The Overlooked Role of Social Norms in Problematic Smartphone Usage

Tasnim Farzana[1], Sandra Gilliland[2], and Mark LaCour[3*]
[1]Department of Psychology, Louisiana State University of Alexandria, LA
[2]Department of Counseling, Ouachita Baptist University, Arkadelphia, AR
[3]Department of Psychology, University of Louisiana at Lafayette, LA
*Corresponding Author: mark.lacour@louisiana.edu, (337) 482-6070, @thestevarkian87

Smartphones have provided many benefits for society, but these benefits have come at some cost. Researchers have identified a number of problematic smartphone usage (PSU) behaviors associated with greater impulsiveness and excessive reassurance seeking, particularly among younger people, women, and minoritized groups. In the present study, we extended this research by (1) examining whether these findings replicate in slightly older demographic groups, (2) determining whether perceived social norms are a substantial predictor of PSU, and (3) confirm that using smartphones specifically for social media is associated with PSU.

We conducted an online survey on 183 participants recruited through Prolific. The participants in the present study were significantly older (approximately 9 years) compared to a previous study. Previous findings were replicated on our older sample. Perceived social norms regarding smartphone use had a large association with PSU. We found that using one's smartphone primarily for social media (rather than other popular applications) was associated with greater PSU. We found no evidence that PSU is linked with depression. Nor did we find evidence that the relationship between age and PSU is mediated by age-related decreases in impulsivity, as previous researchers had speculated.

Keywords: social norms, problematic smartphone usage, PSU, social media

Smartphones and social media have become increasingly ingrained in modern life. From 2017 to 2022, there was a 48.89% increase in smartphone use, which led to 83.72% of people being smartphone users worldwide (Ash, 2022). Smartphones are advantageous in some ways. For instance, a smartphone allows users to access the internet, browse social media, play games, watch videos, use GPS navigation, and even track their health and wellness. For all of these positive effects, there are some unintended consequences, especially when it comes to the increased access to social media that smartphones provide. Past research has shown that heavy digital media use is associated with lower life satisfaction, especially among women (Twenge et

al., 2020) and minoritized groups (Hampton, 2019; Jaidka, 2022). While many users continue to use their smartphones as a helpful and productive tool, constantly using the device can be problematic from a mental health standpoint. Mitchell and Hussain (2018) investigated problematic smartphone usage (PSU), noting that many users experience behavioral addiction symptoms such as "salience, mood modification, tolerance, withdrawal symptoms, interpersonal and intrapersonal conflict, and relapse" (p. 2).

While this, and prior, research have done much to uncover the predictors of PSU, there has not been much work examining how perceived social norms might contribute to PSU. Social norms might have a significant impact on smartphone use and mental health outcomes (see Hong et al., 2021; Salafia & DiPlacido, 2022; Yankah et al., 2017). For instance, older adults exhibit fewer PSU behaviors (Busch & McCarthy, 2021), possibly because of differences in social norms between people from different generations. This, in turn, can alter the way in which smartphone usage impacts one's well-being. It is important, therefore, to examine how social norms correlate with smartphone usage and how social norms further impact the link between smartphone usage and negative mental health outcomes. The current study therefore aims to replicate previous findings but also extend these findings by examining how social norms influence PSU.

LITERATURE REVIEW
PSU and Mental Health

In extreme cases, high levels of PSU can be categorized as a technological addiction. Prior to the fifth edition of the Diagnostic and Statistical Manual (DSM-5), the American Psychological Association only recognized addiction to substances. However, the diagnostic criteria were broadened with the 5th edition to include "Substance-Related and Addictive Disorders." Potenza (2014) highlights that this change in wording represents an increased awareness to identify, treat, and prevent behavioral addiction such as food, sex, gambling, and gaming. As of right now, gambling addiction is the only formally recognized behavioral addiction in the DSM-5.

Internet gaming behaviors become problematic (from a mental health standpoint) when people engage in persistent and recurrent internet gaming, when they exhibit a preoccupation with gaming, and when they experience clinically significant impairment or

distress due to their gaming behaviors. In a similar vein, over-use of social media can result in impaired social functioning and emotional distress. For instance, Instagram users likely experience negative effects due to the platform's positivity bias and because it encourages social comparison processes (Burke & Kraut, 2016). PSU's status as a diagnostic category (i.e., as a form of "addiction") would depend on whether PSU is correlated with individual differences in impulsivity. Indeed, various forms of PSU are correlated with impulsivity issues (Zheng et al., 2014) and these both interact with self-traits (e.g., self-esteem, self-efficacy; Khang et al., 2012; Khang et al., 2013).

PSU has also been linked with symptoms of depression (Elhai et al., 2017; Kim et al., 2015; Seo et al., 2016; Thomée et al., 2011). However, this link might be complex. Mitchell and Hussain (2018), for instance, did not find that PSU correlated with symptoms of depression, but that PSU did correlate with some more specific facets of depression.

One major facet of depression is believed to be excessive reassurance seeking (ERS, Starr & Davilla, 2008; Joiner & Metalsky, 2001). ERS occurs when someone with mild forms of depression looks to others for validation and affirmations of value. This may backfire because people may start rejecting or resisting those who seek social validation and self-affirmation to an excessive degree. Perhaps unsurprisingly, ERS has been linked with PSU (Igarashi et al., 2008; Lu et al., 2011). In other words, people who tend to show problematic smartphone behaviors (e.g., always scrolling through social media) also have a tendency to seek out affirmation from others.

One goal of the present study was to replicate the associations between mental health outcomes and PSU behaviors described above with a new dataset. The first hypothesis formulated for this study (H1) has three parts, each stating that a specific finding from Mitchell and Hussain's (2018) study will replicate in the current data. Namely:

(H1a) Impulsiveness will be positively associated with PSU such that people who are more impulsive exhibit more PSU behaviors.

(H1b) Excessive reassurance seeking (ERS) will be positively associated with PSU such that people who exhibit ERS also tend to exhibit more PSU behaviors.

(H1c) Symptoms of depression will not be associated with PSU. Specifically, experiencing a greater number (or severity) of symptoms of depression will neither be positively nor negatively associated with PSU.

PSU and age

Older adults tend to exhibit fewer PSU behaviors (Busch et al., 2021). Mitchell and Hussain (2018) replicated this finding in their study. They speculated that, as people get older, they become less impulsive and consequently exhibit fewer PSU behaviors. While their findings were consistent with this hypothesis, the hypothesis has not been formally tested using a mediation analysis. Thus, we seek to provide further replication of this effect but also to test the hypothesis with a mediation analysis:

(H2) Age will be negatively associated with PSU such that older adults exhibit fewer PSU behaviors.

(H3) Impulsiveness mediates the relationship between age and PSU.

In addition to testing the hypotheses described above, we sought to recruit a slightly older sample in the present study compared to Mitchell and Hussain (2018) in order to determine whether their findings would generalize to slightly older demographic groups.

The Role of Social Norms

People's attitudes and behaviors are shaped by observing their peers in the social environment. This is often done out of necessity. For instance, when we are in a novel situation, we must infer the expected (or appropriate) behavior by observing the behavior of others. Sometimes, however, these perceived social norms can lead us astray. In one famous study (Asch, 1952), participants were asked to identify which line (among a set of three) matched the length of a specific comparison line, which was off to the side. The other "participants" in the study were confederates, actors pretending to be participants in the study who were really creating a false (experimental) social situation in order to observe how the real participant will react. Each confederate agreed that a particular line from the set was a match when it clearly was not. The real participants, having seen this

strong consensus, tended to agree with the crowd and say that the incorrect line was the correct one.

Perceived social norms have a very strong impact on behavior (Asch, 1952; LaCour et al., 2019; Sherif, 1936). They can have negative effects as well as positive ones. For instance, social norms have been harnessed to encourage positive behaviors such as recycling (and other pro-environmental behaviors: Bateson et al., 2013; Kormos et al., 2015; Pellerano et al., 2017) and various health-promoting behaviors (Bewick et al., 2013; Chernoff & Davidson, 2005; Lapinski et al., 2013; McCoy et al., 2017). Social norms can also play a role in encouraging negative behaviors such as problematic gambling (Celio & Lisman, 2014; Neighbors et al., 2015) and negative social behaviors such as prejudice, harassment, and aggression (Gidycz et al., 2011; Paluck, 2009; Paluck & Shepherd, 2012).

For these reasons, we hypothesized that perceived social norms, where high frequency smartphone use is viewed as normal in the social environment, will have important associations with problematic smartphone use (see also Hong et al., 2021; Salafia & DiPlacido, 2022; Yankah et al., 2017). In this study, we were specifically interested in the extent to which people view frequent ("all the time") smartphone use as a normal behavior within their own social group:

> (H4a) Perceived norms regarding frequent smartphone usage will be associated with more PSU behaviors such that people who view frequent smartphone usage as more socially normal will engage in more PSU behaviors.
>
> (H4b) Adding perceived norms into a model predicting PSU behaviors alongside the other covariates (age, impulsiveness, excessive reassurance seeking, and depression symptoms) will significantly improve overall model fit.

Using Smartphones Primarily for Social Media

There are many different applications on a smartphone: music, streaming, shopping, messaging. It is unclear, however, if social media in particular (versus other smartphone applications) contributes to PSU behaviors. For the present study, we therefore extended previous research by drawing distinctions between different forms of

smartphone use (e.g., social media, streaming, and listening to music) and examined how these differentially associate with PSU.

We asked participants to report what they primarily use their smartphone for (social media/TikTok, messages and calls, streaming, music, work-related communications). Unlike most other uses, social media poses a particular risk for negative social comparisons (Nesi & Prinstein, 2015). The non-social media applications are also more likely to be used for more narrow purpose (e.g., "Oh, I need to order that real quick", "Let me message him and ask before I forget") compared to habitual social media use, such as idly scrolling through social media feeds. The latter is associated with reduced feelings of meaningfulness compared to the former (Lukoff et al., 2018). For these reasons, we formulated the following hypothesis.

(H5) Participants indicating that they use their smartphone primarily for social media will have higher rates of PSU compared to those who report using their smartphone primarily for other purposes.

METHODS
Participants

We recruited 200 participants from Prolific, a survey recruitment platform. Participants were paid $6.59 an hour for their time. The survey itself was hosted and administered via Google Forms. Three of the participants did not complete the survey. Ten participants were removed for failing to answer one of the two attention checks accurately and four were removed because they reported that they did not use a smartphone. Thus, the final sample size was 183. The Institutional Review Board of the university where this research was conducted approved this study.

The majority of the participants were female ($n = 141$, 77.05%). Thirty-six (19.67%) were male. The remaining 6 (3.28%) identified as gender-queer, non-binary, or chose not to answer. The mean age of these participants was 39.33 ($SD = 14.68$), ranging from 18 to 82 years old. The majority of the sample identified as White ($n = 144$, 78.69%). Ten (5.46%) identified as African-American, 10 (5.46%) identified as multiple races/ethnicities, 8 (4.37%) identified as Asian, 8 (4.37%) identified as Latino or Hispanic, and 3 (1.64%) preferred not to answer.

Materials

Participants responded to each of the following measures on a Likert scale or, in the case of the Beck Depression Inventory (BDI), had response options that nonetheless mapped onto numbers. After reverse scoring the appropriate questions, the arithmetic mean was computed for each variable for the purpose of statistical analysis.

Problematic Smartphone Usage (PSU). Following Mitchell and Hussain (2018), we adapted the Modified Internet Gaming Disorder Scale (Pontes & Griffiths, 2014) to measure problematic smartphone usage (PSU). Each of these 9 questions were rephrased to refer to problematic smartphone usage rather than problematic internet gaming behavior. These included questions like "Do you feel more irritability, anxiety or even sadness when you try to either reduce or stop your smartphone usage?" and "Do you feel the need to spend increasing amounts of time engaged on your smartphone in order to achieve satisfaction or pleasure?" Responses to each of these questions were provided via a 5-point Likert scale anchored at "Never" and "Very often." Cronbach's α for the PSU scores was .87.

Perceived Smartphone Usage Norms. We included questions in the survey to assess the degree to which people view frequent smartphone usage as a social norm. More specifically, the questions measure people's perceived *descriptive* social norms rather than, e.g., attitudes towards those norms ("injunctive norms", Cialdini & Trost, 1998). We used a brief, 2-item questionnaire adapted from previous work (LaCour et al., 2019; Davis et al., 2020) to measure perceived descriptive norms. Participants rated their agreement with the following statements on a 7-point Likert scale anchored at "Strongly disagree" and "Strongly agree." "Most people I know use their smartphone a lot" and "People who are like me spend a lot of time on their smartphone." Cronbach's α for the perceived PSU norms in this study was .77.

Excessive Reassurance Seeking (ERS). Four questions originally developed by Joiner and Metalsky (2001) were used to assess the degree to which participants seek out assurances that others care about them or value their relationship. Questions included "Do you find yourself often asking the people you feel close to how they truly feel about you?" and "Do you frequently seek reassurance from the people you feel close to as to whether they really care about you?" Participants rated how often (or to what extent)

these questions applied to themselves on a 7-point Likert scale anchored either from "Never" to "Extremely often" or from "Never" to "Extremely," depending on which phrases grammatically suited the question. Cronbach's α for this scale was .92.

Beck Depression Inventory (BDI). The Beck Depression Inventory (BDI; Beck et al., 1996) measures the degree to which people are suffering from symptoms of depression. Each of the 21 items have the instructions "Please select the option that best describes you." A set of four options appear for each item, which describe increasing intensity of depression symptoms (e.g., poor sleep, inability to work, losing interest in other people). Cronbach's α for the BDI scores was .92.

Barratt Impulsiveness Scale (BIS). The revised version of the Barratt Impulsiveness Scale (BIS; Patton et al., 1995) contains 30 short statements such as "I buy things on impulse" and "I plan tasks carefully." Participants rated how strongly they agreed to each statement with a 7-point Likert scale anchored at "Never" and "Extremely often." Cronbach's α for the BIS scores was .84.

Primary Smartphone Activities. We asked participants how they spend most of their time on their smartphone. We asked them to check "Screen Time" (or a similar application) to answer this question but, if they do not use such an application, to give their best guess. The options were "Streaming (YouTube, Netflix, Hulu, Prime, etc.)," "TikTok," "Messages and calls," "Social Media (Facebook, Instagram, Reddit, Twitter, Snapchat, etc.)," "Shopping (Amazon, eBay, Shein, Wish, etc.)," "Cryptocurrency and stock investment applications," "Music," and "Work related." We also included an option to provide a unique answer. We recognized, after deploying the survey, that it was debatable whether TikTok should be in its own category. Afterall, it resembles a streaming service in some respects, but is also very much a social media platform. Because many researchers consider TikTok to be a social media platform (Marengo et al., 2021; Cosmann et al., 2022; Oppong et al., 2022), we stipulated that "TikTok" was a social media category for our primary analyses. However, we recognize that there is some ambiguity in this categorization and report the results both ways below (including TikTok as a social media platform and excluding it).

Attention Checks. Two attention checks were included in the survey for data quality and screening purposes. The first was added to the BIS section and read, "I am usually

kind to people. Regardless of whether this is true, select option 2." The second question was inserted in the BDI section. It read, "Please select the option that best describes you." The response options were "There are times when I travel to the moon," "I sometimes wish I didn't go to the moon so often," "Select this option," and "I have the ability to become invisible at will."

Open Data and Other Materials. The data collected for this study are publicly available for download (https://osf.io/3s587/). There were some additional measures included in the study that we do not report here. Specifically, we asked participants to estimate how many total hours per week they think they spend on their smartphone. We also included some additional PSU items (e.g., "Do you feel that you should use your smartphone less often?"). These questions were meant to assess milder forms of PSU and increase the measurement acuity of the scale across the spectrum of the latent trait. The results of the study, however, do not change when these questions are included. Thus, they are not reported here.

Procedure

Participants began the study by reading the informed consent page and affirming they understood the terms and conditions associated with participating before proceeding with the survey. Participants were then given a demographic questionnaire, smartphone usage questions, PSU questions, questions about their perceived norms regarding heavy smartphone usage, excessive reassurance seeking (ERS), BDI items, and the impulsiveness scale (BIS) in a fixed order. After completing the survey, participants were thanked for their time and given details on collecting payment.

RESULTS

Age Differences Between Past and Present Samples

The 183 participants had a mean age of 39.32 ($SD = 14.68$), ranging from 18 to 82 years old. The 147 participants from Mitchell and Hussain's (2018) study had a mean age of 30.96 ($SD = 12.97$), ranging from 18 to 68 years old. There is a statistically significant difference between these two samples, $t(328) = 5.41$, $p < .001$. The present data therefore accomplishes our goal of recruiting a slightly older sample of participants. Descriptive

statistics and a full correlation matrix for the variables used in the primary analyses can be found in Table 1.

Table 1
Means, standard deviations, and correlation matrix for each of the primary variables

Variable	*M*	*SD*	1	2	3	4	5
1. Problematic Smartphone Use	1.09	0.70					
2. Age	39.33	14.68	-0.41				
3. Impulsiveness	3.23	0.70	0.37	-0.17			
4. Excessive Reassurance Seeking	2.43	1.51	0.40	-0.36	0.35		
5. Depression Symptoms	0.56	0.49	0.31	-0.18	0.56	0.18	
6. Norms (heavy smartphone use)	5.53	1.21	0.56	-0.23	0.17	0.27	0.18

Replicating Mitchell and Hussain's (2018) Primary Findings, H1a Through H1c

Next, we re-visited the primary analysis from Mitchell and Hussain (2018). We conducted a multiple regression model with the average endorsement of the PSU items as the dependent variable. The independent variables were age, impulsiveness (BIS), excessive reassurance seeking (ERS), and depression symptoms (BDI). The overall model R^2 was .30 (see "Model 1" in Table 2 for the full regression output).

Table 2
Regression output for two models with PSU scores as the dependent variable. Age, BIS, ERS, and BDI were independent variables for the first model. These and perceived social norms were independent variables for the second model

Predictor variables	Model 1	Model 2
Intercept	0.67 (0.27)*	-0.67 (0.29)*
Age	-0.01 (0.003)*	-0.01 (0.003)*
Impulsivity (BIS)	0.19 (0.08)*	0.18 (0.07)*
Excessive reassurance seeking (RES)	0.10 (0.03)*	0.06 (0.03)*
Depression symptoms (BDI)	0.16 (0.11)	0.09 (0.10)
Perceived norms		0.25 (0.03)*
R^2	0.30	0.48
ΔR^2		0.18

   * $p < .05$

There was a statistically significant, positive relationship between impulsivity (BIS) and PSU, suggesting that people who had more problems with impulse control also tended to exhibit more PSU behaviors. This finding is consistent with H1a. There was also a statistically significant, positive relationship between excessive reassurance seeking (ERS) and PSU. In other words, people who report seeking out affirmations from others of their worth tended also to exhibit more PSU behaviors. This finding is consistent with H1b. While BIS and ERS can both be viewed as negative mental health outcomes that are correlated with symptoms of depression, they are not *identical* to symptoms of depression. Mitchell and Hussain (2018) found no statistically significant relationship between PSU behaviors and symptoms of depression, as measured by the BDI. Likewise, we found no evidence of a relationship between PSU and BDI scores, which is consistent with H1c.

## The Impact of Social Norms on PSU, H4a and H4b

So far, we have replicated Mitchell and Hussain's (2018) primary findings. We turn now to areas where we expand on those findings. We predicted that perceived social norms

would have a positive association with PSU. We therefore conducted the same regression analysis as the one above, but with the average of the two perceived norm questions added into the model as an independent variable (see "Model 2" in Table 2 for the full regression output). The second model improved R^2 from 0.30 to 0.48, which was a statistically significant increase in model fit, $F(1, 177) = 57.60$, $p < .001$. Perceived norms had large, positive association with PSU, suggesting that people are more likely to engage in PSU behaviors when they perceive frequent smartphone use as a social norm. Together, these results support hypotheses H4a and H4b.

The Role of Age in PSU, H2 and H3

We observed a statistically significant, negative association between age and PSU (see Table 2). We therefore replicated the finding from past studies that, as people get older, they tend to exhibit fewer PSU behaviors and found support for H2. Mitchell and Hussain (2018) speculated that impulse control (BIS) could mediate this relationship between age and PSU. They argued that, as people's impulse control improves with age, their PSU behaviors decline. In other words, they speculated that the effect of age on PSU is, at least in part, due to how age affects impulsivity (and these changes in impulsivity, in turn, impact PSU). We decided to formally test this hypothesis with a mediation analysis.

Mediation analyses seek to determine whether an observed effect between an independent variable (e.g., age) and a dependent variable (e.g., PSU) occurs, in part, because of a third "intervening" (or "mediating") variable (e.g., impulsivity). Mediation analyses are conducted in multiple steps. One of these steps is to estimate the "total effect" of the independent variable on the dependent variable (e.g., how age impacts PSU). A later phase of the analysis involves estimating an indirect effect: the extent to which the independent variable (age) impacts the dependent variable (PSU) *through the independent variable's impact on a mediating variable* (the effect of age on impulsivity and how impulsivity, in turn, impacts PSU).
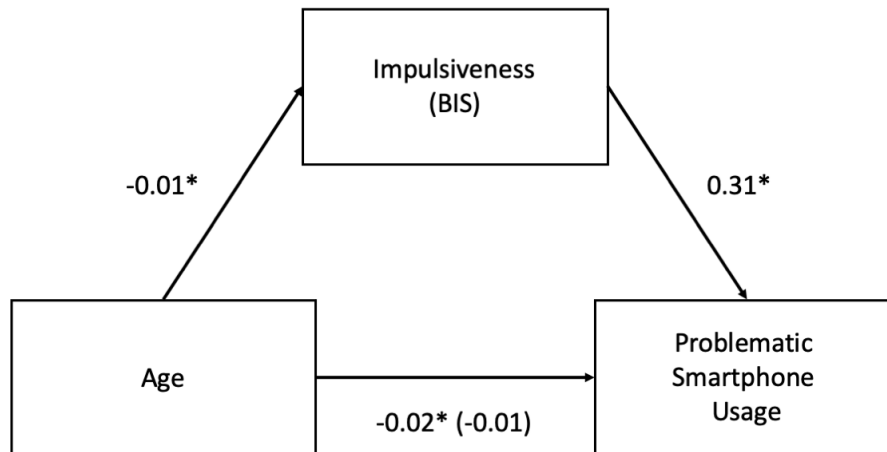
Figure 1. The effect of age on PSU is not mediated by BIS. The coefficient in parentheses represents the indirect effect of age on PSU. * indicates $p < .05$.

The total effect (age's overall association with PSU) was statistically significant, $b = -0.02$, $SE = .003$, $p < .001$. The effect of the independent variable (age) on the mediator (impulsivity) was also statistically significant, $b = -0.01$, $SE = .003$, $p = .021$. There was also a statistically significant association between the mediator (impulsivity) and the dependent variable (PSU), $b = 0.37$, $SE = .07$, $p < .001$ in a model that also included the independent variable (age) as a covariate. Thus far, a mediation analysis appears appropriate for the data. There are a number of issues that can emerge when estimating indirect effects. To avoid these, we used a bootstrap procedure (Preacher & Hayes, 2004). We found that the mean bootstrapped indirect effect of age on PSU (through impulsivity) was -0.01, 95% CI [-0.01, -0.0003]. So, while both age and impulsivity are correlated with PSU (and with each other), it does not appear as though age affects PSU via its effect on impulsivity. This result is inconsistent with H3.

PSU and Social Media Use as Primary Smartphone Application

We sought to determine whether PSU was related to specific smartphone activities (e.g., social media, music, streaming). As can be seen from Table 3, nearly half of the participants in our sample reported using their smartphone primarily for social media

(where TikTok is counted as a form of social media). A substantial number of participants also reported using their smartphones primarily for "messages and calls" and for "streaming".

Table 3
The number of participants (and the percentage of the total sample) that reported using their smartphone primarily for specific activities

Primary use of smartphone	n	% of total
Social media (including TikTok)	90	49.18
Messages and calls	30	16.39
Streaming	18	9.84
Music	9	4.92
Miscellaneous	8	4.37
Work-related	8	4.37
Surveys	8	4.37
Video games	6	2.73
Shopping	5	2.73
Cryptocurrency, investments	1	0.55

Because participants were allowed to specify their own categories (over the predetermined options provided by the survey) a few additional categories emerged. These new categories included "video games" and "filling out surveys". Few participants indicated that these or other categories represented their primary smartphone activities. For each category with 10 or more participants, we ran a regression analysis to determine

whether people belonging to one of these categories had PSU scores that were different from the rest of the sample. Note, however, that some of these categories had insufficient sample sizes to warrant a formal statistical test. The analyses we did run sometimes had appreciably unequal sample sizes. The results of these analyses should therefore be interpreted with caution.

People who said they primarily use their smartphones for social media (including TikTok) had higher PSU scores (model $R^2 = .08$, $b = .40$, $SE = .10$, $p < .001$) compared to the rest of the sample. This result is consistent with H5. By contrast, people who said they use their smartphones primarily for messages and calls had lower PSU scores (model $R^2 = .06$, $b = -0.48$, $SE = 0.13$, $p = .001$). The difference in PSU scores between people who said they primarily use their smartphone for streaming and the rest of the sample was not statistically significant (model $R^2 = .004$, $b = -0.01$, $SE = .17$, $p = .953$).

While many researchers categorize TikTok as a form of social media (Marengo et al., 2021; Cosmann et al., 2022; Oppong et al., 2022) some also consider YouTube to be a form of social media (e.g., Adrian & Sahrani, 2021). Thus, the line between "social media" and "streaming" platforms can be unclear. When TikTok is not included in the social media category, the relationship between identifying social media as one's primary smartphone use and PSU behaviors become non-significant ($R^2 = .02$, $b = 0.19$, $p = .076$). If TikTok is included as a streaming platform, then the relationship between identifying streaming as one's primary smartphone use and PSU becomes statistically significant ($R^2 = .04$, $b = 0.35$, $p = .007$). This led us to speculate that primarily using one's smartphone for TikTok (rather than social media or streaming more generally) is associated with PSU. This indeed appeared to be the case, according to an exploratory regression analysis, $R^2 = .07$, $b = 0.63$, $p < .001$.

DISCUSSION

The present study replicated and extended findings from previous work on problematic smartphone usage (PSU). We demonstrated that PSU decreases with age, is associated with greater impulsiveness, and excessive re-assurance seeking. Furthermore, these replicated results were obtained with a slightly older set of participants compared to previous studies, thus supporting the generality of the results. Consistent with previous

studies, we found no evidence that PSU was linked with symptoms of depression on their own (as measured by the BDI). We confirmed our hypothesis that using one's smartphone primarily for social media (as opposed to, e.g., messaging or shopping) is linked with higher PSU behaviors. However, exploratory analyses revealed that using one's smartphone for TikTok in particular (rather than other social media or streaming platforms) was associated with PSU. We found no evidence that other smartphone applications positively correlate with PSU behaviors. In fact, some forms, i.e., messages and calls, were negatively correlated with PSU behaviors. Thus, the present study helps clarify which specific smartphone applications are correlated with problematic mental health outcomes.

It is well-established that, as people get older, they tend to exhibit fewer PSU behaviors (Busch et al., 2021). While previous researchers speculated that this trend might be due to age-related changes in impulse control (Mitchell & Hussain, 2018), the present results were not consistent with this explanation. The present study found that impulsiveness decreases with age and that PSU decreases with age, but we found no evidence that these two factors are causally related. It should be noted, however, that a single mediation analysis is only one approach to causal inference. Future researchers could use other, more diverse methods to continue exploring this question more thoroughly.

Another goal of the present study was to identify predictors of PSU that had yet to be fully considered in previous research. Perceived social norms was a salient choice because they are a strong predictor of a wide range of behaviors more generally (Chernoff & Davidson, 2005; Bateson et al., 2013; Kormos et al., 2015; Pellerano et al., 2017; McCoy et al., 2017). Indeed, we found that people are more likely to exhibit PSU behaviors to the extent that they view heavy (i.e., high frequency) smartphone use as normal behavior within their social group. It might be the case that belonging to social groups that appear to endorse (or condone) heavy smartphone usage is a contributing factor to developing PSU behaviors in the first place. It also might be the case that older social groups see heavy smartphone use (e.g., at the dinner table) as less normal or less acceptable behaviors compared to younger social groups. These possibilities are consistent with the

negative correlation between age and perceived norms for heavy smartphone use seen in Table 1. Future studies might further explore these possibilities.

Limitations and Future Directions

The present research was correlational, so causal inferences should be made with caution. Also, while Prolific is a high-quality platform for recruiting survey participants (Peer et al., 2022), the current results do not necessarily reflect the general population. For instance, women in this study (77.05% of participants) were overrepresented relative to the general population. We did not observe any statistically significant association between PSU and symptoms of depression. It is worth noting, however, that our sample was drawn from a non-clinical population. It is still possible that PSU is associated with symptoms of depression in clinically depressed populations. It is also possible that there is a relationship between PSU and depression symptoms, but the effect is small and the present sample (and a previous one, Hussain & Mitchell, 2018) were not sufficiently large enough to detect it.

Participants in this study were asked to estimate the activity for which they used their smartphone the most. We subsequently asked them to use applications like "Screen Time," where available, to increase the accuracy of these estimates. It is possible to increase the accuracy of these estimates in future studies. While this added some assurance that the answers were relatively accurate, more could be done in future studies to maximize accuracy. Future researchers might recruit participants and ask them prior to the study (perhaps a week before) to start using a tracking application like "Screen Time," if they don't already. While this approach might have its own methodological challenges (e.g., social desirability effects), it could be helpful overall to better understand how various smartphone activities are differentially associated with PSU.

The present study measured the degree to which participants view heavy (high frequency) smartphone usage as socially normal in a descriptive sense. We did not ask participants any normative questions about heavy smartphone use. In other words, we did not explicitly differentiate what they perceive as normal behavior in their social environment versus what they believe *ought to be normal* in said environment. Future research could ask participants questions specifically tailored to disentangle these different facets of social norms.

Conclusion

Overall, it is clear that problematic smartphone usage is associated with an array of negative mental health outcomes. It is noteworthy, however, that within non-clinical populations, there is no evidence that PSU is associated with symptoms of depression *per se*. The degree to which people over-use their smartphones and develop addiction-like symptoms appears to be driven in large part by perceived social norms. Helping people to avoid problematic smartphone usage therefore may depend largely on the kind of company they keep, i.e., who they surround themselves with in their day-to-day social environments.

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Online Connections

Mark LaCour: @thestevarkian87