.100
SIAS12	I worry about expressing myself in case I appear awkward.	0.231	**0.678**	−0.301	−0.058	−0.295	0.002
SIAS13	I find it difficult to disagree with another's point of view	0.154	**0.308**	−0.064	−0.053	0.031	0.028
SIAS14	I have difficulty talking to persons I find attractive.	0.087	**0.494**	−0.187	0.030	−0.176	0.147
SIAS15	I find myself worrying that I won't know what to say in social situations	0.246	**0.821**	−0.328	0.104	−0.344	0.097
SIAS16	I am nervous mixing with people I don't know well	0.150	**0.819**	−0.281	0.041	−0.292	0.091
SIAS17	I feel I'll say something embarrassing when talking	0.265	**0.653**	−0.363	0.088	−0.445	0.177
SIAS18	When mixing in a group, I find myself worrying I will be ignored	0.279	**0.606**	−0.301	0.172	−0.382	0.156
SIAS19	I am tense mixing in a group	0.109	**0.892**	−0.338	0.138	−0.360	0.090
SIAS20	I am unsure whether to greet someone I know only slightly	0.137	**0.740**	−0.286	0.167	−0.292	0.095
RosSE1	On the whole, I am satisfied with myself.	−0.139	−0.409	0.366	−0.267	**0.687**	−0.242
RoseSE2	At time I think I am no good at all.	−0.200	−0.357	**0.813**	−0.120	0.487	−0.046
RoseSE3	I feel that I have a number of good qualities.	−0.105	−0.441	0.310	−0.278	**0.763**	−0.279
RoseSE4	I am able to do things as well as most other people.	−0.123	−0.361	0.302	−0.122	**0.788**	−0.091
RoseSE5	I feel I do not have much to be proud of.	0.077	−0.310	**0.853**	0.016	0.452	0.043
RoseSE6	I certainly feel useless at times.	−0.147	−0.319	**0.782**	−0.072	0.426	0.009
RoseSE7	I feel that I'm a person of worth, at least on an equal plane with others.	−0.097	−0.519	0.385	−0.180	**0.870**	−0.089

(*continued on next column*)

(*continued*)

Factors							
Variable	Description	Factor 1: Nomophobia	Factor 2: Social Anxiety	Factor 3: Personal/ Social Responsibility	Factor 4: Phone Usage While Driving	Factor 5: Self-Esteem	Factor 6: Email While Driving
RoseSE8	I wish I could have more respect for myself.	−0.161	−0.377	**0.722**	−0.006	0.366	−0.032
RoseSE9	All in all, I am inclined to feel that I am a failure.	−0.057	−0.376	**0.889**	−0.027	0.526	0.045
RoseSE10	I take a positive attitude toward myself.	−0.184	−0.524	0.365	−0.274	**0.778**	−0.131
OPERASEx1	I am the life and soul of the party.	0.064	−0.405	0.166	0.072	0.167	0.001
OPERASEmSt1	I am always prepared to assume responsibility.	−0.185	−0.234	0.212	−0.105	**0.290**	−0.088
OPERASEx2	I find it easy to cope with social situations.	0.018	**−0.723**	0.342	−0.018	0.447	0.080
OPERASEmSt2	I avoid my obligations.	−0.200	−0.228	**0.848**	−0.085	0.308	−0.012
OPERASEx3	I am not very talkative.	0.098	−0.481	**0.613**	0.197	0.100	0.027
OPERASEmSt3	I leave things half done.	−0.144	−0.158	**0.730**	−0.030	0.171	0.029
OPERASEx4	I make friends easily.	−0.018	**−0.636**	0.228	−0.087	0.427	−0.117
OPERASEEmSt4	I am untidy.	−0.139	−0.161	**0.650**	−0.076	0.053	−0.050
OPERASEx5	I prefer others to be the center of attention.	0.015	−0.293	**0.610**	0.130	0.016	0.094
OPERASEmSt5	I am a perfectionist.	0.043	0.104	0.036	−0.095	0.057	0.008
OPERASEx6	I remain in the background.	−0.024	−0.486	**0.699**	0.101	0.222	0.108
OPERASEmSt6	I waste time.	−0.135	−0.314	**0.731**	−0.157	0.270	0.011
OPERASEx7	I know how to get along with people.	0.050	−0.480	0.201	−0.002	**0.554**	−0.066
OPERASEmSt7	When I make plans, I stick to them.	−0.149	−0.267	0.273	−0.232	**0.510**	−0.165
YAPSRef1	I feel anxious or uncomfortable when I can't check my phone.	**0.793**	0.120	−0.092	0.301	−0.046	0.045
YAPSRef2	Having my phone makes me feel safer.	**0.627**	0.076	−0.019	0.072	0.119	−0.030
YAPSRef3	I feel naked without my phone.	**0.648**	0.174	−0.085	0.303	0.020	0.099
YAPSBur1	Being without my phone gives me a sense of relief.	**−0.297**	−0.003	−0.021	0.027	0.038	−0.056
YAPSBur2	I intentionally put my phone out of reach to enjoy an activity I'm engaged in.	−0.049	−0.062	−0.028	−0.066	**0.185**	−0.074
YAPSBur3	I feel better when I don't have my phone on me.	**−0.431**	−0.109	−0.008	−0.089	0.078	−0.076
TxtDrv	How often do you think that you can safely text and drive?	0.285	0.058	−0.081	**0.719**	−0.199	0.310
ReadTxt	In the last 30 days, have you READ text messages while driving?	0.309	0.064	−0.087	**0.824**	−0.212	0.288
ReadTxtFrq	In the last 30 days, WHEN have you READ text messages? (select all that apply)	0.365	0.127	0.160	**0.826**	−0.129	0.233
ReadEml	In the last 30 days, have you READ email while driving?	0.144	0.113	−0.067	0.579	−0.092	**0.688**
ReadEmlFrq	In the last 30 days, WHEN have you READ email? (select all that apply)	0.127	0.152	0.013	0.545	−0.055	**0.634**
MapFrq	In the last 30 days, have you viewed maps or directions on your phone while driving?	0.345	−0.007	−0.039	**0.476**	−0.093	0.110
WriteTxt	In the last 30 days, have you WRITTEN text messages while driving?	0.236	0.039	−0.101	**0.866**	−0.239	0.289
WriteTxtFrq	In the last 30 days, WHEN have you WRITTEN text messages while driving? (select all that apply)	0.339	0.101	0.101	**0.913**	−0.179	0.288
WriteEml	In the last 30 days, have you WRITTEN email while driving?	0.051	0.128	−0.021	0.347	−0.313	**0.913**
WriteEmlFrq	In the last 30 days, WHEN have you WRITTEN email while driving? (select all that apply)	0.062	0.194	−0.022	0.374	−0.246	**0.948**
SocialMedia	In the last 30 days, have you read messages or viewed information on social media apps or sites while driving? (e.g. Facebook, Twitter, Snapchat, etc.)	0.194	0.085	−0.071	**0.681**	−0.137	0.476

*Extraction Method: Maximum Likelihood.
**Rotation Method: Promax with Kaiser Normalization.

Appendix B

The 20 items for the NMP-Q developed by Yildrim and Correia (2015). Scored on a 5-point Likert scale for this study (1 = Strongly Disagree to 5 = Strongly Agree).

NMP-Q Questionnaire
1. I would feel uncomfortable without constant access to information through my smartphone
2. I would be annoyed if I could not look information up on my smartphone when I wanted to do so
3. Being unable to get the news (e.g., happenings, weather, etc.) on my smartphone would make me nervous
4. I would be annoyed if I could not use my smartphone and/or its capabilities when I wanted to do so
5. Running out of battery in my smartphone would scare me
6. If I were to run out of credits or hit my monthly data limit, I would panic
7. If I did not have a data signal or could not connect to Wi-Fi, then I would constantly check to see if I had a signal or could find a Wi-Fi network
8. If I could not use my smartphone, I would be afraid of getting stranded somewhere
9. If I could not check my smartphone for a while, I would feel a desire to check it

(*continued on next column*)

(*continued*)

NMP-Q Questionnaire
If I did not have my smartphone with me,
10. I would feel anxious because I could not instantly communicate with my family and/or friends
11. I would be worried because my family and/or friends could not reach me
12. I would feel nervous because I would not be able to receive text messages and calls
13. I would be anxious because I could not keep in touch with my family and/or friends
14. I would be nervous because I could not know if someone had tried to get a hold of me
15. I would feel anxious because my constant connection to my family and friends would be broken
16. I would be nervous because I would be disconnected from my online identity
17. I would be uncomfortable because I could not stay up-to-date with social media and online networks
18. I would feel awkward because I could not check my notifications for updates from my connections and online networks
19. I would feel anxious because I could not check my email messages
20. I would feel weird because I would not know what to do

Appendix C

The 8 items from MPIQ, developed by Walsh et al. (2010). Scored on a 5 point Likert scale in this study (1 = Strongly Disagree to 5 = Strongly Agree).

Smartphone Involvement Questionnaire (MPIQ):
1. I often think about my smartphone when I am not using it (cognitive salience)
2. I often use my smartphone for no particular reason (behavioral salience)
3. Arguments have arisen with others because of my smartphone use (interpersonal conflict)
4. I interrupt whatever else I am doing when I am contacted on my smartphone (conflict with other activities)
5. I feel connected to others when I use my smartphone (euphoria)
6. I lose track of how much I am using my smartphone (loss of control)
7. The thought of being without my smartphone makes me feel distressed (withdrawal)
8. I have been unable to reduce my smartphone use (relapse and reinstatement)

Appendix D

The 15 items from MPACS, developed by De-Sola et al. (2017). Graded from 1 (strongly disagree) to 5 (strongly agree) on a 5-point Likert scale in this study. The phrase "I would feel uncomfortable [if …]" was added to each question in order for the original Spanish version to translate to English smoothly.

Mobile Phone Addiction Craving Scale ECAM, MPACS
1. [I would feel uncomfortable] If I wanted to turn [my phone] on right now and could not or would not be allowed to.
2. [I would feel uncomfortable] If, at this very moment, I found myself out of battery or without coverage.
3. [I would feel uncomfortable] If, at this very moment, I should be forced to turn [my smartphone] off because I was at the movies or at work.
4. [I would feel uncomfortable] If, at this very moment, I realized that I left [my phone] at home.
5. [I would feel uncomfortable] If, at this very moment, I could not or if they did not let me reply to a message.
6. [I would feel uncomfortable] If I was with people at the moment I was using it and it did not work for me.
7. [I would feel uncomfortable] If I was in a place or a situation in which I always used [my phone] and no longer could.
8. [I would feel uncomfortable] If, at this very moment, I was restless and needed to relax and did not have [my phone] available.

Appendix E

The six items from YAPS, developed by Trub and Barbot (2016). This instrument was given a 5 point Likert scale (1 = "does not describe me at all", 5 = "describes me perfectly").

YAPS Young Adult Attachment to Phone Scale
Factor 1: Refuge
1. I feel anxious or uncomfortable when I can't check my phone.
2. Having my phone makes me feel safer.
3. I feel naked without my phone.
Factor 2: Burden (reverse coded)
4. Being without my phone gives me a sense of relief.
5. I intentionally put my phone out of reach to enjoy an activity I'm engaged in.
6. I feel better when I don't have my phone on me

Appendix F

The 10 items from Rosenberg's Self-Esteem Scale (1965). Items 2, 5, 6, 8, and 9 are reverse coded. Items were graded on a 5 point Likert Scale (1 = strongly disagree, 5 = strongly agree).

Rosenberg Self Esteem Scale
1. On the whole, I am satisfied with myself.
2. At times I think I am no good at all. (reverse coded)
3. I feel that I have a number of good qualities.
4. I am able to do things as well as most other people.
5. I feel I do not have much to be proud of. (reverse coded)
6. I certainly feel useless at times. (reverse coded)
7. I feel that I'm a person of worth, at least on an equal plane with others.
8. I wish I could have more respect for myself. (reverse coded)
9. All in all, I am inclined to feel that I am a failure. (reverse coded)
10. I take a positive attitude toward myself.

Appendix G

The 20 items from the Social Interaction Anxiety Scale (SIAS), developed by. Items were measured on a 5 point Likert scale in this study (1 = "not at all characteristic of you" to 5 = "extremely characteristic of you").

Social Interaction Anxiety Scale (SIAS)
1. I get nervous if I have to speak with someone in authority (teacher, boss, etc.).
2. I have difficulty making eye contact with others.
3. I become tense if I have to talk about myself or my feelings.
4. I find it difficult to mix comfortably with the people I work with.
5. I find it easy to make friends my own age. (reverse coded)
6. I tense up if I meet an acquaintance in the street.
7. When mixing socially, I am uncomfortable.
8. I feel tense if I am alone with just one other person.
9. I am at ease meeting people at parties, etc. (reverse coded)
10. I have difficulty talking with other people.
11. I find it easy to think of things to talk about. (reverse coded)
12. I worry about expressing myself in case I appear awkward.
13. I find it difficult to disagree with another's point of view.
14. I have difficulty talking to attractive persons of the opposite sex.
15. I find myself worrying that I won't know what to say in social situations.
16. I am nervous mixing with people I don't know well.
17. I feel I'll say something embarrassing when talking.
18. When mixing in a group, I find myself worrying I will be ignored.
19. I am tense mixing in a group.
20. I am unsure whether to greet someone I know only slightly.

Appendix H

The 11 items taken from the Distracted Driving Survey (DDS), developed by Bergmark, Gliklich, Guo, and Gliklich (2016). All items were scored on a 5 point Likert scale. All were reverse coded at the end of the study to measure distractedness as the most positive value.

Distracted Driving Survey Questions
How often do you think you can safely text and drive?*
In the last 30 days, have you READ text messages while driving?***
In the last 30 days, WHEN have you READ text messages? (select all that apply)**
In the last 30 days, have you READ email while driving?***
In the last 30 days, WHEN have you READ email? (select all that apply)**
In the last 30 days, have you viewed maps or directions on your phone while driving?***
In the last 30 days, have you WRITTEN text messages while driving?***
In the last 30 days, WHEN have you WRITTEN text messages while driving? (select all that apply)**
In the last 30 days, have you WRITTEN email while driving?***
In the last 30 days, WHEN have you WRITTEN email while driving? (select all that apply)**
In the last 30 days, have you read messages or viewed information on social media apps or sites while driving? (e.g. Facebook, Twitter, Snapchat, etc.)***

*5 point response from 1 = always, 5 = never.
**5 point response from 1 = While driving at any speed, 2 = While driving at low speeds (under 25 mph), 3 = while in stop-and-go traffic, 4 = While stopped at a red light 5 = None of the above.
***5 point response from 1 = every time I drive, 2 = most of the times I drive, 3 = some of the times I drive, 4 = rarely, 5 = never.

Appendix I

Items from the Overall Personality Assessment Scale (OPERAS), developed by Vigil-Colet et al. (2013). Seven Extraversion items (α = 0.85) and Seven Emotional Stability items (α = 0.74) were used in this study from the OPERAS. These items were scored on a 5 point Likert scale.

Extraversion Items
I am the life and soul of the party.
I find it easy to cope with social situations.
I am not very talkative.
I make friends easily.
I prefer others to be the center of attention.
I remain in the background.
I know how to get along with people.
Emotional Stability Items
I am always prepared to assume responsibility.
I avoid my obligations.
I leave things half done.
I am untidy.
I am a perfectionist.
I waste time.
When I make plans, I stick to them.

References

Acharya, J. P., Acharya, I., & Waghrey, D. (2013). A study on some of the common health effects of cell-phones amongst college students. *Journal of Community Medicine & Health Education, 3*(4), 1–4.

Adawi, M., Bragazzi, N. L., Argumosa-Villar, L., Boada-Grau, J., Vigil-Colet, A., Yildirim, C., & Watad, A. (2018). Translation and validation of the Nomophobia Questionnaire in the Italian language: Exploratory factor analysis. *JMIR mHealth and uHealth, 6*(1), e24.

Aggarwal, K. K. (2013). Twenty-six percent doctors suffer from severe mobile phone-induced anxiety: Excessive use of mobile phone can be injurious to your health. *Indian Journal of Clinical Practice, 24*(1), 7–9.

Alavi, S. S., Ferdosi, M., Jannatifard, F., Eslami, M., Alaghemandan, H., & Setare, M. (2012). Behavioral addiction versus substance addiction: Correspondence of psychiatric and psychological views. *International Journal of Preventive Medicine, 3*(4), 290.

Ali, A., Muda, M., Ridzuan, A. R., Nuji, M. N. N., Izzamuddin, M. H. M., & Latiff, D. I. A. (2017). The relationship between phone usage factors and nomophobia. *Advanced Science Letters, 23*(8), 7610–7613.

Anshari, M., Alas, Y., & Sulaiman, E. (2019). Smartphone addictions and nomophobia among youth. *Vulnerable Children and Youth Studies, 14*(3), 242–247. https://doi.org/10.1080/17450128.2019.1614709

Argumosa-Villar, L., Boada-Grau, J., & Vigil-Colet, A. (2017). Exploratory investigation of theoretical predictors of nomophobia using the Smartphone Involvement Questionnaire (MPIQ). *Journal of Adolescence, 56*, 127–135.

Arpaci, I., Baloğlu, M., Özteke Kozan, H., & Kesici, Ş. (2017). Individual differences in the relationship between attachment and nomophobia among college students: The mediating role of mindfulness. *Journal of Medical Internet Research, 19*(12), e404. https://doi.org/10.2196/jmir.8847. . (Accessed 14 December 2017)

Ballestar-Tarín, M. L., Simó-Sanz, C., Chover-Sierra, E., Saus-Ortega, C., Casal-Angulo, M. D. C., & Martínez-Sabater, A. (2020). Self-perception of dependence as an indicator of smartphone addiction—establishment of a cutoff point in the spai–Spain inventory. *International Journal of Environmental Research and Public Health, 17*(11), 3838.

Bergmark, R. W., Gliklich, E., Guo, R., & Gliklich, R. E. (2016). Texting while driving: The development and validation of the distracted driving survey and risk score among young adults. *Injury Epidemiology, 3*(1), 7.

Bhatia, M. S. (2008). Smartphone dependence–A new diagnostic entity. *Delhi Psychiatry Journal, 11*(2), 123–124.

Bhattacharya, S., Bashar, M. A., Srivastava, A., & Singh, A. (2019). Nomophobia: NO MObile PHone PhoBIA. *Journal of Family Medicine and Primary Care, 8*(4), 1297–1300. https://doi.org/10.4103/jfmpc.jfmpc_71_19

Billieux, J., Schimmenti, A., Khazaal, Y., Maurage, P., & Heeren, A. (2015). Are we overpathologizing everyday life? A tenable blueprint for behavioral addiction research. *Journal of Behavioral Addictions, 4*(3), 119–123.

Bommer, W. (2018). *Observational study of distracted driving due to electronic device use among California drivers for 2018: Summary report.* California Office of Traffic Safety. https://www.ots.ca.gov/wp-content/uploads/sites/67/2018/11/2018-OTS-Distracted-Driving-Report-updated.pdf. (Accessed 1 October 2019).

Bragazzi, N. L., & Del Puente, G. (2014). A proposal for including nomophobia in the newDSM-V. *Psychology Research and Behavior Management, 7*, 155–160. https://doi.org/10.2147/PRBM.S41386

Brown, R. I. F. (1988). Reversal theory and subjective experience in the explanation of addiction and relapse, *51. Advances in Psychology* (pp. 191–211). North-Holland.

Brown, R. I. F. (1993). Some contributions of the study of gambling to the study of other addictions. *Gambling Behavior and Problem Gambling, 1*, 241–272.

Brown, R. I. F. (1997). A theoretical model of the behavioural addictions–applied to offending. *Addicted to Crime*, 13–65.

Buctot, D. B., Kim, N., & Kim, S. H. (2020). The role of nomophobia and smartphone addiction in the lifestyle profiles of junior and senior high school students in the Philippines. *Social Sciences & Humanities Open, 2*(1), 100035.

Bychkov, D., & Young, S. D. (2018). Facing up to nomophobia: A systematic review of mobile phone apps that reduce smartphone usage. *Big data in engineering applications*. Singapore: Springer.

Cattell, R. B. (1966). The scree test for the number of factors. *Multivariate Behavioral Research, 1*, 245–276.

Centers for Disease Control and Prevention. (2017). *Youth risk behavior surveillance—United States*. Available at: https://www.cdc.gov/features/yrbs/. (Accessed 1 October 2019).

Chen, B., Liu, F., Ding, S., Ying, X., Wang, L., & Wen, Y. (2017). Gender differences in factors associated with smartphone addiction: a cross-sectional study among medical college students. *BMC Psychiatry, 17*(1), 1–9.

Choliz, M. (2010). Smartphone addiction: A point of issue. *Addiction, 105*(2), 373–374.

Cismaru, M., & Nimegeers, K. (2017). "Keep your eyes up, don't text and drive": A review of anti-texting while driving campaigns' recommendations. *International Review on Public and Nonprofit Marketing, 14*(1), 113–135.

Clayton, R. B., Leshner, G., & Almond, A. (2015). The extended iSelf: The impact of iPhone separation on cognition, emotion, and physiology. *Journal of Computer-Mediated Communication, 20*(2), 119–135.

Collins, L. M., & Lanza, S. T. (2013). *Latent class and latent transition analysis: With applications in the social, behavioral, and health sciences* (Vol. 718). New York: Wiley.

Condon, S., Lieber, M., & Maillochon, F. (2007). Feeling unsafe in public places: Understanding women's fears. *Revue Française de Sociologie, 48*(5), 101–128.

Coyne, S. M., Stockdale, L., & Summers, K. (2019). Problematic smartphone use, depression, anxiety, and self-regulation: Evidence from a three year longitudinal study from adolescence to emerging adulthood. *Computers in Human Behavior, 96*, 78–84.

De-Sola Gutiérrez, J., Rodríguez de Fonseca, F., & Rubio, G. (2016). Cell-phone addiction: A review. *Frontiers in Psychiatry, 7*, 175. https://doi.org/10.3389/fpsyt.2016.00175

De-Sola, J., Talledo, H., Rubio, G., & de Fonseca, F. R. (2017). Development of a smartphone addiction craving scale and its validation in a Spanish adult population. *Frontiers in Psychiatry, 8*, 90.

Digital detox. (2014). In Oxford Online Dictionary. Retrieved from https://en.oxforddictionaries.com/definition/digital_detox.

Duncan, B. M. (2014). *Digital Detox, Mindfulness, and Art Museums*. Drexel: USA: Drexel University.

Emanuel, R., Bell, R., Cotton, C., Craig, J., Drummond, D., Gibson, S., & Lewis, J. (2015). The truth about smartphone addiction. *College Student Journal, 49*(2), 291–299.

EMEK, M. (2014). In C. Kerdpitak, A. Benabdelhafid, K. Keuer, & G. Nartea (Eds.), *Proceedings of European Academic Conference on Business Tourism & Apply Sciences in Europe & America 2014 "International Conference on Tourism Transport & Technology ICTTT 2014", 1-3 August 2014*. United Kingdom: The Brunel University.

Galitz, S. (2017). Killer smartphones and complacent Companies: How apple fails to cure distracted driving fatalities. *University of Miami Law Review, 72*, 880.

Gilbert, P. (2000). The relationship of shame, social anxiety and depression: The role of the evaluation of social rank. *Clinical Psychology & Psychotherapy, 7*, 174–189.

Gliklich, J., Maurer, R., & Bergmark, R. W. (2019). Patterns of texting and driving in a US national survey of millennial parents vs older parents. *JAMA Pediatrics, 173*(7), 689–690.

González-Cabrera, J., León-Mejía, A., Perez-Sancho, C., & Calvete, E. (2017). Adaptation of the nomophobia questionnaire (NMP-Q) to Spanish in a sample of adolescents. *Actas Españolas de Psiquiatría, 45*(4), 137–144.

Griffiths, M. (1995). February). Technological addictions. *Clinical psychology forum*. Division of Clinical Psychology of the British Psychol Soc, 14-14.
Ha, J. H., Chin, B., Park, D. H., Ryu, S. H., & Yu, J. (2008). Characteristics of excessive cellular phone use in Korean adolescents. *CyberPsychology and Behavior, 11*(6), 783–784.
Henson, R. K., & Roberts, J. K. (2001, February). A meta-analytic review of exploratory factor analysis reporting practices in published research. In *Paper presented at the annual meeting of the Southwest Educational Research Association, New Orleans, LA. (ERIC Document Reproduction Service No. ED449227)*.
IBM SPSS statistics for windows, version. Armonk, NY: IBM Corp., 2015.
Junco, R., Merson, D., & Salter, D. W. (2010). The effect of gender, ethnicity, and income on college students' use of communication technologies. *Cyberpsychology, Behavior, and Social Networking, 13*(6), 619–627.
Kaiser, H. F. (1960). The application of electronic computers to factor analysis. *Educational and Psychological Measurement, 20*(1), 141–151.
Kennett, J. M., Matthews, S., & Snoek, A. (2013). Pleasure and addiction. *Frontiers in Psychiatry, 4*, 117.
Kim, Y., Jeong, J., Cho, H., Jung, D., Kwak, M., Rho, M. J., … Choi, I. Y. (2016). Personality factors predicting smartphone addiction predisposition: Behavioral inhibition and activation systems, impulsivity, and self-control. *PloS One, 11*(8), 1–15. https://doi.org/10.1371/journal.pone.0159788
King, A. L. S., Valença, A. M., Silva, A. C. O., Baczynski, T., Carvalho, M. R., & Nardi, A. E. (2013). Nomophobia: Dependency on virtual environments or social phobia? *Computers in Human Behavior, 29*(1), 140–144. https://doi.org/10.1016/j.chb.2012.07.025. ISSN 0747-5632.
Koo, H. Y. (2012). Factors influencing smartphone addiction in middle school students by gender. *Korean Parent-Child Health Journal, 15*(2), 60–70.
Ko, C. H., Yen, C. F., Yen, C. N., Yen, J. Y., Chen, C. C., & Chen, S. H. (2005). Screening for internet addiction: An empirical study on cut-off points for the chen internet addiction scale. *The Kaohsiung Journal of Medical Sciences, 21*(12), 545–551.
Kuss, D. J., & Griffiths, M. D. (2011). Online social networking and addiction—a review of the psychological literature. *International Journal of Environmental Research and Public Health, 8*(9), 3528–3552.
Kwon, M., Lee, J. Y., Won, W. Y., Park, J. W., Min, J. A., Hahn, C., & Kim, D. J. (2013). Development and validation of a smartphone addiction scale (SAS). *PloS One, 8*(2), Article e56936.
Lee, S., Kim, M., Mendoza, J. S., & McDonough, I. M. (2018). Addicted to cellphones: Exploring the psychometric properties between the nomophobia questionnaire and obsessiveness in college students. *Heliyon, 4*(11), Article e00895.
Lin, J. C. (2010). Popularity, funding for health-effect research and cell-phone addiction. *IEEE Antennas and Propagation Magazine, 52*(2), 164–166.
Lin, Y. H., Chang, L. R., Lee, Y. H., Tseng, H. W., Kuo, T. B., & Chen, S. H. (2014). Development and validation of the smartphone addiction inventory (SPAI). *PloS One, 9*(6), Article e98312.
Lin, Y.-H., Chiang, C.-L., Lin, P.-H., Chang, L.-R., Ko, C.-H., Lee, Y.-H., et al. (2016). Proposed diagnostic criteria for smartphone addiction. *PloS One, 11*(11), Article e0163010. https://doi.org/10.1371/journal.pone.0163010
Mattick, R. P., Peters, L., & Clarke, J. C. (1989). Exposure and cognitive restructuring for social phobia: A controlled study. *Behavior Therapy, 20*, 3–23.
Mazaheri, M. A., & Najarkolaei, F. R. (2014). Smartphone and internet addiction among students in Isfahan university of medical sciences-Iran. *Journal of Health Policy and Sustainable Health, 1*(3).
McCarty, K. (2005). *The relationship between attachment and social anxiety, focusing on self-esteem and locus of control as possible mediators*. University of Hertofordshire Thesis Collection. http://hdl.handle.net/2299/14297.
Mobile fact sheet. (2018). *Pew research center, internet and technology*. http://www.pewinternet.org/fact-sheet/mobile/#.
Mohammadi, M., Alavi, S. S., Farokhzad, P., Jannatifard, F., Mohammadi Kalhori, S., Sepahbodi, G., et al. (2015). The validity and reliability of the Persian version test of mobile phone dependency (TMD). *Iranian Journal of Psychiatry, 10*(4), 265–272.
Montag, C., Błaszkiewicz, K., Lachmann, B., Sariyska, R., Andone, I., Trendafilov, B., et al. (2015). Recorded behavior as a valuable resource for diagnostics in smartphone addiction: Evidence from psychoinformatics. *Behavioral Sciences, 5*(4), 434–442.
Morey, J. N., Gentzler, A. L., Creasy, B., Oberhauser, A. M., & Westerman, D. (2013). Young adults' use of communication technology within their romantic relationships and associations with attachment style. *Computers in Human Behavior, 29*(4), 1771–1778.
Osborne, J. W., Costello, A. B., & Kellow, J. T. (2008). Best practices in exploratory factor analysis. *Best Practices in Quantitative Methods*, 86–99.
Panova, T., & Carbonell, X. (2018). Is smartphone addiction really an addiction? *Journal of Behavioral Addictions, 7*(2), 252–259.
Pierce, T. (2009). Social anxiety and technology: Face-to-face communication versus technological communication among teens. *Computers in Human Behavior, 25*(6), 1367–1372.
Rangka, I. B., Prasetyaningtyas, W. E., Ifdil, I., Ardi, Z., Suranata, K., Winingsih, E., & Wijaya, R. S. (2018). November). Measuring psychometric properties of the Indonesian version of the NoMoPhobia questionnaire (NMPQ): Insight from Rasch measurement tool. In *Journal of physics: Conference series* (Vol. 1114), Article 012127. No. 1.
Richards, T. A. (2013). *Successful social anxiety groups*. Retrieved from www.socialphobia.org.
Roberts, J. A., Pullig, C., & Manolis, C. (2015). I need my smartphone: A hierarchical model of personality and cell-phone addiction. *Personality and Individual Differences, 79*, 13–19.
Roberts, J. A., Yaya, L. H. P., & Manolis, C. (2014). The invisible addiction: Cell-phone activities and addiction among male and female college students. *Journal of Behavioral Addictions, 3*(4), 254.
Robins, R. W., Hendin, H. M., & Trzesniewski, K. H. (2001). Measuring global self-esteem: Construct validation of a single-item measure and the Rosenberg Self-Esteem Scale. *Personality and Social Psychology Bulletin, 27*(2), 151–161.
Rodríguez-García, A. M., Moreno-Guerrero, A. J., & Lopez Belmonte, J. (2020). Nomophobia: An individual's growing fear of being without a smartphone—a systematic literature review. *International Journal of Environmental Research and Public Health, 17*(2), 580.
Rosenberg, M. (1965). *Rosenberg self-esteem scale (SES). Society and the adolescent self-image*.
Serrano-Fernández, M. J., Boada-Grau, J., Gil-Ripoll, C., & Vigil-Colet, A. (2016). A predictive study of antecedent variables of workaholism. *Psicothema, 28*(4), 401–406.
Sharot, T. (2011). The optimism bias. *Current Biology, 21*(23), R941–R945.
Stanovsek, S. (2019). *Cultivating digital mindfulness in an era of constant connection: A phenomenological exploration of college students' digital detox*.
Stavrinos, D., Pope, C. N., Shen, J., & Schwebel, D. C. (2018). Distracted walking, bicycling, and driving: Systematic review and meta-analysis of mobile technology and youth crash risk. *Child Development, 89*(1), 118–128.
TeenSafe. (2019). *Texting and driving crashes facts and statistics*.
Tran, D. (2016). Classifying nomophobia as smart-phone addiction disorder. *UC Merced Undergraduate Research Journal, 9*(1).
Trub, L., & Barbot, B. (2016). The paradox of phone attachment: Development and validation of the young adult attachment to phone scale (YAPS). *Computers in Human Behavior, 64*, 663–672.
Ugur, N. G., & Koc, T. (2015). Time for digital detox: Misuse of mobile technology and phubbing. *Procedia-Social and Behavioral Sciences, 195*, 1022–1031.
Uysal, Ş., Özen, H., & Madenoğlu, C. (2016). Social phobia in higher education: The influence of nomophobia on social phobia. *The Global e-learning Journal, 5*(2), 1–8.
Vigil-Colet, A., Morales-Vives, F., Camps, E., Tous, J., & Lorenzo-Seva, U. (2013). Development and validation of the overall personality assessment scale (OPERAS). *Psicothema, 25*(1), 100–106.
Walsh, S. P., White, K. M., & Young, R. M. (2010). Needing to connect: The effect of self and others on young people's involvement with their smartphones. *Australian Journal of Psychology, 62*(4), 194–203.
Whitfield, J. (2002). Nosy neighbours. *Nature, 419*, 242–243.
Winger, G., Woods, J. H., Galuska, C. M., & Wade-Galuska, T. (2005). Behavioral perspectives on the neuroscience of drug addiction. *Journal of the Experimental Analysis of Behavior, 84*(3), 667–681.
World Health Organization & NHTSA (U.S.). (2011). *Smartphone use: A growing problem of driver distraction*. World Health Organization.
Wright, B., & Stone, M. (1979). *Best test design*. Chicago, IL: MESA Press.
Yildirim, C. (2014). *Exploring the dimensions of nomophobia: Developing and validating a questionnaire using mixed methods research*. Doctoral dissertation, Iowa State University.
Yildirim, C., & Correia, A. (2015a). Exploring the dimensions of nomophobia: Development and validation of a self-reported questionnaire. *Computers in Human Behavior, 49*, 130–137.
Yildirim, C., & Correia, A. P. (2015b). Understanding nomophobia: A modern age phobia among college students. *Learning and collaboration technologies* (pp. 724–735). Cham: Springer.
Yildirim, C., Sumuer, E., Adnan, M., & Yildirim, S. (2016). A growing fear: Prevalence of nomophobia among Turkish college students. *Information Development, 32*(5), 1322–1331.
Zwick, W. R., & Velicer, W. F. (1986). Factors influencing five rules for determining the number of components to retain. *Psychological Bulletin, 99*, 432–442.