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PTSD's relation with problematic smartphone use: Mediating role of impulsivity

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ABSTRACT

Posttraumatic stress disorder (PTSD) frequently co-occurs with addictive behaviors. Recently, the addictive behavior of excessive smartphone use is being widely researched. Impulsivity commonly relates to PTSD severity and problematic smartphone use. However, unexamined is the mediating role of impulsivity facets (lack of premeditation, negative urgency, sensation seeking, and lack of perseverance) in the PTSD-problematic smartphone use relationship; this was the purpose of the current study. We used data collected from 346 participants recruited through Amazon's Mechanical Turk (MTurk) platform. PTSD severity, impulsivity facets, and problematic smartphone use were assessed using the PTSD Checklist for DSM-5 (PCL-5), the UPPS Impulsive Behavior Scale, and the Smartphone Addiction Scale-Short Version (SAS-SV), respectively. Negative urgency and lack of perseverance had significant positive correlations with both PTSD severity and problematic smartphone use. Results of mediation analyses indicated that negative urgency significantly mediated the relationship between PTSD severity and problematic smartphone use. Findings support the underlying role of negative urgency in the relation between PTSD severity and problematic smartphone use. Thus, treatments targeting negative urgency may potentially serve to reduce problematic smartphone use among individuals experiencing PTSD symptoms.

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1. Introduction

Posttraumatic stress disorder (PTSD) frequently co-occurs with addictive behaviors (Breslau, 2009). Problematic smartphone use as an addictive behavior is increasingly being researched in relation to psychopathology (Elhai, Dvorak, Levine, & Hall, 2017), including PTSD severity (Contractor, Frankfurt, Weiss, & Elhai, 2017). Research has linked impulsivity to both PTSD severity (Contractor, Armour, Forbes, & Elhai, 2016; Weiss, Connolly, Gratz, & Tull, 2017) and problematic smartphone use (reviewed in Billieux, 2012). No study has examined the potential mediating role of impulsivity facets in the PTSD-problematic smartphone use relation; this was the focus of the current study.

Smartphone addiction (termed as problematic smartphone use

for this paper) has been characterized as a type of non-chemical behavioral addiction (reviewed in Billieux, 2012; van Deursen, Bolle, Hegner, & Kommers, 2015). It involves excessive and problematic use of a smartphone despite functional impairment (Demirci, Akgönül, & Akpınar, 2015). Problematic smartphone use shares characteristics similar to other non-behavioral addictive behaviors including habitual overuse, functional impairment, and withdrawal following cessation of use (e.g., Ezoë et al., 2009). Research has indicated that excessive phone use relates to impaired driving (Violanti, 1998); difficulties in real-life social engagement (Kuss & Griffiths, 2011); sleep difficulties (Demirci et al., 2015); and psychopathology constructs of depression, anxiety, and stress (Demirci et al., 2015; Elhai et al., 2017). The concept of “iDisorder” highlights the detrimental influence of problematic technology use on mental health (Rosen, Cheever, & Carrier, 2012).

Given these aforementioned findings, research on problematic smartphone use in relation to psychopathology is gaining attention. However, only one study to our knowledge has examined the relation between PTSD severity and problematic smartphone use,

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and found a positive significant relation between the two constructs (Contractor et al., 2017). From a negative reinforcement perspective, excessive smartphone use could function to escape or avoid emotional distress stemming from external and internal stimuli perceived as threatening among people experiencing PTSD symptoms (reviewed in Billieux, 2012). This framework is consistent with the *impulsive pathway perspective* (reviewed in Billieux, 2012) in technology addiction research; and the *affective processing model of negative reinforcement* in substance addiction research (Baker, Piper, McCarthy, Majeskie, & Fiore, 2004). Thus, similar to other addictive behaviors, excessive smartphone use may serve an avoidant function among individuals who experience PTSD symptoms, which may prevent the habituation to fear cues and the processing of traumatic memories, exacerbating PTSD severity in the long-term.

As such, it is essential to identify factors that elucidate the mechanism linking PTSD severity to problematic smartphone use. Impulsivity may be an important factor to consider in this regard. The UPPS Impulsivity Scale is one of the most widely researched instruments assessing impulsivity as a multidimensional construct (Whiteside & Lynam, 2001). It identifies four facets of impulsivity: lack of premeditation (tendency to act without careful thought), negative urgency (tendency to engage in rash behaviors in the context of intense negative affect), sensation seeking (tendency to seek excitement), and lack of perseverance (difficulty completing tasks and tendency to become easily bored). Several of these impulsivity facets have been shown to be positively associated with PTSD severity (Contractor et al., 2016; Jakšić, Brajković, Ivezić, Topić, & Jakovljević, 2012) and problematic smartphone use (reviewed in Billieux, 2012; Kim et al., 2016), and may thus serve a mediational role in this relationship.

According to the *disinhibition* viewpoint of impulsivity, individuals with PTSD symptoms may struggle to inhibit risky behaviors (e.g., reading a received text in anticipation of good news when driving) when perceiving rewarding situations (Casada & Roache, 2005). This conceptualization of impulsivity references the lack of premeditation facet which is shown to significantly relate to PTSD severity (Roley, Contractor, Weiss, Armour, & Elhai, 2017) as well as prohibited use of mobile phones (Billieux, Van Der Linden, & Rochat, 2008). Thus, people who experience PTSD symptoms may use smartphones without considering potential adverse consequences.

Alternatively, the impulsivity facet of negative urgency, which relates to *emotion regulation*, could play a role in the relation between PTSD severity and problematic smartphone use. Following the experience of a potentially traumatic event (PTE), one may engage in impulsive behaviors to reduce the consequent negative affect related to PTSD (Marshall-Berenz, Vujanovic, & MacPherson, 2011; Weiss, Tull, Sullivan, Dixon-Gordon, & Gratz, 2015; Weiss, Tull, Viana, Anestis, & Gratz, 2012). Such impulsive behaviors could take the form of illegal/dangerous uses of smartphones (Billieux, Van Der Linden, D'Acremont, Ceschi, & Zermatten, 2007). Thus, the functional role of smartphones could be that of mood repair and emotion regulation (Billieux, 2012; Billieux et al., 2007; Roberts, Pullig, & Manolis, 2015). As expected, negative urgency strongly relates to PTSD severity (Contractor et al., 2016; Roley et al., 2017) and to problematic mobile phone use (Billieux et al., 2007; Billieux et al., 2008).

Further, the impulsivity facet of sensation seeking may mediate the relation between PTSD symptoms and problematic smartphone use. The *compulsive re-exposure* hypothesis states that people with PTSD symptoms may engage in sensation-seeking activities (which may even result in additional PTEs) to mimic the biological arousal experienced during the PTE(s) (Joseph, Dalglish, Thrasher, & Yule, 1997; Van der Kolk, Greenberg, Boyd, & Krystal, 1985).

Alternatively, people with greater sensation-seeking tendencies may be more likely to engage in impulsive, risky behaviors (e.g., substance use; Horvath & Zuckerman, 1993); which in turn may increase the chances of experiencing PTEs (e.g., accidents while intoxicated; Davis, Combs-Lane, & Jackson, 2002), and possibly developing significant post-trauma symptoms. Irrespective of the directionality between sensation-seeking and PTEs, it is possible that high sensation seeking among people with PTSD symptoms in turn may predict problematic use of smartphones (e.g., use while driving) to re-create a hedonic and physically arousing stimulation (Billieux, 2012; Billieux et al., 2008). Research validates that sensation seeking is predictive of PTSD severity (Contractor et al., 2016; Roley et al., 2017).

Lastly, a cognitive explanation underscores the potential role of attentional difficulties and restriction in information processing capacity (lack of perseverance facet) in risky behaviors following the experience of a PTE(s) (Ben-Zur & Zeidner, 2009). Specifically, following the experience of a PTE(s), people may experience intrusive thoughts related to the traumatic events, which may subsequently result in attentional difficulties. Consequently, one may use smartphones to redirect their attention or to distract themselves from intrusive thoughts (Billieux, 2012; Roberts et al., 2015; Wu, Cheung, Ku, & Hung, 2013). Unsurprisingly, results have indicated that lack of perseverance is predictive of PTSD severity (Roley et al., 2017) and relates to problematic mobile use (Billieux et al., 2007).

Extant literature highlights the potential mediating role of impulsivity in the PTSD-problematic smartphone use relation; however, no study to our knowledge has examined this model empirically using impulsivity facets. Further, several models could explain the mediating role of impulsivity facets in the PTSD-problematic smartphone use relation. Hence, we have no *a priori* hypotheses for the mediation models. Results could highlight the functional role of specific impulsivity facets; and targets of clinical interventions for clients with comorbid PTSD-problematic smartphone use.

2. Method

2.1. Procedure and participants

The Institutional Review Board of University of North Texas approved the study. We recruited participants through Amazon's Mechanical Turk (MTurk) platform, a growing platform used by social science researchers to gather reliable data from diverse samples (Buhrmester, Kwang, & Gosling, 2011; Mischna & Carleton, 2017). The Mturk platform is a useful resource for studying mental health problems and clinical populations (Shapiro, Chandler, & Mueller, 2013). We described the study as a 30-min survey of the nature and extent of smartphone use among people with stressful life experiences. Participants 18 years and older were screened for four inclusionary criteria: (1) living in North America; (2) knowledge of the English language; (3) using a smartphone; and (4) experiencing a PTE. After obtaining informed consent, participants completed the survey hosted on Psychdata.com (data collection platform) and were compensated 75 cents.

2.2. Exclusions, missing data, and sample characteristics

Among the 499 respondents who completed the survey, 19 participants attempted the questionnaire twice/thrice and were excluded ($n = 480$). We further excluded participants (1) not meeting one or more of the inclusionary criteria ($n = 120$); (2) missing data on all measures ($n = 11$); and (3) missing more than 70% item-level data on the PTSD Checklist for DSM-5 (≥ 6 items;

$n = 1$; Weathers et al., 2013), the UPPS Impulsive Behavior Scale (≥ 13 items; $n = 1$; Whiteside & Lynam, 2001), or the Smartphone Addiction Scale–Short Version (≥ 3 items, $n = 1$; Kwon, Lee, et al., 2013).

The effective sample included 346 participants. The average age was 33.60 years ($SD = 9.52$), and approximately half were female ($n = 199$, 57.70%). Most were employed full time ($n = 227$, 65.80%), and averaged 15.31 years of schooling ($SD = 2.43$). In terms of racial status, a majority identified themselves as White ($n = 288$, 83.20%); 36 participants identified themselves as Asian (10.40%); 22 participants identified themselves as African American (6.40%); 16 participants identified themselves as American Indian (4.60%); and five participants identified themselves as Native Hawaiian/other Pacific Islander (1.40%). In terms of self-reported ethnicity, 39 participants identified themselves as Hispanic/Latino (11.30%), and 296 participants reported that they were not Hispanic/Latino (86%). The most prevalent PTEs were unexpected death of a family member/close friend ($n = 111$, 32.10%), life-threatening accident ($n = 48$, 13.60%), and life-threatening illness ($n = 33$, 9.50%). Table 1 has additional descriptive information.

2.3. Measures

2.3.1. Demographic information

We obtained information on age, gender, income, educational level, and racial and ethnic status.

2.3.2. Stressful life events screening questionnaire (SLESQ; Goodman, Corcoran, Turner, Yuan, & Green, 1998)

The SLESQ is a 13-item self-report measure that assesses exposure to PTEs. Response options are dichotomous (yes/no). We added three additional items to address changes in DSM-5 criteria for a Criterion A PTE (Elhai et al., 2012). The SLESQ demonstrates good psychometric properties (Goodman et al., 1998). Participants endorsing more than one PTE specified their most distressing PTE.

2.3.3. PTSD checklist for DSM-5 (PCL-5; Weathers et al., 2013)

The PCL-5 is a 20-item self-report measure that assesses severity of PTSD symptoms referencing the past month. Response options range from 0 (Not at all) to 4 (Extremely). The PCL-5 has excellent internal consistency reliability, good test-retest reliability, and good convergent and discriminant validity (Blevins, Weathers, Davis, Witte, & Domino, 2015; Bovin et al., 2016; Wortmann et al., 2016). The item-level responses were summed to create a total PCL score. In the current study, the Cronbach's α was .96.

2.3.4. Smartphone Addiction Scale-Short Version (SAS-SV; Kwon, Kim, Cho, & Yang, 2013)

The SAS-SV is a 10-item self-report measure assessing problematic smartphone use. Response options range from 1 (Strongly disagree) to 6 (Strongly agree). The scale has good internal consistency and good concurrent validity (Akin, Altundağ, Turan, & Akin, 2014; Kwon, Kim, et al., 2013). The item-level responses were summed to create a total SAS-SV score. Cronbach's α in the present sample was 0.91.

2.3.5. UPPS Impulsive Behavior Scale (UPPS; Whiteside & Lynam, 2001)

The UPPS is a 45-item self-report measure that assesses four impulsivity facets: lack of premeditation (11 items), negative urgency (12 items), sensation seeking (12 items), and lack of perseverance (10 items). Response options range from 1 (Agree Strongly) to 4 (Disagree Strongly). The subscales have good internal consistency, convergent and divergent validity (Whiteside & Lynam, 2001; Whiteside, Lynam, Miller, & Reynolds, 2005). Cronbach's α

Table 1

Descriptive information on demographics and psychopathology constructs ($n = 346$).

Variables	Mean (SD)
Age	33.60 (9.52)
Years of schooling	15.31 (2.43)
PTSD severity	32.47 (20.49)
SAS score	29.12 (11.99)
Perseverance	20.34 (5.67)
Negative Urgency	29.39 (7.68)
Sensation Seeking	28.61 (8.28)
Lack of premeditation	21.25 (5.74)
Variables	n (%)
Gender	
Female	199 (57.70%)
Male	146 (42.30%)
Employment status	
Part time	59 (17.10%)
Full time	227 (65.80%)
Retired	7 (2%)
Unemployed	44 (12.80%)
Unemployed student	8 (2.30%)
Relationship status	
Single	123 (35.50%)
Living with significant other	51 (14.70%)
Married	149 (43.10%)
Divorced, separated, or widowed	23 (6.60%)
Ethnicity	
Hispanic or Latino	39 (11.30%)
Not Hispanic or Latino	296 (86%)
Unknown	9 (2.60%)
Racial status	
White	288 (83.20%)
Asian	36 (10.40%)
African American	22 (6.40%)
American Indian	16 (4.60%)
Native Hawaiian/other Pacific Islander	5 (1.40%)
Unknown	4 (1.20%)
Annual Household Income	
Less than \$15,000	40 (11.60%)
\$15,000 to \$24,999	47 (13.60%)
\$25,000 to \$34,999	55 (15.90%)
\$35,000 to \$49,999	53 (15.30%)
\$50,000 to \$64,999	53 (15.30%)
\$65,000 to \$79,999	34 (9.80%)
\$80,000 or higher	64 (18.50%)

Note. *All reported percentages are valid percentages to account for missing data.

in the present sample were .88, .90, .90, and .87 for the subscales of lack of premeditation, negative urgency, sensation seeking, and lack of perseverance respectively; and .91 for the entire scale.

2.4. Data analyses

Based on benchmarks of skewness > 2 and kurtosis > 7 reflecting non-normality (Curran, West, & Finch, 1996), all total scores were normally distributed. Mediation analyses to assess the proposed hypotheses were conducted as path analysis models using Mplus 7.31 (Muthén & Muthén, 1998–2007). We used the product of path coefficients approach for mediation analyses (MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002), the multivariate delta method to compute standard errors (MacKinnon, Fairchild, & Fritz, 2007), and the bootstrap method to estimate standard errors (Bollen & Stine, 1990).

The PCL-5 total score, the UPPS subscale scores, and the SAS-SV total score were the variables in four mediation analyses. Each of the four UPPS subscales were mediators in the four independent mediation models. Direct effects included the relationship between (1) the PCL-5 and SAS-SV total scores; (2) the PCL-5 total and the UPPS subscale scores; and (3) the UPPS subscale and the SAS-SV

Table 2
Correlations between PTSD, smartphone addiction, and impulsivity facets.

	PCL-5	SAS-SV	Lack of premeditation	Negative Urgency	Sensation Seeking	Lack of Perseverance
PCL-5	1					
SAS-SV	.40*	1				
Lack of premeditation	.11	.16***	1			
Negative Urgency	.41*	.43*	.24*	1		
Sensation Seeking	.02	.08	.13	.20**	1	
Lack of Perseverance	.26**	.30*	.57*	.41*	-.08	1

Note. *** $p < .05$; ** $p < .01$; * $p < .001$; PCL-5 is the total PTSD score; SAS-SV is problematic smartphone use.

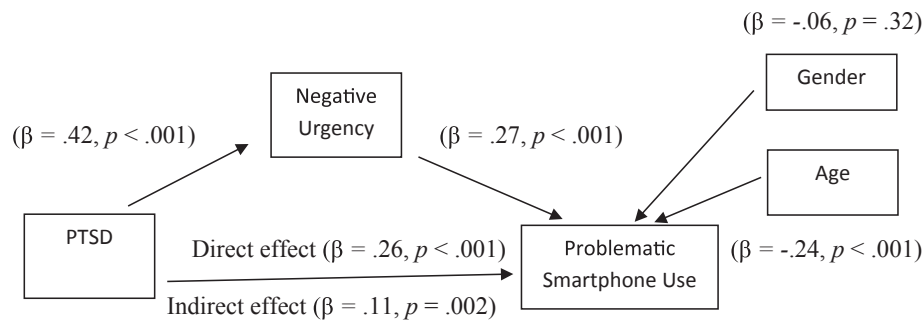


Fig. 1. Mediating role of negative urgency in the relationship between PTSD and problematic smartphone use.

total score. The effect of the PCL-5 total score on the SAS-SV total score accounting for each of the UPPS subscale scores (separately) were the indirect effects. Age and gender were entered as covariates of problematic smartphone use in all mediation analyses based on research indicating that problematic smartphone use relates to being younger (Lu et al., 2011) and being female (Jeong, Kim, Yum, & Hwang, 2016).

3. Results

PCL-5, lack of premeditation, negative urgency, sensation seeking, lack of perseverance, and SAS-SV scores averaged 32.47 ($SD = 20.49$), 21.25 ($SD = 5.74$), 29.39 ($SD = 7.68$), 28.61 ($SD = 8.28$), 20.34 ($SD = 5.67$), and 29.12 ($SD = 11.99$) respectively. Further, 162 participants (46.80%) had a probable PTSD diagnosis based on a cut-off criterion score of ≥ 31 (Bovin et al., 2016).¹

Table 2 indicates correlation results. Correlation results indicated that the PCL-5 total score had a significant positive correlation with the SAS-SV total score, the negative urgency subscale score, and the lack of perseverance subscale score. Further, the SAS-SV total score had a significant positive correlation with the negative urgency, and the lack of perseverance subscale scores. Among the UPPS subscales, the lack of premeditation subscale score significantly and positively correlated with the negative urgency and lack of perseverance subscale scores; and the negative urgency subscale score significantly and positively correlated with the sensation seeking and lack of perseverance subscale scores.

Results of mediation analyses using the bootstrap method indicated that negative urgency significantly mediated the relationship between the PCL-5 and SAS-SV total scores [$\beta = .11$ 95% CI (.06–.17), $SE = .04, p = .002$; see Fig. 1]. Results indicated significant

direct effects of the PCL-5 score on the negative urgency subscale score [$\beta = 0.42$, 95% CI (.33–.51), $SE = 0.05, p < .001$]; of the negative urgency subscale score on the SAS-SV total score [$\beta = 0.27$, 95% CI (.15–.39), $SE = 0.07, p < .001$]; and of the PCL-5 score on the SAS-SV total score [$\beta = 0.26$, 95% CI (.14–.36), $SE = 0.07, p < .001$].

Results of mediation analyses using the bootstrap method indicated that lack of perseverance did not significantly mediate the relationship between the PCL-5 and SAS-SV total scores [$\beta = .03$, 95% CI (.004–.07), $SE = .02, p = .10$]. However, results indicated significant direct effects of the PCL-5 score on the lack of perseverance subscale score [$\beta = 0.26$, 95% CI (.17–.35), $SE = 0.05, p < .001$], and a marginally significant direct effect of the lack of perseverance subscale score on the SAS-SV total score [$\beta = 0.13$, 95% CI (.02–.25), $SE = 0.07, p = 0.07$].

Results of mediation analyses using the bootstrap method indicated that sensation seeking did not significantly mediate the relationship between the PCL-5 and SAS-SV total scores [$\beta < .001$ 95% CI (–0.01–.10), $SE = .004, p = .99$]. Further, results indicated no significant direct effects of the PCL-5 score on the sensation seeking subscale score [$\beta = 0.001$, 95% CI (0.11–.10), $SE = 0.07, p = 0.98$]; and of the sensation seeking subscale score on the SAS-SV total score [$\beta = 0.02$, 95% CI (–0.08–.12), $SE = 0.06, p = 0.71$].

Lastly, lack of premeditation did not significantly mediate the relationship between the PCL-5 and SAS-SV total scores [$\beta = -0.002$ 95% CI (–0.02–.01), $SE = .01, p = .80$]. Further, results indicated no significant direct effects of the PCL-5 score on the lack of premeditation subscale score [$\beta = 0.11$, 95% CI (–0.005–.214), $SE = 0.07, p = 0.11$]; and of the lack of premeditation subscale score on the SAS-SV total score [$\beta = -0.02$, 95% CI (–0.15–.09), $SE = 0.08, p = 0.77$]. Age was a significant covariate ($\beta = -0.24$, 95% CI (–0.31 to –0.16), $SE = 0.05, p < .001$) and gender was not a significant covariate in the mediation models ($\beta = -0.06$, 95% CI (–0.16–.04), $SE = 0.06, p = 0.32$).

4. Discussion

The current study examined the relations among PTSD severity, impulsivity facets (i.e., lack of premeditation, negative urgency,

¹ We attempted to model all constructs as latent variables; however, the results of the measurement models indicated a poor and unacceptable fit. Fit indices for the UPPS four-factor model were: $\chi^2(939, N = 346) = 3010.43, p < .001$; Root Mean Square Error of Approximation (RMSEA) value = 0.80; Comparative Fit Index (CFI) value = 0.83; Tucker Lewis Index (TLI) values = 0.82. Further, fit indices for the one-factor SAS-SV model were: $\chi^2(45, N = 346) = 236.01, p < .001, CFI = 0.90, TLI = 0.88, RMSEA = 0.11, SRMR = 0.06$.

sensation seeking, and lack of perseverance), and problematic smartphone use. Extending research on the PTSD-addictive behavior relationship (e.g., Weiss et al., 2012), greater PTSD severity was associated with problematic smartphone use. Further, partially consistent with study hypotheses, higher levels of negative urgency and lack of perseverance were detected among individuals with greater PTSD severity and problematic smartphone use; and negative urgency mediated the link between PTSD severity and problematic smartphone use. These results align with research underscoring the underlying role of negative urgency in risky behaviors among individuals who experience PTSD symptoms (Tripp & McDevitt-Murphy, 2015; Weiss et al., 2017).

Although research highlights heightened levels of all impulsivity facets among individuals with greater PTSD severity, only negative urgency has been shown to consistently relate to PTSD severity across studies (Contractor et al., 2016; Weiss, Tull, Anestis, & Gratz, 2013; Weiss et al., 2017). Likewise, whereas prior studies link all impulsivity facets to problematic smartphone use (Billieux et al., 2007; Billieux et al., 2008), recent meta-analyses indicate that the emotion-related impulsivity dimension of negative urgency most strongly relates to addictive behaviors (Berg, Latzman, Bliwise, & Lilienfeld, 2015; Coskunpinar, Dir, & Cyders, 2013) which may include problematic smartphone use.

Indeed, a growing body of literature suggests that impulsive and possibly risky behaviors such as problematic smartphone use may be emotion-dependent, or are more likely to occur in the context of intense distressing emotions (Cyders & Smith, 2007; Cyders & Smith, 2008) among individuals who experience PTSD symptoms. For instance, intense distressing emotions associated with PTSD (Litz, Orsillo, Kaloupek, & Weathers, 2000) may impair decision-making (Bechara, 2004; Dreisbach, 2006) by resulting in less discretionary use of information (Forgas & Bower, 1987), and greater distractibility (Dreisbach & Goschke, 2004). Consequently, one may focus on short- versus long-term goals (Slovic, Finucane, Peters, & MacGregor, 2004). Alternatively, experience of intense and distressing emotional experiences among individuals with heightened PTSD severity may interfere with one's ability to control urges to use a smartphone, as they may be motivated by immediately rewarding experiences that function to reduce or distract from negative affect in the short-term (Inzlicht & Schmeichel, 2012). Overall, these findings suggest that problematic smartphone use among individuals with greater PTSD severity may be explained by maladaptive ways of responding to negative emotions associated with PTSD severity.

Inconsistent with study hypotheses, lack of perseverance was the only other impulsivity dimension significantly related to PTSD severity and problematic smartphone use, suggesting that the ability to focus or follow through on difficult/boring tasks is disrupted among individuals with heightened PTSD severity and problematic smartphone use. Further, the impulsivity facets of lack of premeditation, sensation seeking, and lack of perseverance did not mediate the relation between PTSD severity and problematic smartphone use. Existing literature indicates some mixed findings regarding the associations between impulsivity facets and both PTSD (Contractor et al., 2016; Weiss et al., 2017) and smartphone use (Billieux et al., 2007; Billieux et al., 2008) which can be attributed to several factors.

One, impulsivity facets may differentially relate to PTSD symptom clusters. For instance, in a sample of college students, Contractor et al. (2016) reported significant positive relations between sensation seeking and each of the PTSD clusters; between negative urgency and all PTSD symptom clusters excluding avoidance; and between lack of perseverance and the PTSD cluster of intrusions. An additional factor may relate to the measured construct (e.g., PTSD diagnosis vs. severity), and the modality of

measurement (e.g., self-report versus clinician-administered) (Contractor et al., 2016; Weiss et al., 2017). Indeed, counter to the above-mentioned findings, among inpatients with PTSD and a substance use disorder (versus a substance use disorder alone), Weiss et al. (2013) detected significantly higher levels of negative urgency and lower levels of sensation seeking, whereas Weiss et al. (2017) found significantly higher levels of both negative urgency and lack of premeditation. Likewise, research on the relations among impulsivity facets and problematic smartphone use has focused on different smartphone use outcomes. Specifically, among college students, Billieux et al. (2007) found higher levels of both negative urgency and lack of perseverance to be related to perceived dependence on mobile phones, whereas Billieux et al. (2008) found higher levels of both lack of premeditation and negative urgency to be related to problematic mobile phone use among individuals from the community. Finally, sample characteristics varied greatly across the aforementioned studies, which could have influenced study findings.

There has been some skepticism in the existing literature about categorizing problematic smartphone use as a behavioral addiction; mainly attributed to current scarce data on the unique theory-based phenomenology of problematic smartphone use (Billieux, Maurage, Lopez-Fernandez, Kuss, & Griffiths, 2015). Alternatively, problematic smartphone use is categorized as a coping strategy, rather than an addictive behavior (Kardefelt-Winther et al., in press). Our results indicate that excessive smartphone use may serve the functional role of coping with the distress of PTSD symptoms in an impulsive manner; thus supporting the conceptualization of problematic smartphone use as a coping strategy. Overall, our results provide support for the impulsive pathway explanation wherein smartphone use is driven by the psychological characteristic of poor impulse control (Billieux et al., 2015). Future research could explore the question of the types of smartphone uses that could be categorized as addictive behaviors, compared to other types of smartphone uses that could be coping strategies.

4.1. Limitations, implications, and future directions

Several limitations warrant consideration. First, data were collected via self-report measures, which may result in response biases. Second, collecting data via the internet using an online format has disadvantages such as sample biases (because of self-selection), and lack of control over the research environment (e.g., no opportunity to clarify questions; distractions) (Kraut et al., 2004); thus possibly limiting generalizability of results. However, the MTurk recruitment platform is a notable strength of our study. Research has shown that an MTurk subject pool is quite diverse compared to traditional internet-recruited samples (Buhrmester et al., 2011); is representative of the population in demographic characteristics (Mischra & Carleton, 2017); and generates reliable data (Buhrmester et al., 2011; Shapiro et al., 2013). Additionally, prevalence of mental health problems (e.g., traumatic events, anxiety and depression) are similar to those found in epidemiological studies (Shapiro et al., 2013); in fact, some problems (e.g., gambling) have a larger prevalence rates (Mischra & Carleton, 2017).

Third, data were cross-sectional, which precludes drawing causal conclusions. Fourth, we did not assess other relevant mental health constructs such as neuroticism. Fifth, positive urgency, a tendency to act impulsively when experiencing positive emotions (Cyders et al., 2007), was added to later versions of the UPPS, and was not assessed in the current study. A recent meta-analysis indicated that negative and positive urgency demonstrated the strongest associations with psychopathology constructs compared to other UPPS facets, which was attributed to the affective

component embedded in both these constructs (Berg et al., 2015). Hence, this prompted the question of whether a broader category of urgency subsumes the closely related facets of positive and negative urgency. Future investigations could compare and contrast the mediating role of both urgency facets in the PTSD-problematic smartphone use association.

Despite these limitations, our results have theoretical and clinical implications. First, our results highlight the importance of assessing the impulsivity facet of negative urgency among those experiencing PTSD symptoms and problematic smartphone use; specifically, how one responds in the context of intense negative emotional states. Second, our results highlight the importance of targeting negative urgency in clinical interventions aimed at reducing problematic smartphone use among individuals who experience PTSD symptoms. Thus, skills for facilitating behavioral control in the context of negative emotional states, such as redirecting attention to non-emotional stimuli and promoting more adaptive actions in the face of negative emotional arousal are critical. Interventions that target negative urgency have been developed for the treatment of PTSD (e.g., skills training in affect and interpersonal regulation plus modified exposure, dialectical behavior therapy prolonged exposure; Cloitre, Koenen, Cohen, & Han, 2002; Harned, Korlund, Foa, & Linehan, 2012) and risky behaviors (e.g., distress tolerance treatment, emotion regulation group therapy; Brown et al., 2008; Gratz, Tull, & Levy, 2014). Future research is warranted to examine the efficacy of these treatments in reducing problematic smartphone use among individuals who experience PTSD symptoms. Finally, our findings provide most support for an emotional regulation hypothesis compared to alternative explanations linking PTSD severity and problematic smartphone use. Future research could test such models addressing different forms of cyber addictions.

In conclusion, the current study adds to the literature on the interrelations among PTSD severity, impulsivity facets, and problematic smartphone use. Our findings suggest that (a) an inability to focus or follow through on difficult or boring tasks is related to PTSD severity and problematic smartphone use, separately; and (b) a tendency to engage in impulsive behaviors in the context of intense negative emotions underlies the association between PTSD severity and problematic smartphone use. Negative urgency may be a transdiagnostic construct underlying the relation between PTSD severity and other impulse-based behaviors; an area in need of further research.

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