Psychological issues and problematic use of smartphone: ADHD's moderating role in the associations among loneliness, need for social assurance, need for immediate connection, and problematic use of smartphone

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Abstract

Going beyond looking at the direct association between psychological issues (loneliness and ADHD) and problematic use of media (smartphone), the present study examined the covert mechanism connecting the two. NSA (need for social assurance) and NIC (need for immediate connection) were selected as mediating steps between the two. A total of 615 U.S. American participants were recruited nationally for survey participation. Research findings suggest that individuals who are lonely would rely on smartphone hoping to be connected with and get assurance from others, but might end up struggling with problematic use of smartphone. Those with ADHD showed higher levels of loneliness, NSA, NIC, and problematic use of smartphone, and also showed stronger associations linking loneliness, NSA and NIC compared to those without ADHD. Face-to-face (FtF) interaction decreased the association between NSA and NIC for those with ADHD.

1. Introduction

Expected to surpass two point three billion users worldwide by the end of year 2017 (Statista, 2017), smartphone has truly become a dominant communication device. Smartphone has brought out revolutionary changes in the ways people interact with one another, with the ubiquitous trait of mobile phones and computing features of PDA (personal digital assistance) combined in one handheld device (Beal, 2008). Indeed, smartphone is expected to give users a “feeling of constant connection” with others, and even make them believe that they would never be lonely (Turkle, 2011). Such a permeating attribute and numerous communication applications in it, smartphone naturally leads us to ask whether it has been playing a positive role in reducing people’s loneliness and building meaningful relationships.

Unfortunately, there has been a growing number of studies showing negative side effects of smartphone rather than positive ones. Specifically, studies have shown adverse outcomes of excessive and unregulated use of mobile phone/smartphone including sleep disturbance (Thomee, Harenstam, & Hagberg, 2011), emotional distress (Choliz, 2010), and financial problems (Billieux, Van der Linden, & Rochat, 2008). Not everyone who uses smartphone ends up having such issues, but those who have psychological issues, such as loneliness (Kim, Seo, & David, 2015) or ADHD (Attention Deficit Hyperactivity Disorder) (Seo, Kim, & David, 2015), have been found to develop problematic use of smartphone more than those without such issues.

Even though psychological issues have been noted as “distant causes” of problematic media use in previous studies (e.g., Caplan, 2007; Kim, LaRose, & Peng, 2009; LaRose, Lin, & Eastin, 2003), which steps would fill in the “distance” between the two has been rarely investigated. In investigating a mechanism linking psychological issues and problematic use of smartphone, the present study starts from an assumption that those with psychological issues would use smartphone with a strong desire to relieve their problems, especially issues in interacting with others. Starting from this postulation, this study proposes a model suggesting that individuals who experience deficiency in social interaction (those with a high level of loneliness) are to be obsessed with getting...
assurance from others (need for social assurance) and being connected to others (need for immediate connection) via smartphone more than those without such problem. However, too much preoccupation with being accepted by and connected to others would eventually lead to unregulated reliance on smartphone, rather than alleviating their original deficiency in social interaction. Provided that face-to-face (FtF) interaction has been known to work as a buffer impeding unhealthy use of media to some extent, the moderating effect of FtF interaction is examined in the hypothesized model. Whether SMS (short message system), one of the most frequently used mediated communication methods via smartphone, would inhibit or exacerbate the negative cycle is also investigated. Finally, given that those with ADHD tend to experience higher levels of loneliness compared to those without ADHD, how these two groups of people would show difference in the path model leading to problematic use of smartphone is examined.

2. Literature review

2.1. Problematic use of smartphone and loneliness

Problematic use of smartphone refers to an excessive or uncontrolled use of smartphone (Billeux, 2012), including preoccupation with smartphone, frustration when smartphone is not available, relying on smartphone to alleviate unpleasant mood, and interference with interpersonal or work-related activities (Bianchi & Phillips, 2005; Choliz & Villanueva, 2009; Choliz, 2010; Jenaro, Flores, Gomez-Vela, Gonzalez-Gil, & Caballo, 2007; Toda, Monden, Kubo, & Morimoto, 2006). Interchangeably called by the term smartphone addiction, problematic use of smartphone has been proven to share some common characteristics with substance addiction listed in DSM-IV (Diagnostic and Statistical Manual of Mental Disorders) (American Psychiatric Association, 2006): craving for smartphone, a growing level of tolerance in time spent on smartphone, withdrawal symptoms such as anxiety when smartphone use is not allowed, a diminished impulse control to the point that users have to look at their phones even in dangerous situations (e.g., while driving), and the feeling that other activities that used to be fun are no longer enjoyable. Although problematic use of smartphone does not involve any chemical, it shares some similar characteristics with behavioral addictions, such as compulsive shopping, pathological gambling, or video game playing (Choliz, 2010).

Individuals’ psychological conditions, such as levels of loneliness or depression, have been found to be associated with problematic use of the Internet (Caplan, 2007; LaRose et al., 2003) and smartphone (Kim et al., 2015) as distant predictors. Among many psychological factors, the present study particularly pays attention to loneliness and Attention Deficit Hyperactivity Disorder (ADHD) as a likely antecedent and moderator of problematic use of smartphone.

Loneliness is a perceived deficiency when one feels that his/her relationship networks are smaller or less satisfying than one desires (Peplau, Russell, & Heim, 1979, p. 55). With limited opportunities to interact with others, lonely people tend to lack communication skills (Jones, 1982), and thus be anxious about interacting with others. Such anxiety leads the lonely to avoid social interaction, especially FtF interaction, and rather drive them to spend time alone (Spitzberg & Canary, 1985) or to have a higher preference for mediated interactions because of its greater anonymity. As a way to get an immediate and easy diversion from their negative emotional states, lonely people tend to rely on media, such as watching TV or browsing the Internet (Young, 2007). However, the problem is that those who have a high level of loneliness or other psychological issues tend to have hard times in maintaining a healthy level of media use compared to those with healthy psychological composites (Bandura, 1999). When lonely people rely on media as a temporary remedy, their poor self-regulation systems would fail to moderate excessive uses, rather than providing long-term relief from their original problems (e.g., Ha, Chin, Park, Ryu, & Yu, 2008; Smetaniuk, 2014). Actually, loneliness has been found to be one of the distant contributors of addictive or deviant behaviors such as drug and alcohol abuse, overeating, and even suicide (Gaev, 1976; Wenz, 1977). In the same line, loneliness has been found to have a positive association with problematic media use, especially the Internet (Davis, 2001; Engelberg & Sjoberg, 2004; Morahan-Martin, 2005) and mobile phone (Park, 2005; Townsend, 2000). Because of its ubiquitous nature and diverse functions available within one device, it is easy to expect that smartphone can increase the possibility of lonely people’s unregulated use even more.

H1. Loneliness is positively associated with problematic use of smartphone.

2.2. Need for Social Assurance (NSA), Need for Immediate Connection (NIC) and Problematic Use of Smartphone

Although it has been shown that psychological ill-being such as loneliness can be a distant predictor of problematic use of media, specifically smartphone, which factors would connect loneliness and problematic use of smartphone has been rarely investigated. In other words, this study investigates a hidden mechanism linking loneliness to problematic use of smartphone. Given that loneliness refers to perceived deficiency and dissatisfaction with one’s relationships with others, it is natural to assume that lonely people would have a stronger desire to be with others compared to those who are less lonely. Need to belong is one of the most fundamental human desires (Baumeister & Leary, 1995), and has been a major driver for various communication or social interaction activities (Lee & Robbins, 1995). As a way to specify need to belong, a bit broad and ambiguous concept to be concretely operationalized, the current study chose need for social assurance, defined as “need for reassurance from at least one or more persons for a sense of belongingness (Lee & Robbins, 1995, p. 237).” In other words, need for social assurance (NSA) refers to one’s desire to be assured and accepted by others to feel that he/she belongs to someone or others. Although one’s desire to be assured or accepted by others is not negative itself, one with excessive NSA could be highly other-dependent, relying too much on others’ approval, and less confident in functioning independently (Lee & Robbins, 1995). Provided that lonely people are usually not satisfied with the quantity and quality of their current social networks, they are expected to have a strong desire to amend their defective relationships by being accepted and assured by others (NSA).

H2. Loneliness is positively associated with need for social assurance (NSA).

To gratify one’s NSA would not be possible without engaging in social interaction with others (Baumeister & Leary, 1995). Someone with a very high level of NSA might have to be constantly interacting with or connected to others so that he/she would be fueled by others’ assurance and acceptance unrelentingly. Mobile phone, especially smartphone, is an ultimate communication device for incessant connection with others with its diverse communication features including voice call, short message service (SMS), or other Internet-based communication services (Pearson, Carmon, Töböl, & Fowler, 2010). Thus, smartphone can make users believe that they can communicate with others all the time and anytime, and even that they would never be alone (Turkle, 2011). The flip side of the coin is, however, that the illusion of constantly being with
others via smartphone can also heighten users’ expectation to be connected with others to the point that they have hard times to cope with being alone. Such tendency would be more obvious for those who have a stronger NSA, and the perception of being “always connected” via smartphone would increase their anticipation to get immediate responses from others (Atchley & Warden, 2012; Walsh, White, Cox, & Young, 2011) as well as their paranoia to be always available for others.

**H3.** NSA is positively associated with need for immediate connection (NIC).

A strong desire to get immediate responses from others as well as to be always available for others via smartphone inevitably leads to a high level of dependency on smartphone. Being highly dependent on smartphone also means that users have a strong attachment to mediated communication, which is one of the typical symptoms of those who are trying to reduce loneliness and amend one’s unsatisfactory social relationships (Caplan, 2005). Such eagerness to be always connected to others accompanied by attachment to smartphone-mediated communication can lead to defective regulation in smartphone use. A recent study (Seo et al., 2015) showed that NIC has a positive association with problematic use of mobile phone.

**H4.** NIC is positively associated with problematic use of smartphone.

Putting all the aforementioned hypotheses together, a hypothesized path model is built (Fig. 1).

### 2.3. ADHD’s associations with loneliness, NSA, NIC, and problematic use of smartphone

ADHD is characterized by symptoms of inattention, hyperactivity, and impulsivity according to DSM-IV (American Psychiatric Association, 2006). ADHD is known to be a psychiatric disorder with childhood onset and usually continue into adulthood (Yen, Yen, Chen, Tang, & Ko, 2009a). Children with ADHD tend to have deficits in their social interaction skills, accompanied by aggression, inattentiveness, and disruptiveness, leading to rejection by peers and isolation (Frederick & Olmi, 1994; Landau & Moore, 1991).

Although ADHD has been one of the most common psychiatric disorders among children (Shekim et al., 1985; Bird et al., 1988), the fact that adult ADHD can be also a commonly occurring and seriously impairing disorder has not been acknowledged until recently (Wilen, Spencer, & Biederman, 2002). A researcher even argued that ADHD might be probably the most common chronic undiagnosed psychiatric disorder in adults (Wender, 1998). Even with its seriousness and commonness, there have been very few large-scale survey and research on adult ADHD carried with random sampling methods (Kessler et al., 2006). While screening for ADHD is routine for children, screening for adult ADHD is not. This is partially because primary care physicians who are mainly in charge of diagnosing adult ADHD lack in training as well as are skeptical and conservative about diagnosing ADHD for those who had not been diagnosed in childhood (Faraone & Biederman, 2005). Such reluctance or hesitance in diagnosing adult ADHD is partially based on the belief that adult ADHD might not be as prevalent as that of children.

Still, it has been found that adults with ADHD encounter serious problems at work or in relationships due to forgetfulness and difficulty concentrating on conversations or tasks (Hoza et al., 2005), as in the case of children ADHD. Studies suggested that adults with ADHD had greater friendship problems (Young, Toone, & Tyson, 2003), and thus showed a higher level of loneliness compared to those without ADHD (Philipsen et al., 2009). In addition to the core symptoms of ADHD, diverse stigma and prejudice attached to ADHD also have been playing significant roles in disrupting social interactions of those with ADHD (Hoza, 2007; Mueller, Fueraimaer, Koerts, & Tucha, 2012).

**H5.** Those with ADHD would show a higher level of loneliness than those without ADHD.

There has not been any study linking ADHD directly with NSA or NIC. However, given that those with ADHD tend to be lonely and not that welcomed by others because of their aggression, inattentiveness, and disruptiveness, it is logical to predict that those with ADHD would also have a high level of desire to amend their loneliness by being assured by and connected to others. Some of the ADHD’s core symptoms include being easily bored and seeking for constant stimulation (Jeong & Fishbein, 2007; Yen et al., 2009a). Thus, engaging in diverse media activities, even at the same time (multitasking) (e.g., Cain & Mitroff, 2011; Minear, Brasher, McCurdy, Lewis, & Younggren, 2013) has been found to be helpful in quenching the constant thirst for excitement and stimulation. Provided that media activities involve interaction with others, either direct interaction with acquaintances via communication devices or pseudo interaction through mass media, interaction with others seem to be working as a way to reduce constant restlessness or uneasiness of those with ADHD. Congregating deprived social interaction with others, which leads to loneliness, and their constant seeking for external stimulation via mediated or pseudo interaction, those with ADHD would be likely to seek for others’ presence and assurance both as ways to diminish their loneliness and to invigorate their under-stimulated state.

**H6.** Those with ADHD would show a higher level of NSA as well as NIC than those without ADHD.

Provided that those with ADHD would also suffer from a high level of loneliness, there is a plausible chance that ADHD would contribute to problematic use of smartphone, as loneliness has been found to be one of the distant predictors of problematic use of media. Although there has been rarely any study looking at the direct association between ADHD and problematic use of smartphone, the positive association between the two can be predicted by a group of relevant studies. For instance, one of the symptoms of ADHD, impulsivity, has been found to be highly correlated with smartphone addiction (Kim et al., 2014; Wilmer & Chein, 2016).

![Fig. 1. The hypothesized model leading to problematic use of smartphone.](image-url)
Except for one study (Seo et al., 2015), there has not been any study validating ADHD’s positive association with problematic mobile phone use. Still, a group of studies showed that ADHD are positively associated with problematic use of other types of media including TV, video games, and the Internet (e.g., Cho, Kim, Kim, Lee, & Kim, 2008; Ko et al., 2009; Yen et al., 2009b; Yoo et al., 2004). Given that smartphone has all the media features in one device (TV, games, and the Internet), it is possible to assume that ADHD is positively related to problematic use of smartphone.

H7. Those with ADHD would show a higher level of problematic use of smartphone than those without ADHD.

Going beyond comparing those with ADHD and those without ADHD in loneliness, NSA, NIC, and problematic use of smartphone, the present study examines whether there is any difference in the hypothesized paths linking those focal variables between those with ADHD and those without ADHD.

RQ1. What is the moderating effect of ADHD in the proposed path model leading to problematic use of smartphone?

2.4. Moderation via FtF interaction, SMS, and ADHD

Except for a few (Kim et al., 2015; Pea et al., 2012), there has been rarely any study looking at the role of FtF interaction in the effects of media on users’ well-being. Pea et al. (2012) study found that FtF interaction induced positive effects on individuals’ psychological well-being (e.g., more social success and positive feeling about themselves), while reducing their desire to rely on media. In terms of mobile phone, a recent study (Kim et al., 2015) found that those who spend more time on FtF interaction tend to develop problematic use of mobile phone less than those who spend less time in FtF interaction. Such result indicates that FtF interaction can play a significant role as an “antidote” to problematic media use, by helping individuals develop social skills and feel comfortable when interacting with others. Offering stronger perception of social support, FtF interaction can also reduce loneliness and users’ desire to rely on mediated communication (Kim et al., 2015). Meanwhile, it was found that lonely individuals’ increased use of media led to reduced time for FtF interpersonal interaction (Perse & Rubin, 1990), causing more unhealthy reliance on mediated communication. Based on such research findings, the present study investigates if FtF interaction can weaken any association in the path model linking loneliness, NSA, NIC, and problematic use of smartphone. In addition, this study examines the possibility that individuals with ADHD would show a different pattern in FtF interaction’s moderating influence on the hypothesized path model compared to individuals without ADHD. Thus, the following research question is set.

RQ2. What are the moderating effects of FtF communication in the proposed path model leading to problematic use of smartphone for those with ADHD and for those without ADHD?

Can smartphone-mediated communication such as SMS (short message system) also weaken any link among loneliness, NSA, NIC, and problematic use of smartphone? Relying on mediated communication is not expected to have as positive effects on users’ well-being as FtF interaction (Pea et al., 2012). As mentioned earlier, those with a high level of loneliness or other psychological issues tend to rely on mediated communication as a relatively easy way to relieve their negative emotional states (compared to FtF interaction that is challenging for them). However, such emotionally weighted reliance on mediated communication would not provide long-term relief from their original problem (Ha et al., 2008; Smetaniuk, 2014), although it can offer some temporary break from their negative states. The present study investigates what kinds of effects SMS use would have on the path model linking loneliness, NSA, NIC, and problematic use of smartphone. As in the case of FtF interaction, the present study examines the possibility that individuals with ADHD would show a different pattern in SMS’s moderating influence on the hypothesized path model compared to individuals without ADHD. Thus, the following research question is set.

RQ2. What are the moderating effects of SMS in the proposed path model leading to problematic use of smartphone for those with ADHD and for those without ADHD?

3. Method

3.1. Data collection

A total of 615 U.S. American adult participants were recruited nationally through a professional survey company. Provided that the present study is about smartphone use and users tend to be younger, participants were limited to the age categories between 19 and 40 years old (50.7% for age 19–30, 49.3% for age 31–40) (M = 30.39, SD = 5.62). 75.5% of the participants were White, 51.3% were male.

3.2. Measures

Loneliness. Loneliness was measured by 10 items from Russell’s UCLA Loneliness scale (Russell, 1996). On a 5-point scale (1 = never; 5 = very often), participants were asked to answer how often they found themselves in the 10 described situations (e.g., I felt unhappy doing so many things alone; I felt completely alone; I felt shut out and excluded by others) over the past 6 months. Responses were averaged to create a composite score of loneliness (M = 2.15, SD = 0.99, Cronbach’s α = 0.95).

Attention Deficit Hyperactivity Disorder (ADHD). Although there are some self-report measures of adult ADHD (e.g., Barkley, 1995; Brown, 1996; Conners, Erhardt, & Sparrow, 1998; Mehringer et al., 2002), they do not fully reflect DSM-IV criteria for adult ADHD. The advisory group of clinical experts in adult ADHD assembled by WHO (World Health Organization) suggested developing a new self-report measure of adult ADHD, and Adult ADHD Self-Report Scale (ASRS) was developed jointly by Kessler et al. and WHO (Kessler et al., 2005). The 18-item scale based on DSM-IV criteria, ASRS has been compared with and validated by clinician-administered ADHD rating scale (Adler et al., 2006). Out of the 18 items, the first six items in part A turned out to be the most effective screener of ADHD and the remaining 12 items are not as effective (Kessler et al., 2005). Therefore, this study used the first six items to examine whether participants are highly likely to have adult ADHD or not. If four or more marks appear at least in three points (Sometimes) or greater for the first three questions, and at least four points (Often) or greater for the following three questions, participants are considered to have symptoms highly consistent with adult ADHD. Based on this criteria, the collected data was separated into two groups: A group with symptoms highly consistent with ADHD (N = 142, M = 3.74) and the other group with a very low (or even no) possibility to have ADHD (N = 473, M = 1.99).

Need for Social Assurance (NSA). Need for social assurance (NSA) was measured by eight items from Lee and Robin’s Social Connectedness and Social Assurance Scales (Lee & Robbins, 1995). On a 5-point scale (1=Strongly Disagree; 5=Strongly Agree), participants were asked to answer how strongly they agreed with eight statements including, “My life is incomplete without a buddy beside me” “I join groups more because of my friends than the activity itself “, and “I wish to find someone who can be with me all the time.” Responses were averaged to create a composite score of NSA (M = 3.85, SD = 1.27, Cronbach’s α = 0.89).
Need for Immediate Connection. Need for immediate connection (NIC) was measured with seven items from the connectedness scale developed by Seo et al. (2015). This scale taps on people’s desire to be constantly connected with others via smartphone or other mobile devices. On a 5-point scale (1=strongly disagree; 5=strongly agree), participants were asked to answer how strongly they agreed with seven statements including, “I constantly check and answer text messages”, “I try to be available for phone calls or messages.” Responses were averaged to create a composite score of NIC (M = 4.86, SD = 1.03, Cronbach’s α = .84).

Problematic Use of Smartphone. Problematic use of smartphone was measured by 23 items from previous studies measuring problematic mobile phone and smartphone use (Bianchi & Phillips, 2005; Kwon, Kim, Cho, & Yang, 2013). These scales consisted of items originally developed to measure problematic use of the Internet (Kim & Haridakis, 2009; Young, 1996) and TV (Horvath, 2004), and were modified for smartphone. Participants were asked to answer how often (1 = Never, 5 = Always) they engaged in 23 behaviors and thoughts indicative of problematic use of smartphone (e.g., I am annoyed if others bother me when I am using my smartphone; When I can’t use my smartphone, I obsess about checking my smartphone; I have tried to cut down the amount of time spent on my smartphone but failed). Answers to the 23 items were averaged to create an index (M = 2.72, SD = 0.87, Cronbach’s α = .95).

Face-to-Face (FtF) Interaction. FtF interaction was measured with four questions asking how much time participants spent on interacting or communicating with others face-to-face (e.g., Hanging out with friends or families face-to-face; Meeting people face-to-face for work or school work). As a way to increase the accuracy of the measure, the same set of four questions were repeated for yesterday and a typical day respectively. To increase the accuracy in reporting how many hours and minutes participants spent on FtF interaction, a drop-down menu was used. Both data were transformed into minutes and averaged to create an index (M = 189.29, SD = 164.98).

Short Message Service (SMS). SMS usage was measured with four questions asking how much time participants spent on exchanging text messages or other smartphone-based messaging services with others. As in the case of FtF interaction, the same set of four questions were repeated for yesterday and a typical day respectively. The collected data were transformed into minutes and averaged to create an index (M = 78.37, SD = 94.11). Inter-scale correlation values were calculated for all seven variables (Table 1).

As a way to verify demographic variables that need to be controlled, bivariate correlation analysis was run with two demographic variables (age and gender) and four focal variables (loneliness, NSA, NIC, and problematic use of smartphone) except ADHD which is a dichotomous variable in this study. While age was coded as ratio scale, gender (1 = male, 0 = female) was coded as a dichotomous variable. Both age and gender turned out to be significantly related to at least one of the focal variables. Thus, as a way to control age and gender in the path model analysis, residual values of four focal variables were obtained through regressing them with age and gender. These residuals of four focal variables are variances that are not explained by the two covariates (age and gender) (Lance, 1988)

4. Results

4.1. Hypothesized path models

The hypothesized path model was tested with AMOS 21 (Arbuckle, 2012). The model showed an excellent fit with the data, χ²(1) = 2.805, p = 0.094, CFI = 0.998, NFI = 0.996, RMSEA = 0.054. The paths from loneliness to problematic use of smartphone (H1) (β = .43, p < .001), from loneliness to NSA (H2) (β = .48, p < .001), from NSA to NIC (H3) (β = .42, p < .001), and from NIC to problematic use of smartphone (H4) (β = .40, p < .001) were all turned out to be positively significant as predicted. All the standardized coefficients in the hypothesized model were presented in Fig. 2.

4.2. Comparison between those with ADHD and those without ADHD

Hypotheses 5 through 7 examined the effect of ADHD on each of the core variables in the hypothesized path model. A one-way between subjects ANOVA was conducted to compare the group of participants with ADHD and the group of participants without ADHD in loneliness, NSA, NIC, and problematic use of smartphone. Those with ADHD showed a higher level of loneliness (M = 3.13) than those without ADHD (M = 1.85) [F (1,613) = 258.92, p < .001] (H5), a higher level of NSA (M = 5.01) than those without ADHD (M = 3.50) [F (1,613) = 205.32, p < .001], a higher level of NIC (M = 5.33) than those without ADHD (M = 4.72) [F (1,613) = 40.59, p < .0001] (H6), and a higher level of problematic use of smartphone (M = 3.55) than those without ADHD (M = 2.47) [F (1,613) = 234.33, p < .001] (H7).

4.3. Multi-group analyses

First, to investigate the moderating effect of ADHD on the hypothesized path model, a multi-group analysis was conducted with two groups—those with ADHD and those without ADHD (RQ1). In a multi-group analysis, each path was constrained equally across the hypotheses. If the hypothesized path model, a multi-group analysis was conducted with two groups (Kline, 1998).

For the first multi-group analysis, the entire sample was separated into two—participants with ADHD (N = 142, M = 3.74) and participants without ADHD (N = 473, M = 1.99). From the multi-group analysis, the path from loneliness to NSA turned out to be significantly stronger for those with ADHD (β = .46, p < .001) than

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**Note:** All correlation coefficients are statistically significant at p < .05.
those without ADHD ($\beta = .24, p < .001$) ($\Delta \chi^2 (1) = 4.481, p < .05$). The path from NSA to NIC also is significantly stronger for those with ADHD ($\beta = .58, p < .001$) than those without ADHD ($\beta = .30, p < .001$) (Fig. 3).

For the second set of multi-group analyses, participants without ADHD were separated into two groups—smaller amounts of FtF interaction ($M = 85.15, \text{MIN} = 0, \text{MAX} = 150 \text{ min}$) and larger amounts of FtF interaction ($M = 318.89, \text{MIN} = 153.75, \text{MAX} = 1473.75 \text{ min}$)—by median split. Participants with ADHD were also separated into two groups—smaller amounts of FtF interaction ($M = 56.57, \text{MIN} = 0, \text{MAX} = 105 \text{ min}$) and larger amounts of FtF interaction ($M = 237.91, \text{MIN} = 105, \text{MAX} = 780 \text{ min}$)—by median split. From the former multi-group analysis with those without ADHD, no path was found to be significantly different across smaller amounts of FtF interaction and larger amounts of FtF interaction. From the latter multi-group analysis with those with ADHD, however, the path from NSA to NIC gets weaker for those who spend larger amounts of time on FtF interaction ($\beta = .50, p < .001$) than those who spend smaller amounts of time on FtF interaction ($\beta = .71, p < .001$) (Fig. 4).

For the third set of multi-group analyses, participants without ADHD were separated into two groups—smaller amounts of SMS ($M = 20.21, \text{MIN} = 0, \text{MAX} = 37.50 \text{ min}$) and larger amounts of SMS ($M = 123.70, \text{MIN} = 45, \text{MAX} = 1170 \text{ min}$)—by median split. No path was found to be significantly different across smaller amounts of SMS and larger amounts of SMS from those without ADHD. Participants with ADHD were also separated into two groups—smaller amounts of SMS ($M = 27.46, \text{MIN} = 0, \text{MAX} = 45 \text{ min}$) and larger amounts of SMS ($M = 141.34, \text{MIN} = 52.50, \text{MAX} = 705 \text{ min}$)—by median split. Spending more time on SMS weakened the association between NSA and NIC for those with ADHD somewhat, but it barely missed the significance probability ($\Delta \chi^2 (1) = 3.314, p = .069$).

5. Discussion

This study investigated how loneliness leads to problematic use of smartphone via NSA (need for social assurance) and NIC (need for immediate connection). Going beyond looking at the direct association between psychological issues and problematic use of smartphone, the present study examined the covert mechanism connecting the two. NSA and NIC were selected as mediating steps based on the answer to the question “What would be the crucial needs people try to fulfill via smartphone when they suffer from deficiency in social interaction with others?”

Overall, all the associations hypothesized in the path model turned out to be positive and significant. Such results indicate that individuals who are lonely would rely on smartphone hoping to be connected to and get assurance from others, but rather might end up struggling with another problem—unregulated use of smartphone. Such proposition that individuals with psychological issues would be prone to experience problematic use of media can be explained by the social enhancement model (Kraut et al., 2002), which is also called, “the rich get richer, the poor get poorer” model. According to this model, those who are already suffering from psychological issues would have a higher chance to develop unhealthy use of media in the long run compared to those with healthy psychological composites, even though those with psychological issues initially used media to alleviate their issues.

The present study attempts to advance the social enhancement model by suggesting that strong (even excessive) desire to compensate for defective relationships (NSA and NIC) can fill the gap in explaining how the psychologically/socially poor would get even poorer against their initial intention to improve their undesirable states. NSA itself is one of the core human needs and healthy if moderate, but those who suffer from psychological issues and defective relationships are expected to have somewhat disproporionate NSA (Lee & Robbins, 1995). Furthermore, with its diverse communication features, smartphone would be a perfect device to cultivate the illusion of “constantly being with others” for those who are highly other-dependent and lack confidence in functioning independently. Combining excessive craving to be assured by others and heavy reliance on smartphone, those who are psychologically vulnerable and do not have healthy self-regulation system would have a higher chance to develop unregulated dependence on smartphone (Kim et al., 2015; LaRose et al., 2003).

One of the key contributions of the present study is to examine how those with ADHD (very likely to have ADHD) and those without ADHD (very low possibility to have ADHD) are different in the focal variables of the hypothesized path model—loneliness,
NSA, NIC, and problematic use of smartphone. As predicted, adults with ADHD turned out to experience a higher level of loneliness than those without ADHD. The higher level of loneliness would lead those with ADHD to feel stronger needs to be assured by and connected to others because of their deprived social interactions with others. Furthermore, those with ADHD’s tendency to be easily bored and seeking for constant stimulation (Jeong & Fishbein, 2007; Yen et al., 2009a) would naturally make them crave for constant connection with others via smartphone.

Going beyond comparing those with ADHD and those without ADHD in each of the focal variables, the present study also examined whether ADHD affects any association in the hypothesized model linking loneliness, NSA, NIC, and problematic use of smartphone. Although all the paths are significantly associated for both groups of participants, those with ADHD showed significantly stronger associations between loneliness, NSA, and NIC than those without ADHD. This supports the proposition that having ADHD would exacerbate the unhealthy cycle starting from loneliness and leading to problematic use of smartphone, upholding “the rich get richer and the poor get poorer” prediction. Already suffering from loneliness and deprived social interaction, having another psychological issue (ADHD) would accelerate their paths to unhealthy reliance on others (NSA and NIC) via smartphone.

Finally, the present study also looked at how FtF interaction and SMS use would affect the associations in the disconcerting paths to problematic use of smartphone, but separately for those without ADHD and those with ADHD. For those without ADHD, FtF interaction or SMS use did not do much in weakening or strengthening any link in the path leading to problematic use of smartphone. However, for those with ADHD, spending more time on FtF interaction significantly weakened the link between NSA and NIC than spending less time on FtF interaction. These findings imply that individuals with ADHD might benefit more from interacting with others FtF than those without ADHD. FtF interaction, with its higher level of social cues and stimuli, would be an ideal communication channel to fulfill the desire to be connected to others and reduce boredom of those with ADHD. Thus, it is necessary and important for those with ADHD to continue trying to mingle and interact with others FtF, although they might have to face tremendous challenges in FtF interaction settings.

Spending more time on SMS also weakened the association between NSA and NIC for those with ADHD somewhat, but it barely missed the significance test ($p = 0.069$). Given that it is hard to find a large number of people with ADHD ($N = 142$), and even those with ADHD were divided into two groups depending on the amount of time they spend on SMS, a larger sample size might have produced a significant outcome. Such conjecture on using smartphone as a way of mitigating desires to be connected to others for those with ADHD can be drawn from a few propositions that adults with ADHD tend to have high levels of thirst for stimulation, and that engaging in diverse media activities (even at the same time) are one of the easy and convenient ways to quench the constant crave for stimulation. Media, especially smartphone, has been a major source for mediated interaction with others as well as media content consumption, which can easily lead to the illusion of constant connection to people and the world. Although such heightened expectation to be always connected to others via smartphone tends to bring more disappointment to many, mediated interaction via smartphone might be useful for soothing the restlessness of adults with ADHD.

In the interest of future research, it is important to recognize the limitations of the present study. First of all, the cross-sectional data in this study requires some caution in insinuating causality associations in the hypothesized path model. Provided that the causal relationships between problematic media use and psychological issues have not been consistent, a future study should collect a set of longitudinal data. Another issue is the challenging task of coming up with valid and legitimate ways to measure time spent on FtF interaction as well as SMS. Although most studies on media still rely on self-report, relying on individuals’ memories is rapidly losing its validity when we are living in the era of media multitasking instead of using one medium at a time. More objective and recordable data collection methods (e.g., log data) should be actively explored. If we can combine the longitudinal study and media use log data, it would be the most efficient way to measure causal associations as well as the least intrusive way to measure people’s changes in media use behaviors over time.

Even with such limitations, the present study has contributed to understanding how individuals with psychological issues (loneliness) might develop problematic use of smartphone on account of their strong, and even desperate desire to be assured by others (NSA) as well as their needs to be immediately and constantly connected to others (NIC) via smartphone. Although NSA might be a reasonable need for individuals to compensate for deficiency in social relationships, smartphone might inflate users’ anticipation to be immediately connected to others to the point that they rely on smartphone in unhealthy ways. And such tendency seems to be stronger especially for those who suffer from ADHD. FtF interaction, as the best way to form meaningful relationships with others, still seems to work as a buffer and ease some of the unhealthy desire to be assured by and connected to others relentlessly for those with ADHD.

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**References**


