

An investigation into problematic smartphone use: The role of narcissism, anxiety, and personality factors

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(Received: October 22, 2016; revised manuscript received: May 30, 2017; accepted: August 3, 2017)

Background and aims: Over the last decade, worldwide smartphone usage has greatly increased. Alongside this growth, research on the influence of smartphones on human behavior has also increased. However, a growing number of studies have shown that excessive use of smartphones can lead to detrimental consequences in a minority of individuals. This study examines the psychological aspects of smartphone use particularly in relation to problematic use, narcissism, anxiety, and personality factors. *Methods:* A sample of 640 smartphone users ranging from 13 to 69 years of age (mean = 24.89 years, $SD = 8.54$) provided complete responses to an online survey including modified DSM-5 criteria of Internet Gaming Disorder to assess problematic smartphone use, the Spielberger State-Trait Anxiety Inventory, the Narcissistic Personality Inventory, and the Ten-Item Personality Inventory. *Results:* The results demonstrated significant relationships between problematic smartphone use and anxiety, conscientiousness, openness, emotional stability, the amount of time spent on smartphones, and age. The results also demonstrated that conscientiousness, emotional stability, and age were independent predictors of problematic smartphone use. *Conclusion:* The findings demonstrate that problematic smartphone use is associated with various personality factors and contributes to further understanding the psychology of smartphone behavior and associations with excessive use of smartphones.

Keywords: smartphones, problematic smartphone use, narcissism, anxiety, personality

INTRODUCTION

Due to the multi-functionality of smartphones, research suggests that smartphones have become a necessity in the lives of individuals (Campbell & Park, 2008), with 4.23 billion smartphones being used around the world (Statista.com, 2016). A study of 2,097 American smartphone users reported that 60% of users cannot go 1 hr without checking their smartphones with 54% reporting they checked their smartphones while lying in bed, 39% checked their smartphone while using the bathroom, and 30% checked it during a meal with others (Lookout Mobile Security, 2012). Such findings suggest that some individuals show signs of smartphone dependence. Negative consequences of smartphone use have been investigated over the last 10 years. For instance, Salehan and Negahban (2013) found that high smartphone use is associated with high social networking site (SNS) use, and that SNS use was a predictor of smartphone addiction. Research has also shown that smartphone users who report more frequent SNS use also report higher addictive tendencies (Wu, Cheung, Ku, & Hung, 2013). Dependency may occur due to the immediacy of the reward factors when checking a smartphone. This has been termed as the “check habit” (Oulasvirta, Rattenbury, Ma, & Raita, 2012) in which individuals are prone to wanting to compulsively check their smartphones for updates.

Research into smartphone use and personality is an area that has received increasing attention. Research has shown that extroverts are more likely to own a smartphone and are also more likely to use the texting functions to communicate with others (de Montjoye, Quoidbach, Robic, & Pentland, 2013; Lane & Manner, 2012; Phillips, Butt, & Blaszczyński, 2006). Bianchi and Phillips (2005) reported that problem mobile phone use was a function of age, extraversion, and low self-esteem. Research has also shown that extroverts use social media for social enhancement, whereas introverts use social media to disclose personal information (e.g., Ross et al., 2009; Zywicka & Danowski, 2008), thus using it for social compensation (Amichai-Hamburger & Vinitzky, 2010). Roberts, Pullig, and Manolis (2014) found introversion was negatively associated with smartphone addiction. Research by Ehrenberg, Juckes, White, and Walsh (2008) has demonstrated an association between neuroticism and smartphone addiction. More recently, Andreassen et al. (2016) reported significant correlations between symptoms of addictive technology use and attention-deficit/hyperactivity disorder, obsessive-compulsive disorder, anxiety, and depression. Age appeared to be inversely related to the

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addictive use of technologies. Furthermore, being female was significantly associated with addictive use of social media. Taken together, these studies suggest that personality and demographic factors play a role in how people interact with smartphones.

Narcissism, a trait related to possessing grandiose self-views and a sense of entitlement, has been the focus of studies of social media and smartphone use. Pearson and Hussain's (2015) survey research of 256 smartphone users found that 13.3% of the participants were classified as addicted to their smartphones and that higher narcissism scores and neuroticism levels were associated with addiction. Andreassen, Pallesen, and Griffiths' (2017) survey of over 23,000 participants found that addictive social media use was related to narcissistic traits. Moreover, several studies (e.g., Buffardi & Campbell, 2008; Carpenter, 2012; McKinney, Kelly, & Duran, 2012; Ong et al., 2011; Sorokowski et al., 2015; Wang, Jackson, Zhang, & Su, 2012) have reported that narcissists tend to upload attractive and self-promoting photos to SNSs and update their status more frequently for self-presentation. Together, these studies highlight important associations between narcissism and social media use.

Anxiety is another important psychological trait that has been examined in relation to smartphone use. Research by Cheever, Rosen, Carrier, and Chavez (2014) found that heavy and moderate smartphone users felt significantly more anxious over time. They concluded that dependency upon smartphones, mediated by an unhealthy connection to their constant use, may lead to increased anxiety when the device is absent. Several studies have reported associations between problematic smartphone use and social interaction anxiety (Enez Darcin et al., 2016; Lee, 2015; Sapacz, Rockman, & Clark, 2016), compulsive anxiety (Khang, Woo, & Kim, 2012), and general anxiety (Lee et al., 2010; Lepp, Barkley, & Karpinski, 2014; Ha, Chin, Park, Ryu, & Yu, 2008; Hong, Chiu, & Huang, 2012; Park & Choi, 2015; Tavakolizadeh, Atarodi, Ahmadpour, & Pourghesiar, 2014). Relationships between high smartphone use and high anxiety, insomnia, and being female have also been reported (Jenaro, Flores, Gómez-Vela, González-Gil, & Caballo, 2007). Taken together, these studies provide justification for further research examining anxiety and the associations with smartphone use.

Some researchers (e.g., Billieux, Maurage, Lopez-Fernandez, Kuss, & Griffiths, 2015; Billieux, Philippot, Schmid, Maurage, & Mol, 2014; Lopez-Fernandez, Kuss, Griffiths, & Billieux, 2015) have likened problematic smartphone use to drug and gambling addiction. The negative relationship between technology use and psychological health has been termed "iDisorder" (Rosen, Cheever, & Carrier, 2012), and there is increasing research evidence to support such a claim. For example, a study focusing on young Swedish adults found that increased smartphone use predicted increased symptoms of depression a year later (Thomée, Härenstam, & Hagberg, 2011). In a study of African-American students, individuals who text messaged excessively and spent large amounts of time on SNSs were found to present symptoms of paranoid personality disorder because they were reported to experience abnormal perceptions of reality (Hogg, 2009). These studies suggest

that excessive use of smartphones in some individuals is associated with both mental health problems and addiction-like problems.

There is also increasing evidence showing a relationship between depression and those activities that can be engaged in on a smartphone such as texting, viewing videos, gaming, and listening to music (Allam, 2010; Augner & Hacker, 2012; Katsumata, Matsumoto, Kitani, & Takeshima, 2008; Lu et al., 2011; Steelman, Soror, Limayem, & Worrell, 2012). Other factors associated with problematic smartphone use include low self-esteem and extraversion (Bianchi & Philips, 2005). Ha et al. (2008) identified that Korean adolescents who were excessive smartphone users expressed more depressive symptoms, higher interpersonal anxiety, and lower self-esteem than non-excessive smartphone users. The same study also reported a correlation between excessive use of smartphone and Internet addiction. Similar findings were reported by Im, Hwang, Choi, Seo, and Byun (2013).

Research indicating a positive (or negative) association between normal technology use and depressive symptoms has also been reported. For instance, a longitudinal study of *Facebook* usage (Steinfeld, Ellison, & Lampe, 2008) found that *Facebook* use led to a gain in bridging social ties and those users with low self-esteem reported more gains in social ties due to their *Facebook* use. Research by Davila et al. (2012) found that more frequent usage of SNSs was not associated with depressive symptoms. However, more negative interactions while social networking was associated with depressive symptoms. Park and Lee (2012) reported that smartphones can improve psychological well-being if they were used to fulfill a need to care for others or for supportive communication. In contrast to many research studies, Jelenchick, Eickhoff, and Moreno (2013) found no relationship between social networking and depression among a sample of 190 adolescents.

More recent studies have highlighted the associations between perceived stress and the risk of smartphone addiction (Chiu, 2014; Jeong, Kim, Yum, & Hwang, 2016; Samaha & Hawi, 2016). Given the previous research in the area and the relative lack of research on personality variables, this study investigated problematic smartphone use and associated factors of personality, anxiety, and narcissism. The main focus of the study was to examine the contribution of narcissism and anxiety in problematic smartphone use. In addition, the relationship with personality factors was also examined. This study made use of online survey methods to collect data concerning the possible psychological factors associated with smartphone use with the aim of adding novel findings to the small but growing empirical research base.

METHODS

Participants

A total of 871 smartphone users (mean age = 25.06 years, $SD = 8.88$) participated in the study. Some data were missing from surveys due to incomplete responses. Therefore, inferential statistical analysis was performed on 640 fully

completed questionnaires (73.5%). The age ranged from 13 to 69 years (mean = 24.89 years, $SD = 8.54$) and there were 214 males (33.4%) and 420 females (65.6%); six people did not provide information about gender. The ethnicity of the sample was varied with the sample comprising White (80.0%), Black (2.0%), Asian (9.3%), South-East Asian (1.9%), African (1.9%), Arab or North African (0.5%), mixed/multiple ethnic groups (3.9%), and other (2.0%). The majority of participants were from the United Kingdom (86.0%), followed by those from the United States (3.3%), Canada (0.5%), Germany (0.5%), and United Arab Emirates (0.5%), although many other countries (Turkey, Switzerland, Australia, Greece, Denmark, Sweden, and South Korea) were represented among the sample. Participants were mostly students (68.6%), employed (23.6%), self-employed (3.0%), unemployed (4.3%), or retired (0.5%). The marital status of participants was single (52.5%), married (14.6%), or in an intimate relationship (32.9%).

Design and materials

An online survey was used in this study for the collection of data, and was developed with the use of *Qualtrics* online survey software. The survey comprised four psychological instruments that together assessed the association between smartphone use and personality variables. The four instruments assessed: (a) narcissistic personality, (b) state-trait anxiety, (c) five-factor model of personality traits (neuroticism, agreeableness, openness to experience, extraversion, and conscientiousness), and (d) problematic smartphone use. In addition, questions regarding demographic characteristics of participants, smartphone usage time, daily glances at smartphone screen, most utilized smartphone application (app), attitudes toward others' social networking behavior, and problems caused due to smartphone use were also collected.

Narcissistic personality. Narcissistic personality was assessed using the 40-item Narcissistic Personality Inventory (NPI; Raskin & Terry, 1988). The NPI comprises 40 pairs of statements that belong to seven subsections, with each subsection a known trait of narcissism. The traits assessed were authority, self-sufficiency, superiority, exhibitionism, vanity, exploitativeness, and entitlement. Each statement belongs to either column A or column B. Statements from column A are typically narcissistic and score one point, for example, "I would prefer to be a leader." Statements from column B are not typically narcissistic and therefore do not score any points, for example, "It makes little difference to me whether I am a leader or not." People with narcissistic personality disorder are expected to endorse 20 column A answers. In this study, the internal consistency of the NPI was good (Cronbach's $\alpha = .85$).

State-trait anxiety. The Spielberger State-Trait Anxiety Inventory (STAI) Short-Form (Marteau & Bekker, 1992) was used to assess state-trait anxiety. This scale comprises six statements measured on a 4-point Likert scale (where 1 = not at all, 2 = somewhat, 3 = moderately, and 4 = very much). Examples of the STAI items were as follows: "I feel calm," "I am tense," and "I am worried." Marteau and Bekker (1992) reported acceptable reliability and validity for the STAI Short-Form. Furthermore, when compared

with the full form of the STAI, the six-item version offers a briefer and acceptable scale for participants (Marteau & Bekker, 1992). In this study, the internal consistency of the STAI was good (Cronbach's $\alpha = .85$).

Personality. Personality traits were assessed using the Ten-Item Personality Inventory (TIPI; Gosling, Rentfrow, & Swann, 2003), which is a valid measure of the Big-Five (five-factor model) dimensions. The TIPI comprises 10 items using a 7-point rating scale (ranging from 1 = disagree strongly to 7 = agree strongly) and five subscales: Extraversion, Agreeableness, Conscientiousness, Emotional stability, and Openness. Gosling et al. (2003) report that the TIPI has adequate levels in terms of: (a) convergence widely used Big-Five measures in self, observer, and peer reports, (b) test-retest reliability, (c) patterns of predicted external correlates, and (d) convergence between self and observer ratings. The internal consistency for the subscales were as follows: Extraversion (Cronbach's $\alpha = .69$), Agreeableness (Cronbach's $\alpha = .29$), Conscientiousness (Cronbach's $\alpha = .56$), Emotional Stability (Cronbach's $\alpha = .69$), and Openness to Experiences (Cronbach's $\alpha = .45$).

Problematic smartphone use. The Problematic Smartphone Use Scale was used to assess problematic smartphone use and the scale was adapted from items in the Internet Gaming Disorder Scale Short-Form (IGDS9-SF) developed by Pontes and Griffiths (2014, 2015). The IGDS9-SF is a short, nine-item psychometric tool adapted from the nine criteria that define Internet Gaming Disorder (IGD) according to the fifth edition of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5; American Psychiatric Association, 2013). Example adapted items are as follows: "I am preoccupied with my smartphone," "I use my smartphone to escape or relieve a negative mood," "I have made unsuccessful attempts to control my smartphone use," "I have spent increasing amounts of time on my smartphone," "I have jeopardized or lost a significant relationship, job, or educational career opportunity because of my smartphone use." Participants rated all items on a 5-point Likert scale (where 1 = strongly disagree, 2 = disagree, 3 = neither agree or disagree, 4 = agree, 5 = strongly agree). Scores on the IGDS9-SF range from 9 to 45. In relation to IGD, Pontes and Griffiths (2014) stated that for research purposes only, the scale may be used to classify disordered users and non-disordered users by considering only those users that obtain a minimum of 36 out of 45 on the scale. In this study, the internal consistency of the IGDS9-SF was high (Cronbach's $\alpha = .86$).

Procedure

An Internet-posted message inviting smartphone users to participate in the study was placed in the off-topic and general discussion forums of various well-known smartphone, social news, and online gaming websites (e.g., *mmorpg.com*, *androidcentral.com*, *reddit.com*, *iMore.com*, and *neoseeker.com*). Internet-posted messages were also posted on the first author's social networking accounts (e.g., *Facebook* and *Twitter*). Furthermore, students at two large UK universities were also informed by the first author who made study recruitment announcements at the beginning of lectures and directed them to the *Twitter*

account and hashtag for the study. Each smartphone, social news, and online gaming site had similar structural features (e.g., latest news, help guide, site map, forums, etc.). The online recruitment posting informed all participants about the purpose of the study and contained a link to the online survey. Once participants visited the hyperlink address to the survey, they were presented with a participant information page followed by clear instructions on how to complete the survey and were assured that the data they provided would remain anonymous and confidential. A debriefing statement at the end of the survey reiterated the purpose of the study and informed participants of their right to withdraw from the study.

Analytic strategy

First, descriptive statistics regarding general smartphone use were calculated. Then, correlational analysis was conducted. Finally, to delineate the factors underlying problematic smartphone use, multiple regression analysis was performed using problematic smartphone use as the outcome variable. The predictor variables were age and narcissism (entered at step one), and extraversion, agreeableness, conscientiousness, emotional stability, openness to experience, and anxiety scores (entered at step two).

Ethics

The study procedures were carried out in accordance with the Declaration of Helsinki and with the British Psychological Society ethical guidelines. The University Ethics Committee approved the study. All participants were informed about the study and all provided informed consent.

RESULTS

Smartphone user behavior

The average time spent on a smartphone per day was 190.6 min (*SD* = 138.6). Participants reported making 39.5 glances (*SD* = 33.7) on average at a smartphone screen during the day. Participants' average monthly smartphone phone bill was £27.50 (*SD* = 17.2). The most utilized smartphone applications among the participants were social networking applications (49.9%), followed by instant messaging applications (35.2%), and then music applications (19.1%). Table 1 shows the smartphone applications used by the participants.

Problematic smartphone use

The average problematic smartphone score among the participants was 21.4 (*SD* = 6.73). Using the classification criteria suggested by Pontes and Griffiths (2014), 17 participants (2.7%) were classed as disordered smartphone users. Figure 1 shows the distribution of scores on the Problematic Smartphone Use Scale.

Table 1. Most utilized smartphone application among the participants (responses refer to response per application category, participants could choose more than one application)

Smartphone application	Percentage (no. of participant responses)
Social networking sites (e.g., Facebook)	49.1% (428)
Instant messaging (e.g., WhatsApp)	35.2% (307)
Shopping (e.g., eBay/Groupon)	11.4% (99)
Photo/video apps (e.g., Photobucket)	10.1% (88)
News (e.g., BBC News, and The Guardian)	12.1% (105)
Gaming (e.g., Clash of Clans)	8.2% (71)
Fitness/diet	5.2% (45)
Music	19.1% (166)
Dating	2.3% (20)
TV catch up (e.g., BBC iPlayer)	5.2% (45)
Educational	5.2% (45)
Other	9.2% (80)

Problematic smartphone use correlates

Bivariate correlations demonstrated that problematic smartphone use was positively related to time spent on the smartphone and anxiety, and negatively related to age, conscientiousness, emotional stability, and openness. Time spent on the smartphone was positively related to the length of ownership, narcissism, and anxiety, and negatively related to age and emotional stability. Length of ownership was positively related to age (Table 2).

Predictors of problematic smartphone use

Collinearity issues were checked using variance inflation factor (VIF) values, which were all below 10 (average VIF = 1.33) and the tolerance statistics, which were all above 0.2. This indicated that multicollinearity was not a concern. Using the enter method for the multiple regression, it was found that the predictor variables explained a significant amount of variance in problematic smartphone use [for Step 1, $R^2 = .05$, $\Delta R^2 = .10$, $F(2, 637) = 17.39$, $p < .001$; for Step 2, $F(8, 631) = 11.85$, $p < .001$]. The analysis showed that after adjusting for age and narcissism, conscientiousness, emotional stability, and openness significantly and negatively predicted problematic smartphone use (Table 3), that is, individuals scoring high on openness, emotional stability, and conscientiousness were less likely to have problematic smartphone use.

DISCUSSION

This study examined problematic smartphone use and potential associated factors. The findings demonstrated that time spent on a smartphone, conscientiousness, emotional stability, openness, and age were significant predictors of problematic smartphone use. With the negative predictors, the findings showed that problematic smartphone use was predicted by lower conscientiousness, lower openness, lower emotional stability, and being of younger age. In relation to emotional stability, the findings are similar to

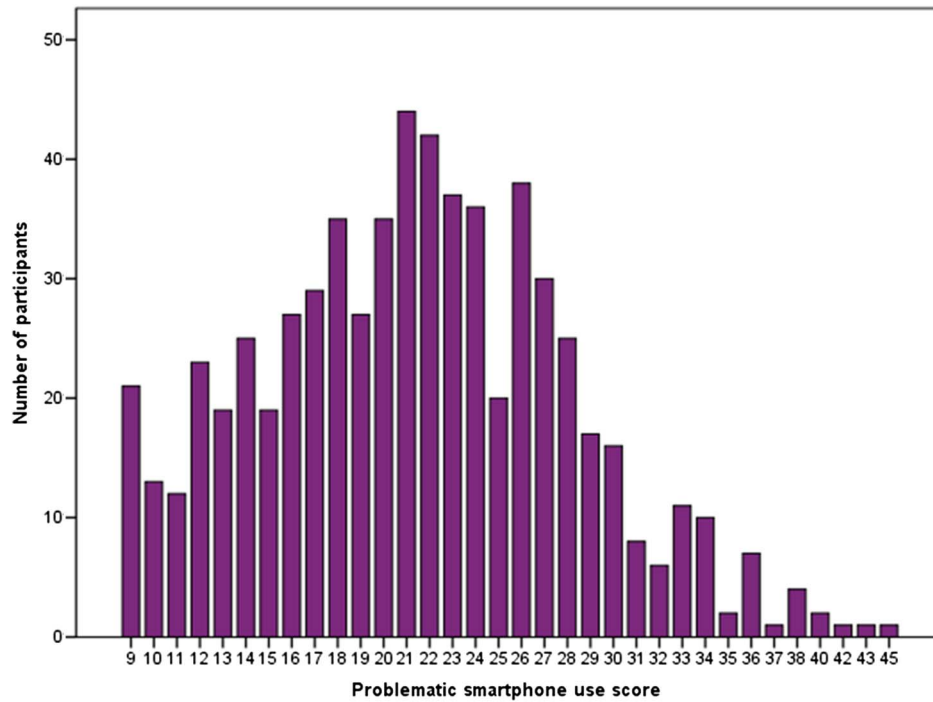


Figure 1. Problematic smartphone use score distribution (kurtosis = -0.102, skewness = 0.280)

Table 2. Pearson’s correlations between smartphone problematic use and other variables (n = 640)

	Problematic smartphone use	Time spent on smartphone	Length of ownership
Time spent on smartphone	0.41**		
Length of ownership	0.01	0.09*	
Age	-0.22**	-0.22**	0.19**
Narcissism	0.01	0.10*	-0.01
Extraversion (TIPI)	-0.01	-0.04	-0.02
Agreeableness (TIPI)	-0.08	-0.05	0.03
Conscientiousness (TIPI)	-0.24**	-0.04	0.06
Emotional stability (TIPI)	-0.27**	-.15**	0.04
Openness (TIPI)	-0.15**	-0.03	0.09
Anxiety (STAI)	0.22**	0.09*	-0.01

Note. TIPI: Ten-Item Personality Inventory; STAI: Spielberger State-Trait Anxiety Inventory.

*p < .05. **p < .01.

findings of Ha et al. (2008) who reported that excessive smartphone users experienced more depression symptoms, difficulties in the expression of emotion, higher interpersonal anxiety, and low self-esteem. The results of this study suggest that increased time spent using a smartphone may lead to problematic use. These results support the findings of previous studies, which found that increased time on smartphones was associated with smartphone addiction

Table 3. Model of predictors of problematic smartphone use (n = 640)

	B	SE	β	t	p
<i>Step 1</i>					
Age	-0.18	0.03	-.23	-5.89	<.001
NPI score	0.00	0.04	.00	-.06	.96
<i>Step 2</i>					
Age	-0.14	0.03	-.17	-4.50	<.001
NPI score	0.09	0.04	.09	2.02	.04
Extraversion	0.27	0.18	.06	1.52	.13
Agreeableness	0.29	0.24	.05	1.21	.23
Conscientiousness	-0.87	0.21	-.17	-4.22	<.001
Emotional stability	-0.75	0.21	-.17	-3.53	<.001
Openness	-0.50	0.23	-.09	-2.17	.03
Anxiety	0.11	0.08	.07	1.37	.17

Note. SE: standard error; NPI: Narcissistic Personality Inventory. R² = .05 for step 1 (p < .01); ΔR² = .10 for step 2 (p < .01).

(e.g., Im et al., 2013; Wu et al., 2013). Age was a significant negative predictor of problematic use, and supports previous research findings reporting problematic smartphone use among young adult samples (e.g., Bianchi & Phillips, 2005; Chiu, 2014; Jenaro et al., 2007; Jeong et al., 2016; Lepp et al., 2014; Samaha & Hawi, 2016; Sapacz et al., 2016). It may be that young people are more willing to try out new technology and thus be more prone to problem use.

It is interesting to note that the predictors of conscientiousness and emotional stability were significant negative predictors of problematic smartphone use. Conscientiousness is characterized by orderliness, responsibility, and dependability (McCrae & Costa, 1999), and this study suggests that the less conscientiousness individuals are, the

more likely they are to display problematic behaviors. Emotional stability is characterized by being stable and emotionally resilient (McCrae & Costa, 1999), and in this study, being less emotionally stable was associated with problematic smartphone behavior. This finding supports the findings of Augner and Hacker (2012) who reported that low emotional stability was associated with problematic smartphone use. This is of potential concern because people who experience mood swings, anxiety, irritability, and sadness are more likely to develop problematic smartphone use behavior. Being less emotionally stable (i.e., neurotic) has been associated with many health disorders such as anorexia and bulimia (Davis & Claridge, 1998) and drug addiction (Gossop & Eysenck, 1980). Thus, while the findings presented here are correlational, this relationship is potentially concerning and requires further empirical investigation.

The bivariate correlations demonstrated significant relationships between a number of variables and problematic smartphone use. For instance, time spent using a smartphone was significantly related to problematic smartphone use and is similar to previous research findings (e.g., Khang et al., 2012; Thomee et al., 2011). Anxiety was positively correlated with problematic smartphone use supporting past research that has found anxiety to be associated with problematic smartphone use (i.e., Hogg, 2009). This finding suggests that as anxiety increases, problematic smartphone use also increases. The personality trait of openness was negatively related to problematic smartphone use. This finding suggests that people who are low in this trait are more likely to experience problematic smartphone use. Conscientiousness, emotional stability, and age were negatively related to problematic smartphone use (as discussed above).

Time spent using a smartphone was positively related to the length of ownership, narcissism, and anxiety, suggesting that increased time on a smartphone can lead to narcissistic traits and anxiety. These findings were similar to previous research by Lepp et al. (2014) who reported a relationship between high-frequency smartphone use and higher anxiety, and to that of Andreassen et al. (2016) who demonstrated a relationship between social media addiction and narcissism. The findings also concur with research by Jenaro et al. (2007) who reported associations between high smartphone use and high anxiety.

In contrast to previous research that has shown associations between extraversion and increased smartphone use (de Montjoye et al., 2013; Lane & Manner, 2012; Phillips et al., 2006), in this study, extraversion was not associated with problematic use. This study also found no association between narcissism and problematic smartphone use in contrast to previous research (e.g., Pearson & Hussain, 2015). This may be because the study sample contained very few narcissistic individuals or they were not motivated to use smartphones for narcissistic purposes.

The results of this study demonstrated that SNS use was a popular application among the participants and the average time spent daily on a smartphone was 190 min. If most of this time is spent using SNS apps then this could lead to excessive use as highlighted by previous research (e.g., Jeong et al., 2016; Salehan & Negahban, 2013). These studies have highlighted the association between SNS use, games, and entertainment, and how they are related to

problematic use. The ability to access different types of entertainment (such as games, music, and videos) through the use of SNSs may be the reason why social networking has become very popular (Kuss & Griffiths, 2017). One of the most important aspects of smartphone use is the media content and communication aspects. Instant messaging, SNSs, shopping, news, music, and photo/video sharing apps were popular among the participants in this study. These findings support the uses and gratification approach (Ruggiero, 2000), which suggests that people use smartphones to satisfy a wide range of needs. Smartphones are extrinsically rewarding because they deliver immediate access to other individuals and feature mobile applications. They are also intrinsically rewarding because they offer users the opportunity to customize and manipulate the device interface (Phillips et al., 2006). All the popular applications used among the participants provide high-frequency rewards/messages that promote regular monitoring of smartphones (in this study, the average glances at smartphone was 39.5 glances per day) and can thus increase excessive use.

The results of this study contribute to the small base of empirical research that has focused on the problematic use of smartphones. Overuse of smartphones can have negative effects on psychological health including depression and chronic stress (Augner & Hacker, 2012) and increased suicidal ideation (Katsumata et al., 2008). Research supports an association between depression and excessive texting, social networking, gaming, emailing, and viewing videos, all of which can all be accessed via a smartphone (Allam, 2010; de Wit, Straten, Lamers, Cuijpers, & Penninx, 2011). Future research may need to consider problematic phone use and associations with situational factors such as home and school environment, and individual factors such as mental health and behavioral problems. Understanding the correlates of excessive use of smartphones is an important area of investigation.

While the contributions of this study are novel and informative, there are a number of limitations to consider. The majority of the sample was self-selecting students from the UK. While students are avid smartphone users with the devices forming an important aspect of this generation's identity (Palfrey & Gasser, 2013), the ability to generalize the findings is therefore limited. Future research should investigate problematic smartphone use in samples of students and non-students from different geographic regions and across a more diverse age range using nationally representative samples. The self-report methods used may have led to misreporting of actual smartphone usage. Andrews, Ellis, Shaw, and Piwek (2015) found that when it came to self-reporting, participants often underestimated their actual smartphone usage. This raises questions about the reliability and validity of the data collected. However, these issues affect all types of self-report research (Wood, Griffiths, & Eatough, 2004). Most smartphone studies, like this study, are quantitative, cross-sectional, and tend to adapt other psychometric tools to assess smartphone use. The Problematic Smartphone Use Scale is currently being validated, although the internal consistency of the scale was good in this study. The internal consistencies of some of the personality subscales were low bringing up issues of reliability in relation to these particular personality traits.

However, these were used for their brevity and to overcome survey fatigue. Further studies are required to confirm the validity of such instruments and perhaps use longer and more psychometrically robust instruments in future research. Despite these limitations, the findings of this study demonstrate that problematic smartphone use is associated with various personality factors and contributes to further understanding the psychology of smartphone behavior and associations with excessive use of smartphones.

Funding sources: No financial support was received for this study.

Authors' contribution: Study concept and design: ZH and DS; analysis and interpretation of data: ZH, MDG, and DS; access to data: ZH, DS, and MDG. All authors contributed to the writing of the paper. All authors had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

Conflict of interest: The authors declare no conflict of interest.

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