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# Excessive reassurance seeking mediates relations between rumination and problematic smartphone use

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*Aside from depression and anxiety, less is known about the relationship of problematic smartphone use (PSU) to other psychopathology-related variables. The authors' aim was to test previously neglected variables in relation to PSU: rumination and excessive reassurance seeking behavior (ERSB). The authors recruited 295 college students for a web-based survey of smartphone use frequency, PSU, depression and anxiety, ruminative thinking, and ERSB. The authors tested linear regression and mediation models, assessing rumination and ERSB as mediating associations between depression/anxiety severity with PSU, adjusting for*

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*age, sex, and smartphone use frequency. Results demonstrate that ERSB was significantly related to PSU severity, and ERSB mediated the association between rumination and PSU. Furthermore, the combination of rumination and ERSB mediated relations between both depression and anxiety severity with PSU. Results provide evidence for ERSB as an important variable in understanding relationships between psychopathology symptoms and PSU severity among college students. (Bulletin of the Menninger Clinic, 84[1], 00-00)*

*Keywords:* depression, anxiety, rumination, excessive reassurance seeking, smartphone addiction

Problematic smartphone use (PSU) refers to excessive levels of smartphone use accompanied by symptoms resembling substance-related dependence, such as tolerance and physiological withdrawal when separated from one's phone, dangerous use, and associated functional impairment (Billieux, Muraige, Lopez-Fernandez, Kuss, & Griffiths, 2015). For example, an individual engaging in PSU may suffer significant emotional distress when his or her smartphone battery is drained, or the phone is being repaired. Social impairment may be present, involving arguments with one's family because of excessive phone use while together during social activities (Billieux, Muraige, et al., 2015). Furthermore, dangerous use may be characterized by persistent text messaging while driving or crossing intersections. In the present study, our focus is on psychopathology constructs related to PSU, specifically, cognitive and coping processes, that may predict PSU.

PSU is associated with traffic accidents because of distracted driving (reviewed in Cazzulino, Burke, Muller, Arbogast, & Upperman, 2014), and musculoskeletal pain in the shoulders, neck, and hands (Xie, Szeto, Dai, & Madeleine, 2016). PSU also correlates with mental health problems, in particular, depression and anxiety symptoms (reviewed in Elhai, Dvorak, Levine, & Hall, 2017; Elhai, Levine, & Hall, 2019).

Depression and anxiety severity are the most widely supported psychopathology constructs associated with PSU (reviewed

in Elhai, Dvorak, et al., 2017; Elhai, Levine, et al., 2019). This literature is based on studies where the majority sampled college students, from the United States, China, and Korea, with a mean sample size of about 600 participants, using standardized self-report surveys of PSU, depression, and anxiety. Moderate effect sizes with PSU have been found for depression severity (mostly bivariate correlations between .30 and .40) (Elhai, Dvorak, et al., 2017), and mild effects for anxiety severity (bivariate correlations between .20 and .40) (Elhai, Levine, et al., 2019). For example, in a study of 308 North American participants recruited through Amazon's Mechanical Turk (Mturk) survey platform, Smartphone Addiction Scale (SAS) scores correlated .24 with depression symptom severity and .40 with anxiety symptom severity (from the Depression Anxiety Stress Scale-21, DASS-21) (Elhai, Levine, Dvorak, & Hall, 2017). And in a study of 319 Turkish college students, Demirci, Akgönül, and Akpınar (2015) found SAS scores correlated .27 with Beck Depression Inventory and .28 with Beck Anxiety Inventory scores. However, some studies find small, or even inverse associations with PSU for depression or anxiety (reviewed in Elhai, Dvorak, et al., 2017).

Other, more recent studies have moved beyond examining depression and anxiety in relation to PSU by exploring transdiagnostic psychopathology-related constructs—those observed in numerous mental disorders. Transdiagnostic constructs have become important in psychopathology research in understanding the etiology and maintenance of mental disorders (Mansell, Harvey, Watkins, & Shafran, 2008). This advancement in research is important because it provides a functional/mechanistic understanding of psychopathology, can generalize knowledge to future mental disorders included in subsequent diagnostic manuals, and can lead to treatment components that work across disorders (Mansell et al., 2008). Recent constructs have been found to significantly mediate relationships between psychopathology such as depression/anxiety and PSU. Behavioral inactivation (using the Behavioral Activation Scale for Depression-Short Form) and emotional dysregulation (using the Emotion Regulation Questionnaire) served as significant mediators be-

tween DASS-21 depression and SAS scores in a sample of 308 North American Mturk participants (Elhai, Levine, Dvorak, & Hall, 2016). Impulsivity (UPPS Impulsive Behavior Scale) served as a significant mediator between Posttraumatic Stress Disorder Checklist and SAS-Short Version (SAS-SV) scores in 346 North American Mturk participants (Contractor, Weiss, Tull, & Elhai, 2017). Furthermore, decreased distress tolerance (Distress Tolerance Scale) significantly mediated relations between Anxiety Sensitivity Index-3 scores and SAS-SV scores in 261 American college students (Elhai, Levine, O'Brien, & Armour, 2018). Additionally, lack of self-control (using the Brief Self-Control Scale) was a significant mediator in relations between Symptom Checklist 95 Stress scores and Self-Assessment PSU scores in a sample of 400 Korean community participants (Cho, Kim, & Park, 2017). Finally, Boredom Proneness Scale-Short Form scores significantly mediated relations between both DASS-21 depression and anxiety scores with SAS severity in 289 American college students (Elhai, Vasquez, Lustgarten, Levine, & Hall, 2018). These findings come from studies mostly comprising college students and Mturk participants, with sample sizes of approximately 300 participants, using standardized self-report measures of the constructs.

Ruminative thinking is an additional important variable in explaining PSU. Rumination is a maladaptive coping strategy for regulating negative emotion involving the focus on one's own negative self-referencing thoughts, rather than using the more adaptive coping strategy of emotion processing (Mennin & Fresco, 2013). Rumination is related to psychopathology, including depression and anxiety (Aldao, Nolen-Hoeksema, & Schweizer, 2010). Using the Ruminative Thought Styles Questionnaire (RTSQ), researchers recently empirically linked rumination to greater frequency of smartphone use (Elhai & Contractor, 2018). RTSQ scores correlated .34 with SAS-SV scores, while also mediating relationships between both Patient Health Questionnaire-9 depression and Social Interaction Anxiety Scale severity scores with SAS-SV scores in 296 American college students (Elhai, Tiamiyu, & Weeks, 2018). Finally, rumination is similar to worry, both of which involve repetitive nega-

tive thinking; worry was recently correlated with higher PSU levels ( $r = .31$ ) using a sample of 300 American college students, analyzing the Penn State Worry Questionnaire-Abbreviated and SAS-SV (Elhai, Rozgonjuk, Yildirim, Alghraibeh, & Alafnan, 2019).

A potentially important construct accounting for how rumination may mediate relations between depression/anxiety and PSU involves excessive reassurance seeking behavior (ERSB). ERSB is a type of safety behavior used to avoid or cope with interpersonal-related threat (Joiner, Metalsky, Katz, & Beach, 1999). ERSB maintains pre-existing depression and anxiety (Cogle et al., 2012; Evraire & Dozois, 2011). Billieux, Philippot, et al. (2015) conceptualized rumination as a cause of ERSB, driving some people to excessively check and interact with their smartphones for social- and interpersonal-related notifications. Furthermore, the habitual checking for smartphone notifications is implicated in PSU (Oulasvirta, Rattenbury, Ma, & Raita, 2012; van Deursen, Bolle, Hegner, & Kommers, 2015). Furthermore, a recent study of 147 participants recruited from social networking sites found ERSB (Depression Interpersonal Relationships Inventory's Reassurance Seeking Scale) positively correlated .36 with PSU severity (using a version of the Modified Internet Gaming Disorder Scale-Short Form, adapted for PSU) (Mitchell & Hussain, 2018).

## Aims

Our aim was to test ERSB as a variable explaining relations between rumination and PSU severity. We also tested whether the rumination-ERSB relationship accounted for associations between both depression and anxiety symptom severity with PSU.

## Theory

We conceptualized our study using the Interaction of Person-Affect-Cognition-Execution (I-PACE) model of specific internet use disorders (Brand, Young, Laier, Wolfling, & Potenza, 2016). In I-PACE, personal predisposition factors are thought to influ-

ence excessive internet use (e.g., PSU) and include genetic and biological influences, psychopathology, personality, cognitions, and use motives. We used depression and anxiety symptom severity variables in the present study, which would correspond to psychopathology variables in I-PACE's predisposition factor. Additionally, responses to such personal factors are conceptualized to serve as mechanisms that may be risk or resilience factors for internet use, including cognitive bias, coping style, inhibitory control, craving, and attention bias. Excessive reassurance seeking and rumination would be considered coping styles (though maladaptive) that fit into I-PACE's responses factor. Such responses are viewed as mediating or moderating variables in I-PACE, and they may lead to using a particular type of internet use or application (e.g., smartphones), which may in turn lead to healthy gratification or excessive use (such as PSU) (Brand et al., 2016).

### Research models tested

We first tested ERSB for its relationship with PSU severity using linear regression. Further, we assessed ERSB as a mediator in relations between rumination and PSU severity. Finally, we tested rumination and ERSB as mediators in relations between both depression and anxiety with PSU severity. We included sex and age as regression covariates of PSU. PSU is associated with being female (Jeong, Kim, Yum, & Hwang, 2016; Wang, Wang, Gaskin, & Wang, 2015) and younger (van Deursen et al., 2015). We also included smartphone use frequency as a regression covariate of PSU, to control for levels of use in relationships with problematic use.

### Hypotheses

We posited several hypotheses.

*Hypothesis 1: ERSB would be positively and significantly associated with PSU*

ERSB involves repeated attempts at checking and testing whether others care about the individual (Joiner et al., 1999).



As conceptualized by Billieux, Philippot, et al. (2015), ERSB should drive frequent and PSU through checking and interacting with social- and interpersonal-based smartphone notifications. Furthermore, such habitual checking for notifications develops into PSU (Oulasvirta et al., 2012). This hypothesis is supported by recent work (Mitchell & Hussain, 2018). ERSB would be considered a coping or cognitive response style in I-PACE that can lead to PSU.

*Hypothesis 2. ERSB would mediate the association between rumination and PSU*

Rumination is associated with PSU (Elhai, Tiamiyu, & Weeks, 2018), and fits within I-PACE as a cognitive or coping response style that can lead to PSU. ERSB should be an intermediary variable between rumination and PSU, based on Billieux, Philippot, et al.'s (2015) conceptualization of rumination driving ERSB, and in turn ERSB driving increased social-based smartphone checking behavior. Increased, habitual smartphone checking is associated with levels of PSU (Oulasvirta et al., 2012).

*Hypothesis 3. ERSB and rumination would mediate relations between depression and anxiety severity with PSU*

Depression and anxiety severity are often, but not always, strongly related to PSU (reviewed in Elhai, Dvorak, et al., 2017). Rumination mediated relations between depression and anxiety severity with PSU (Elhai, Tiamiyu, & Weeks, 2018). As stated above, ERSB should be an intermediary variable between rumination and PSU. Therefore, a path from rumination to ERSB (as serial mediators) should mediate relations between both depression (H3a) and anxiety (H3b) with PSU. This mediation hypothesis is consistent with I-PACE, whereby ERSB and rumination are conceptualized as cognitive or coping response styles that may serve as mediating variables between psychopathology and PSU.

## Method

We recruited 301 participants in the fall of 2017 from the psychology department research pool of a large Midwestern U.S. university, with institutional review board approval. Depart-

ment studies, including this one, were displayed on the university's Sona Systems web portal for students to potentially enroll. Those enrolling were routed online to an informed consent statement and, for those consenting, the web survey. Six participants were missing more than 50% of items on at least one study measure, and were therefore excluded, thus leaving an effective sample of 295 participants.

Among the effective sample, 212 (71.9%) were women. Age averaged 19.7 years ( $SD = 3.97$ ). Most participants identified as Caucasian ( $n = 238, 80.7\%$ ), with minority representation from Hispanic/Latino ( $n = 19, 6.5\%$ ), African American ( $n = 42, 14.2\%$ ), Asian ( $n = 12, 4.1\%$ ), and Native American ( $n = 6, 2.0\%$ ) backgrounds (these designations were not mutually exclusive). The majority were freshman ( $n = 158, 53.7\%$ ) or sophomores ( $n = 99, 33.7\%$ ) at the time of the study. Slightly less than half were employed part-time ( $n = 147, 49.8\%$ ), and the remaining participants were employed full-time ( $n = 33, 11.2\%$ ) or not working ( $n = 115, 39.0\%$ ).

### *Instruments*

We first queried about demographics, including sex, age, race and ethnicity, schooling, and employment status. Participants were next administered the following instruments online. Coefficient alpha values in our sample are presented in Table 1.

*Smartphone usage frequency.* We used the scale by Elhai et al. (2016) querying frequency of using 11 smartphone features, with a 6-point scale ranging from 1 (*Never*) to 6 (*Very often*). Features queried included "Voice/video calls (making and receiving)," "Texting/instant messaging (sending and receiving)," "Email (sending and receiving)," "Social networking sites," "Internet/websites," "Music/podcasts/radio," "Games," "Taking pictures or videos," "Watching video/TV/movies," "Reading books/magazines," and "Maps/navigation." We summed item responses to form a total score (with a possible range from 11 to 66). Elhai et al. (2016) discovered adequate internal consistency and a moderate correlation with Kwon et al.'s (2013) Smartphone Addiction Scale.

Table 1. Descriptive statistics and correlations among study variables

Variable	M	SD	1	2	3	4	5	6	7	8
1. Sex	—	—	(N/A)							
2. Age	19.7	3.97	-.12*	(N/A)						
3. DASS-21 Depression	4.29	4.72	.05	-.07	(.89)					
4. DASS-21 Anxiety	3.65	4.01	.11	-.05	.75***	(.82)				
5. Rumination	86.26	28.21	.14*	-.06	.55***	.51***	(.96)			
6. ERSB	14.92	6.62	.25***	-.09	.44***	.44***	.51***	(.90)		
7. Smartphone Use Frequency	49.60	7.23	.16**	-.13*	.08	.02	.27***	.16**	(.74)	
8. PSU	88.37	22.95	.11	-.24***	.34***	.35***	.44***	.36***	.31***	(.92)

Note. DASS-21 = Depression Anxiety Stress Scale-21, ERSB = excessive reassurance seeking behavior, PSU = problematic smartphone use (from the Smartphone Addiction Scale). Coefficient alphas (for scale scores) are presented on the diagonal in parentheses. \*  $p < .05$ . \*\*  $p < .01$ . \*\*\*  $p < .001$ .

*Smartphone Addiction Scale (SAS)*. We administered Kwon et al.'s (2013) SAS, a 33-item measure of levels of PSU. Response options range from 1 (*Strongly disagree*) to 6 (*Strongly agree*). We reworded several items into a first-person voice for greater accessibility and consistency for participants, such as rewording "Missing planned work due to smartphone use" to "I missed planned work due to smartphone use" (Duke & Montag, 2017). We summed items to form a total score. Summed scores can range from 33 to 198. Kwon et al. (2013) reported adequate internal consistency and convergent validity against other measures of problematic internet and smartphone use. Elhai, Tiamiyu, Weeks, et al. (2018) discovered that SAS scores moderately related to objectively measured smartphone use frequency.

*Depression Anxiety Stress Scale (DASS)-21*. We implemented the DASS-21, a brief version of the original DASS developed by Lovibond and Lovibond (1995). The DASS-21 has 21 items, with responses ranging from 0 (*Did not apply to me at all*) to 3 (*Applied to me very much or most of the time*). We summed item responses to form depression and anxiety subscale scores (7 items each). Each subscale score can range from 0 to 21, and they demonstrate reliability and validity.

*Ruminative Thought Style Questionnaire (RTSQ)*. We used the RTSQ developed by Brinker and Dozois (2009). This measure has 20 items, rated on a scale from 1 (*Does not describe me at all*) to 7 (*Describes me very well*). Summed scores can range from 20 to 140. The RTSQ has evidenced internal consistency, and convergent validity with similar scales (Brinker & Dozois, 2009).

*Threat-Related Reassurance Seeking Scale (TRSS)*. We administered the TRSS developed by Cogle et al. (2012), which measures reassurance seeking behavior. The original TRSS has 10 items, on a scale from 1 (*No, not at all*) to 7 (*Yes, very much*). We summed the four "general threat" item responses to form a total ERSB score (ranging from 4 to 28). These four items have good internal consistency, test-retest reliability, and strong rela-

tionships with similar scales, and with depression and anxiety severity (Cogle et al., 2012).

### *Analysis*

Roughly 5–10% of participants typically missed one to two items per scale. We used maximum likelihood procedures to estimate and impute missing item-level data, separately for each scale. We subsequently summed items on each scale to obtain scale scores for use in analysis. We conducted descriptive analyses on our primary measures' scale scores. All scale scores were normally distributed, with no skewness or kurtosis value greater than 2.0 in absolute size.

First, we tested the relationship between ERSB and PSU severity, adjusting for our covariates in linear regression (Hypothesis 1). Next, we assessed mediation using a regression approach (again adjusting for covariates), testing several indirect effects by computing cross-products of direct paths. Standard errors for indirect effects were computed using the Delta method, with 500 bootstrapped samples (MacKinnon, 2008). We assessed ERSB as a mediator of the relationship between levels of rumination and PSU severity (Hypothesis 2). We also assessed rumination and ERSB simultaneously as mediators of the relationship between severity of depression and PSU (Hypothesis 3a). Finally, we conducted an analysis similar to that tested in 3a, but replacing depression with anxiety severity (Hypothesis 3b).

### Results

Table 1 presents descriptive statistics and a bivariate correlation matrix of the demographic covariates (age and sex) and observed scale scores. Sex and age were associated with only some scales scores; all other relationships were statistically significant, except for smartphone use frequency with DASS-21 depression and anxiety scores. ERSB had a large association with rumination and a moderate association with PSU severity (Hypothesis 1).

Next, we assessed ERSB in relation to PSU severity using linear regression (Table 2). Adjusting for age, sex, and smartphone

*Table 2. Direct and indirect effects for regression and mediation models, with PSU severity as the dependent variable*

	$\beta$	SE	<i>p</i>
<b>Hypothesis 1: Path to PSU Severity</b>			
Age	-.18	.05	< .001
Sex	-.07	.12	.56
Smartphone Use Frequency	.24	.06	< .001
ERSB	.31	.05	< .001
<b>Hypothesis 2:</b>			
<b>Path to PSU Severity</b>			
Age	-.18	.05	< .001
Sex	-.07	.12	.60
Smartphone Use Frequency	.18	.06	.002
ERSB	.17	.06	.01
Rumination	.30	.06	< .001
Rumination → >ERSB	.09	.03	.01
<b>Hypothesis 3:</b>			
<b>Path to PSU Severity</b>			
Age	-.19	.05	< .001
Sex	-.06	.12	.60
Smartphone Use Frequency	.18	.06	.002
ERSB	.17	.06	.01
Rumination	.31	.07	< .001
Depression → Rumination → ERSB (H3a)	.03	.01	.01
Anxiety → Rumination → ERSB (H3b)	.02	.01	.04

*Note.* ERSB = excessive reassurance seeking behavior. Paths with arrows are mediation/indirect effects, with PSU severity as the final dependent variable.

use frequency, ERSB was significantly related to PSU severity (Hypothesis 1),  $\beta = .31$  ( $SE = .05$ ),  $p < .001$ .

Then we tested several mediation effects (see Table 2). Assessing Hypothesis 2, adjusting for age, sex, and smartphone use frequency, ERSB mediated relations between rumination scores and PSU severity,  $\beta = .09$  ( $SE = .03$ ),  $p < .01$ . Assessing Hypothesis 3, adjusting for age, sex, and smartphone use frequency covariates, rumination and ERSB together (as serial mediators) mediated relations between depression and PSU severity (Hy-

pothesis 3a),  $\beta = .03$  ( $SE = .01$ ),  $p = .01$ . Furthermore (adjusting for covariates), rumination and ERSB together mediated relations between anxiety and PSU severity (Hypothesis 3b),  $\beta = .02$  ( $SE = .01$ ),  $p = .04$ .

## Discussion

ERSB was significantly and positively associated with PSU, which supported Hypothesis 1. This finding is consistent with Billieux, Philippot, et al.'s (2015) conceptualization of ERSB as a pathway leading to PSU and empirical findings by Mitchell and Hussain (2018). In the digital technology age, individuals engaging in ERSB can test interpersonal relationships using their smartphones by excessively checking for notifications from family, friends, and loved ones. Furthermore, Oulasvirta et al. (2012) demonstrated that such frequent, habitual smartphone checking behavior is strongly associated with PSU. This phenomenon fits well with reinforcement models of how addictions form, including PSU (reviewed in Elhai, Dvorak, et al., 2017). Specifically, Elhai, Dvorak, et al. (2017) discussed the prominent role of positive and negative reinforcement in PSU, where PSU initially develops from the rewarding, hedonic value experienced from receiving phone notifications. Over time, checking and interacting with one's smartphone becomes compulsory, and negative mood can result when not using one's phone (i.e., withdrawal), or when not receiving notifications. Therefore, individuals engaging in PSU continue to check their phone in order to boost their mood. This finding and conceptualization fit with I-PACE, whereby ERSB is a coping strategy that can lead to PSU.

Hypothesis 2 was also supported. ERSB mediated relations between rumination and PSU. Billieux, Philippot, et al. (2015) conceptualized that in interpersonal relationships, high ruminators may cope with their rumination and negative affect by engaging in ERSB. After all, ERSB is a safety behavior aimed at alleviating negative affect (Joiner et al., 1999). Thus, rumination may lead to ERSB, in turn leading to increased and excessive

smartphone checking behavior to test interpersonal relationships. This conceptualization also fits with I-PACE.

Our results demonstrate support for Hypothesis 3. Rumination and ERSB together mediated relationships between both depression and anxiety severity with PSU. This finding supports other recent results on psychopathology-related constructs mediating these relationships (Cho et al., 2017; Contractor et al., 2017; Elhai et al., 2016; Elhai, Vasquez, et al., 2018; Wolniwicz, Tihamiyu, Weeks, & Elhai, 2018). Depression and anxiety may not be strongly associated with PSU on their own. Instead, intermediary variables such as these constructs may explain such relationships. Fortunately, cognitive-behavioral psychological treatments are effective in managing depression (Ekers, Richards, & Gilbody, 2008), anxiety (Stewart & Chambless, 2009), and rumination (Watkins et al., 2011). Cognitive-behavioral treatments are also well suited to target ERSB by using operant conditioning behavioral strategies, such as response-prevention. Theoretically, managing such mental health conditions may be associated with decreases in PSU. Our finding fits with I-PACE in explaining PSU by depression and anxiety psychopathology severity mediated through cognitive and coping response mechanisms.

Finally, we should note that sex was not a significant correlate of PSU. However, younger age was a significant correlate of PSU severity. This relationship between younger age and PSU severity corroborates prior work (van Deursen et al., 2015).

### *Limitations*

Our study had several notable limitations. First, our depression and anxiety symptom measures used self-report methodology, rather than a structured diagnostic interview format. The results might not generalize to people with these diagnoses. Additionally, self-reported smartphone use may not be valid against objective measurement (Elhai, Tihamiyu, Weeks, et al., 2018; Rozgonjuk, Levine, Hall, & Elhai, 2018). Third, we relied on cross-sectional data, preventing us from drawing causal inferences. Finally, we sampled college students who, despite being



heavy smartphone users, may not generalize to the general population.

### *Implications for practice*

Our results are important in better understanding psychopathology's relations with PSU by examining psychopathology-related mediating variables. This study also provides further support for I-PACE in explaining mechanisms driving psychopathology's relation with PSU. Because of the role we found for ERSB in PSU severity, these results have clinical and societal implications for the management and treatment of individuals presenting with PSU. Specifically, mental health clinicians should consider managing PSU symptoms by first assessing and then treating social impairments in such individuals. The excessive need for reassurance from family and friends could be treated using traditional cognitive restructuring and reframing techniques (Ekers et al., 2008). Future research should test additional variables that may account for the relationship between psychopathology and PSU.

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