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The Roles of Emotion Regulation Difficulties and Impulsivity in the Associations between Borderline Personality Disorder Symptoms and Frequency of Nonprescription Sedative Use and Prescription Sedative/Opioid Misuse

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Abstract

Despite evidence of a strong relationship between BPD and substance use problems in general, little research has examined the associations of BPD symptoms with the misuse of sedatives or opioids, and no studies have explored possible factors that may underlie these associations. Thus, this study examined the relationships of BPD symptoms (i.e., the number of BPD criteria with threshold ratings on a diagnostic interview) to nonprescription sedative use, nonprescription opioid use, and prescription sedative/opioid misuse among 194 patients with alcohol and/or cocaine dependence in a residential substance use disorder treatment facility, as well as the roles of two theoretically-relevant factors in these relationships: emotion regulation (ER) difficulties and impulsivity facets. We found significant positive associations between BPD symptoms and nonprescription sedative use, nonprescription opioid use, and prescription sedative/opioid misuse. We also found significant positive indirect relationships of BPD symptoms to nonprescription sedative use through ER difficulties, $ab = .04$, 95% CI [.003, .09], and to prescription sedative/opioid misuse through two facets of impulsivity: lack of perseverance, $ab = .05$, 95% CI [.01, .11], and negative urgency, $ab = .03$, 95% CI [.002, .07]. Findings highlight the differential relevance of ER difficulties and impulsivity dimensions to the relationships of BPD symptoms to nonprescription sedative use and prescription sedative/opioid misuse, respectively, among patients with alcohol and/or cocaine dependence.

Keywords

emotion regulation; borderline personality disorder; impulsivity; sedatives; opioids; substance use

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Declaration of Interest

All authors declare that they have no conflicts of interest.

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Borderline personality disorder (BPD) is characterized by severe emotional, behavioral, cognitive, and interpersonal dysregulation (American Psychiatric Association [APA], 2013; Linehan, 1993), as well as numerous co-occurring physical health (e.g., chronic pain, arthritis, cardiovascular disease; El-Gabalawy, Katz, & Sareen, 2010; Frankenburg & Zanarini, 2004; Lee et al., 2010; Sansone & Sansone, 2012) and mental health (e.g., anxiety disorders, posttraumatic stress disorder, major depressive disorder, risky behaviors; Kleindienst et al., 2008; Klonsky, 2007; McGlashan et al., 2000; Skodol et al., 1995, 2002; Svaldi, Phillipsen, & Matthies, 2012; Tomko, Trull, Wood, & Sher, 2014; Zanarini et al., 1998) problems. Although BPD is found at rates of 1–6% in the general population (Grant et al., 2008; Lenzenweger, Lane, Loranger, & Kessler, 2007; Tomko et al., 2014; Torgersen, Kringlen, & Cramer, 2001), BPD is the most common personality disorder among patients receiving mental health treatment, with 15–20% of inpatients and 8–10% of outpatients having a diagnosis of BPD (APA, 2013; Widiger & Weissman, 1991; Zimmerman, Rothschild, & Chelminski, 2005).

One mental health population with particularly high rates of BPD is patients with substance use disorders (SUDs). Rates of BPD range from 10–50% among individuals with SUDs (Cacciola, Alterman, McKay, & Rutherford, 2001; Trull et al., 2018; Trull, Sher, Minks-Brown, Durbin, & Burr, 2000), with rates as high as 61% among SUD inpatients (Trull et al., 2000). The co-occurrence of BPD and SUDs is related to worse outcomes than either disorder alone (Bornoalova et al., 2018), including increased risk for suicidal and nonsuicidal self-injury (Gunderson & Links, 2008; McMain & Ellery, 2008), greater variety of abused substances (Kruegelbach, McCormick, Schulz, & Grueneich, 1993), increased chronicity of BPD symptoms (Links, Heslegrave, Mitton, Van Reekum, & Patrick, 1995), and worse treatment outcomes (Pennay et al., 2011; Stone, 1990).

Notably, the majority of the research examining the association between BPD and substance use problems has focused on alcohol or cocaine use or examined substance use in general (vs. specific drug classes), with limited research examining central nervous system depressants (e.g., tranquilizers, sedatives, and opioids). However, there is considerable value in research focused on identifying the factors associated with the misuse of central nervous system depressants in particular. First, in recent years, these substances have become among the most frequently abused drugs within the general population (Jann, Kennedy, & Lopez, 2014; NIDA, 2018). Second, there is evidence that the misuse of central nervous system depressants may be particularly relevant to BPD. Given that individuals with BPD pathology have high rates of both physical health problems (including chronic pain) and anxiety disorders (see Frankenburg & Zanarini, 2004; Skodol et al., 1995; Zanarini et al., 1998) and are frequent utilizers of health care (see Bateman & Fonagy, 2003; Frankenburg & Zanarini, 2004), they may have increased access to both sedative and opioid prescription drugs that increase risk for abuse over time (see, e.g., Frankenburg, Fitzmaurice, & Zanarini, 2014). Moreover, given evidence that individuals with BPD tend to engage in a number of other health-risk behaviors (e.g., nonsuicidal self-injury) to escape or avoid negative affect (e.g., Hulbert & Thomas, 2010), they may be particularly motivated to use substances such as central nervous system depressants that function to reduce negative arousal. Finally, BPD pathology has been linked to dysregulation of the endogenous opioid system (Bandelow, Schmahl, Falkai, & Wedekind, 2010; Stanley & Siever, 2010), including deficits in

endogenous opioids and more sensitive endogenous opioid system receptors. Thus, substances that activate this system may be more reinforcing for individuals with BPD pathology than those with typically developed endogenous opioid systems, increasing the frequency with which these substances are used.

Although considerable research has examined the association between BPD pathology and substance use in general (e.g., Grant et al., 2008; Maraz et al., 2016; Skodol, Oldham, & Gallaher, 1999; see also Trull et al., 2000, 2018), research examining the relationship of BPD pathology to sedative and opioid misuse (prescribed or non-prescribed) in particular is minimal. Nonetheless, the research that has been done demonstrates significant associations between BPD and both opioid and sedative use disorders (Carpenter, Wood, & Trull, 2016), as well as heightened rates of BPD among heroin users and individuals with opioid use disorders in general (Mackesy-Amiti, Donenberg, & Ouellet, 2012; Trull et al., 2000). Moreover, BPD features (specifically, self-harm/impulsivity features) have been found to be positively associated with risk for prescription opioid misuse (Tragesser, Jones, Robinson, Stutler, & Stewart, 2013).

Yet, despite this emerging support for an association between BPD pathology and the misuse of opioids and sedatives, the factors underlying this association remain unclear. Given the recent increase in abuse of opioids and sedatives within the U. S. population (Bachhuber, Hennessy, Cunningham, & Starrels, 2016; Compton & Volkow, 2006), as well as the high risk for accidental overdose with these substances (Florence, Zhou, Luo, & Zu, 2016; Jann et al., 2014; O'Brien, 2005), the misuse of these substances is a major public health concern (SAMHSA, 2017) and necessitates further research on the factors driving the misuse of these substances in high-risk populations, such as individuals with BPD pathology.

Two factors that may play a role in the association between BPD and sedative and opioid misuse are emotion regulation (ER) difficulties and impulsivity, both of which are theorized to underlie BPD, substance use difficulties, and their co-occurrence (Bornoalova, Lejuez, Daughters, Rosenthal, & Lynch, 2005; Maraz et al., 2016; Weiss et al., 2012). With regard to the former, ER difficulties refer to maladaptive ways of responding to emotions, including deficits in the understanding, acceptance, and effective use of emotions and modulation of emotions (Gratz, Moore, & Tull, 2016; Gratz, Dixon, Kiel, & Tull, 2018). Grounded in theory and research on the functionality of emotions (Cole, Michel, & Teti, 1994; Ekman & Davidson, 1994; Thompson, 1994) and paradoxical consequences of efforts to avoid or control emotions (e.g., Hayes, Luoma, Bond, Masuda, & Lillis, 2006), the conceptualization of ER difficulties used here proposes that responses to emotions are more important than the quality of those emotions. Notably, an extensive body of literature demonstrates that individuals with BPD pathology exhibit broad deficits in ER (Gratz et al., 2016; Salsman & Linehan, 2012), including greater nonacceptance and avoidance of emotions (Beblo et al., 2010; Gratz, Tull, & Gunderson, 2008; Yen, Zlotnick, & Costello, 2002), greater unwillingness to experience emotional distress (Bornoalova et al., 2008; Gratz, Rosenthal, Tull, Lejuez, & Gunderson, 2006), and greater difficulties controlling behaviors in the context of emotional distress (Chapman, Dixon-Gordon, Layden, & Walters, 2010). The heightened levels of emotional unwillingness in BPD, combined with an absence of adaptive, non-avoidant strategies for tolerating and managing the elevated levels of

emotional distress found in this population, may prompt individuals with BPD pathology to seek out alternative means for obtaining rapid relief from intense emotional distress, such as the use of substances. In particular, individuals with BPD pathology may be especially likely to abuse substances that bring about a sense of calm or result in feelings of euphoria that counter emotional distress, such as sedatives or opioids. The negative reinforcement provided by these substances may then result in an increased reliance on these substances to manage emotional distress, eventually contributing to sedative or opioid dependence (see Baker, Piper, McCarthy, Majeskie, & Fiore, 2004). Indeed, this premise is further supported by research indicating that BPD features among college women are significantly associated with coping motives for prescription opioid use (Vest, Murphy, & Tragesser, 2018).

Impulsivity is well documented as a mechanism driving the development and maintenance of substance use difficulties in general (Ouzir & Errami, 2016; Verdejo-García, Bechara, Rechner, & Pérez-García, 2007), and has been implicated in the pathogenesis of BPD pathology (Crowell, Beauchaine, & Linehan, 2009). According to Whiteside and Lynam (2001), impulsivity is a multi-faceted construct consisting of negative urgency (i.e., the tendency to act impulsively when experiencing intense negative affect), lack of premeditation (i.e., the failure to consider the consequences of an action before engaging in that action), lack of perseverance (i.e., the inability to focus or follow through on difficult or boring tasks), and sensation seeking (i.e., the tendency to enjoy and pursue activities that are exciting). Notably, impulsivity among individuals with co-occurring BPD and substance use pathology is heightened relative to those with substance use problems or BPD alone (Links et al., 1995; Trull, Waudby, & Sher, 2004), which may partially explain the risk for more severe consequences among individuals with co-occurring BPD and substance use problems.

Previous research on impulsivity among individuals with BPD pathology suggests that the specific impulsivity facets of negative urgency and lack of perseverance are uniquely related to BPD symptoms (Bøen et al., 2015; DeShong, & Kurtz, 2013; Jacob et al., 2010; Peters, Upton, & Baer, 2013). Likewise, individuals with (vs. without) SUDs report higher levels of negative urgency and lack of perseverance, as well as greater lack of premeditation (Verdejo-García et al., 2007). Although few studies have examined the facets of impulsivity most relevant to opioid or sedative misuse, preliminary research suggests that negative urgency and sensation seeking may be related to misuse of prescription opioids among chronic pain patients (Vest, Reynolds, & Tragesser, 2016). Together, evidence for the converging relevance of negative urgency to BPD and both prescription opioid misuse and substance use pathology in general, as well as findings of the relevance of lack of perseverance to both BPD and substance use pathology, suggest that these particular facets of impulsivity could explain the association of BPD pathology with opioid and sedative misuse. Specifically, with regard to negative urgency, the intense negative emotions experienced by individuals with BPD pathology, combined with the higher levels of emotional unwillingness and avoidance in this population (see Gratz et al., 2006; Gratz, Tull, Baruch, Bornovalova, & Lejuez, 2008), may make it difficult to resist urges to seek out or use substances that could function to bring about rapid relief from those emotions. Perseverance, on the other hand, involves persistence on a task and the ability to continue or stay focused even when a task becomes difficult or boring, and corresponds with the personality traits of self-discipline and conscientiousness (Whiteside & Lynam, 2001). Thus, low perseverance among individuals

with BPD pathology may interfere with their ability to take these medications as prescribed and/or persist through the unpleasant withdrawal symptoms associated with the recurrent use of these substances, resulting in the misuse of these substances.

Thus, given (a) the recent increase in abuse of opioids and sedatives within the U.S.; (b) the high risk for accidental overdose with these substances; (c) evidence for the particular relevance of sedatives and opioids to BPD pathology; and (d) the relative paucity of research on both the association between BPD pathology and the misuse of opioids and sedatives in particular and the factors underlying this association, the aims of the current study were to: 1) examine the associations between BPD symptoms (i.e., the number of BPD criteria with threshold ratings on a diagnostic interview) and sedative and opioid misuse (across nonprescription sedative use, nonprescription opioid use, and prescription sedative/opioid misuse) within an at-risk clinical population; and 2) explore the roles of ER difficulties and impulsivity facets in these associations. In particular, research highlights the importance of examining sedative and opioid misuse in the context of other SUDs (particularly alcohol and cocaine dependence) among individuals with BPD pathology. Not only are alcohol and cocaine dependence common among individuals with BPD (Carpenter et al., 2016), the use of opioids and sedatives in the context of alcohol and/or cocaine use is particularly risky. Specifically, research indicates that co-occurring sedative and opioid misuse in the context of alcohol or cocaine dependence is associated with a variety of negative outcomes, including heightened risk for overdose (Gudin, Mogali, Jones, & Comer, 2013), more severe drug use, risky behaviors, and substance use problems (e.g., injection drug use, risky sexual behavior; Leri, Bruneau, & Stewart, 2003; McCabe, Cranford, Morales, & Young, 2006; Subramaniam, Ives, Stitzer, & Dennis, 2010), and worse treatment outcomes (Leri et al., 2003). Thus, SUD patients with alcohol and/or cocaine dependence are a particularly relevant population for examining the associations between BPD pathology and sedative and opioid misuse.

We hypothesized that the relationships of BPD symptoms to all three sedative and opioid misuse outcomes within this population would be indirect through both ER difficulties and two particular facets of impulsivity: negative urgency and lack of perseverance.

Methods

Participants

Participants included in the current study ($N = 194$, 49.5% women) were those with complete data drawn from a larger sample of patients ($N = 226$) consecutively admitted to a residential SUD treatment facility located in the southern United States. This treatment facility is managed by the state department of mental health and located on the campus of the state's primary psychiatric hospital. The treatment facility largely serves a rural population and accepts both voluntary and involuntary admissions. The majority (58.4%) of participants in this study were court-ordered to treatment. Following a short detoxification period, standard treatment at this facility involves a combination of strategies from Alcoholics Anonymous and Narcotics Anonymous, as well as groups focused on relapse prevention and life skills (e.g., stress management, social skills training). The facility requires complete abstinence from drugs (including nicotine) and alcohol, with the

exception of caffeine. Aside from scheduled activities or medical appointments, residents are not permitted to leave the treatment facility. Contract duration is approximately 30 days for all patients.

The 194 participants included in this study ranged in age from 18 to 65 years ($M_{age} = 34.22 \pm 10.06$) and were ethnically/racially diverse (59.3% White; 37.6% Black/African American; 1.5% Latinx). With regard to educational attainment, 33% had completed high school or received a GED, 28.9% had attended some college or technical school, and 9.7% had graduated from college. Most participants (74%) reported a household income of less than \$30,000. With regard to SUD treatment history, 57.1% indicated previous treatment for alcohol use and 71.6% reported past treatment for drug use.

Measures

Borderline personality disorder symptoms—The BPD module of the *Diagnostic Interview for DSM-IV Personality Disorders* (DIPD-IV; Zanarini, Frankenberg, Sichel, & Yong, 1996) was used to assess BPD symptoms (i.e., the number of BPD criteria with threshold ratings), as well as BPD diagnostic status. Interviews were conducted by bachelors- or masters-level clinical assessors trained to reliability with study investigators (diagnostic agreement > 88%). Detailed information on each criterion was collected by interviewers, and all ratings were reviewed by the study investigators. In the case of disagreements, ratings were discussed by the investigators and interviewer until a consensus was reached. The DIPD-IV has demonstrated good interrater and test-retest reliability (Carcone, Tokarz, & Ruocco, 2015; Grilo & McGlashan, 2000; Zanarini et al., 2000). Internal consistency in this sample was acceptable ($\alpha = .83$).

Emotion regulation difficulties—The *Difficulties in Emotion Regulation Scale* (DERS; Gratz & Roemer, 2004) is a 36-item measure that assesses dispositional ER difficulties across six domains: nonacceptance of negative emotions, inability to engage in goal-directed behaviors when experiencing negative emotions, difficulties controlling impulsive behaviors when experiencing negative emotions, lack of access to effective ER strategies, lack of emotional awareness, and lack of emotional clarity. Participants rate each item on a 5-point Likert-type scale (1 = “almost never” [0–10%], 2 = “sometimes” [11–35%], 3 = “about half the time” [36–65%], 4 = “most of the time” [66–90%], 5 = “almost always” [91–100%]). Factor analytic examinations of the DERS provide support for a meaningful overall factor represented by the DERS total score (Hallion, Steinman, Tolin, & Diefenbach, 2018; Osborne, Michonski, Sayrs, Welch, & Anderson, 2017). The DERS total score demonstrates good reliability and construct and convergent validity and is significantly associated with objective measures of ER and the unwillingness to experience emotions in particular (Gratz, Bornovalova, Delany-Brumsey, Nick, & Lejuez, 2007; Gratz & Roemer, 2004; Gratz et al., 2006; Vasilev, Crowell, Beauchaine, Mead, & Gatzke-Kopp, 2009). Internal consistency in this sample was acceptable ($\alpha = .93$).

Impulsivity—Facets of impulsivity were measured using the *UPPS Impulsive Behavior Scale* (UPPS; Whiteside & Lynam, 2001; Whiteside, Lynam, Miller, & Reynolds, 2005). The UPPS assesses impulsivity as a multidimensional construct consisting of four facets:

lack of premeditation, lack of perseverance, negative urgency, and sensation seeking. These scales have demonstrated good convergent and discriminant validity (Cyders & Smith, 2007). Participants rate 59 items on a 4-point Likert-type scale (1 = “agree strongly”, 2 = “agree some”, 3 = “disagree some”, 4 = “disagree strongly”). As the UPPS was designed to assess unique facets of impulsivity, a separate score is obtained for each facet and a total score is not calculated. Internal consistency of the subscales in this sample ranged from .77-.84.

Substance use—Substance use across the substances of interest (i.e., nonprescription sedatives, nonprescription opioids, and prescription sedatives and/or opioids) was assessed using the *Drug Use Questionnaire* (DUQ; Hien & First, 1991), a self-report measure of past-year frequency of alcohol and drug use. The DUQ characterizes frequency of use in a manner consistent with criteria for establishing the presence of a SUD in the Structured Clinical Interview for DSM-IV (SCID-IV; First, Spitzer, Gibbon, & Williams, 1996). Specifically, participants rate the frequency with which they used thirteen specific substances over the course of the past year on a 6-point Likert-type scale (0 = “never”, 1 = “one time”, 2 = “monthly or less”, 3 = “2–4 times a month”, 4 = “2–3 times a week”, and 5 = “4 or more times a week”). Of particular interest to this study were the items assessing the frequency of nonprescription sedative use, heroin use, and prescription drug misuse. Participants who endorsed prescription drug misuse were instructed to list the specific prescription drugs they had misused (i.e., used not as prescribed). Those endorsing misuse of prescription drugs other than sedatives or opioids were not included in this sample. This measure has demonstrated good construct validity (Bornoalova, Ouimette, Crawford, & Levy, 2009; Lejuez, Bornoalova, Reynolds, Daughters, Curtin, 2007; Tull, Kiel, McDermott, & Gratz, 2013) and convergence with SUD diagnoses from structured clinical interviews in associations with relevant outcomes (Lejuez et al., 2007).

Other psychopathology—Current mood and anxiety symptoms were assessed using the *Depression Anxiety Stress Scales* (DASS-21; Lovibond & Lovibond, 1995), a self-report measure that provides individual subscale scores of the severity of depression, anxiety, and stress symptoms. Participants rate the items on a 4-point Likert-type scale indicating how much each item applied to them in the past week (0 = “did not apply to me at all”, 1 = “applied to me some of the time”, 2 = “applied to me a good part of the time”, 3 = “applied to me most of the time”). This measure has demonstrated good reliability and validity (Lovibond & Lovibond, 1995). Internal consistency of these subscales ranged from .84-.90.

SUDs, including alcohol and cocaine dependence, were assessed using the SCID-IV (First et al., 1996). As with the DIPD-IV, interviews were conducted by bachelors- or masters-level clinical assessors trained to reliability with study investigators (diagnostic agreement > 88%). All interviews were reviewed by investigators, with disagreements discussed to reach a consensus.

Procedure

All procedures were reviewed and approved by the Institutional Review Boards of participating institutions. Data were collected between October 2011 and October 2013 as

part of a larger study on risk-taking among patients with alcohol and/or cocaine dependence (the most common SUDs for which individuals sought treatment at the time in the state where data were collected; SAMHSA, 2015). Participants were recruited for this study no sooner than 72 hours after entry into the facility to limit the possible interference of withdrawal symptoms on study engagement. All patients at the treatment facility were provided with information about the study in group meetings and given the opportunity to meet with study personnel to learn more about the study and determine eligibility for the study. Participants interested in learning more about the study scheduled a time to meet in private with study personnel. During that meeting, eligibility was determined.

To be eligible for inclusion in the larger study, participants were required to: 1) be dependent on cocaine and/or alcohol (although participants could also be dependent on other substances in addition to cocaine and alcohol); 2) have a Mini-Mental Status Exam (Folstein, Folstein, & McHugh, 1975) score of ≥ 24 (indicative of no significant cognitive impairment); and 3) have no current psychotic disorder (as determined by the psychosis screener from the SCID-I; First et al., 1996). Those who met inclusion criteria were provided with information about study procedures and associated risks, following which written informed consent was obtained. Fewer than 5% of eligible patients refused to participate in this study. After providing written informed consent, participants completed a diagnostic interview, followed by a series of self-report questionnaires. Participants were reimbursed \$25.

Analysis Plan

Mean replacement of individual items was used for cases with less than 20% missing data on any measure used in the analyses; cases with $> 20\%$ missing data on any included measure were excluded from analyses (resulting in the exclusion of 32 participants from the larger sample of 226). All analyses were conducted with the final sample of 194 participants. Using values recommended in Fritz and MacKinnon (2007), a sample size of 162 is adequate to detect a small to medium-sized effect (power = .80).

Correlation analyses were conducted to examine interrelations among the primary variables of interest. To identify covariates for primary analyses, associations between relevant demographic and clinical variables (i.e., age, racial/ethnic background, gender, depression symptoms, anxiety symptoms, alcohol dependence, and cocaine dependence) and the intervening and outcome variables of interest were examined using *t* tests and correlation analyses. Next, the PROCESS macro in SPSS (Model 4; Hayes, 2017), a tool that uses observed variable ordinary least squares regression to analyze path models, was used to examine relevant indirect relationships of BPD symptoms to past-year frequency of nonprescription sedative use, nonprescription opioid use, and prescription sedative/opioid misuse through ER difficulties (DERS total score) and impulsivity facets (UPPS subscales), as warranted by the initial correlation analyses. Specifically, only those intervening variables (i.e., UPPS subscales, DERS total score) significantly correlated with both the independent and dependent variables (i.e., BPD symptoms and the respective sedative or opioid use outcome variable) were included in each model. Each model also contained all identified relevant covariates (i.e., those associated with the intervening or outcome variables).

Specific paths tested in each examined model are presented in Figures 1 and 2. As depicted in Figures 1 and 2, *path a* captures the relationships between BPD symptoms and the intervening variable(s) (i.e., DERS and relevant UPPS scales), *path b* captures the relationships between the intervening variables and the outcome, and *path c* captures the relationship between BPD symptoms and the outcome variable. The indirect relationships of BPD symptoms to the sedative and opioid misuse outcomes are calculated as $a \times b$ (ab), and *path c'* captures the direct relationship of BPD symptoms to the outcome variables (i.e., the remainder of the relationship not accounted for by the indirect relationship; Preacher & Hayes, 2008). Of note, all relevant intervening variables included in each model (i.e., those associated with both BPD pathology and the outcome of interest) were examined simultaneously as shown in Figures 1 and 2.

Following recommendations by Preacher and Hayes (2008), the current study used a bootstrapping technique to estimate the indirect relationships. This approach is recommended over other approaches for examining indirect relationships (i.e., Sobel test, causal steps approach; MacKinnon, Lockwood, Hoffman, & West, 2002; MacKinnon, Lockwood, & Williams, 2004), as bootstrapping allows for better control of Type I error and provides greater power (Preacher & Hayes, 2008). In this study, as recommended by Hayes (2017) and Yzerbyt, Muller, Batailler, and Judd (2018), the estimates of the indirect relationships were derived from the mean of 5000 bootstrap samples. Bias corrected and accelerated 95% confidence intervals were calculated, and indirect relationship estimates were considered significant when the confidence intervals did not contain zero.

Results

Identification of Covariates

Participant age was negatively associated with ER difficulties, $r = -.16$, $p = .03$, and prescription sedative/opioid misuse, $r = -.31$, $p < .001$. Further, there were significant differences in negative urgency, $t(180) = 3.32$, $p = .001$, nonprescription sedative use, $t(192) = 5.72$, $p < .001$, and prescription sedative/opioid misuse, $t(192) = 8.01$, $p < .001$, as a function of racial/ethnic background, with White participants reporting greater negative urgency and more frequent drug misuse than participants who identified as a racial/ethnic minority. Likewise, there were significant differences in nonprescription sedative use, $t(192) = -2.28$, $p = .02$, and lack of perseverance, $t(179) = 2.13$, $p = .03$, between participants with an annual income below versus above \$10,000, such that participants earning less than \$10,000 annually reported significantly greater sedative use and significantly lower levels of lack of perseverance than those earning more than \$10,000 annually. No significant gender differences were found for any intervening or outcome variable ($t < 1.63$, $ps > .10$). Depression symptoms were significantly related to ER difficulties, $r = .44$, $p < .001$, and negative urgency, $r = .30$, $p < .001$, and anxiety symptoms were significantly related to ER difficulties, $r = .41$, $p < .001$, negative urgency, $r = .34$, $p < .001$, nonprescription sedative use, $r = .28$, $p = .01$, and prescription sedative/opioid misuse, $r = .20$, $p = .01$. Finally, there were no significant differences in any of the intervening or outcome variables as a function of the presence (vs. absence) of either alcohol dependence or cocaine dependence ($t < |1.59|$).

$ps > .13$). Thus, age, racial/ethnic background, income, depression symptoms, and anxiety symptoms were included as covariates in all primary analyses.

Preliminary Analyses

Descriptive data on and correlations among the primary variables of interest are reported in Table 1. Consistent with past research on SUD samples (see Gratz et al., 2008; Trull et al., 2000), 34.1% of participants in this sample met criteria for BPD, 10.7% reported past-year use of nonprescription opioids, 51.7% reported past-year use of nonprescription sedatives, and 56.2% reported past-year prescription drug misuse. Of the participants reporting prescription drug misuse, 56.4% reported misusing prescription opioids and 24.8% reported misusing prescription sedatives. Current SUD diagnoses of participants are presented in Table 2.

As expected, BPD symptoms were significantly positively correlated with past-year frequency of nonprescription sedative use, nonprescription opioid use, and prescription sedative/opioid misuse, as well as ER difficulties and the impulsivity facets of negative urgency and lack of perseverance (see Table 1). All associations were small in magnitude, with the exception of the correlation between BPD symptoms and ER difficulties, which was associated with a moderate effect size (see Table 1). Additionally, ER difficulties and the impulsivity facets of negative urgency, lack of perseverance, and sensation seeking were significantly positively associated with frequency of both nonprescription sedative use and prescription sedative/opioid misuse, and lack of premeditation was significantly associated with all three drug use outcomes (although all but the moderate-sized correlation between sensation seeking and prescription sedative/opioid misuse were small in magnitude).

Thus, primary analyses focused on the indirect relationships of BPD symptoms to frequency of nonprescription sedative use and prescription sedative/opioid misuse through ER difficulties and both negative urgency and lack of perseverance. Given that the only ER or impulsivity variable associated with nonprescription opioid use (i.e., lack of premeditation) was not significantly correlated with BPD symptoms, this particular outcome was not examined further.

Primary Analyses

Results of the model examining the indirect relationships of BPD symptoms to frequency of nonprescription sedative use through ER difficulties, negative urgency, and lack of perseverance are shown in Figure 1. BPD symptoms were uniquely positively associated with ER difficulties and negative urgency, but not lack of perseverance (Figure 1). Conversely, ER difficulties and lack of perseverance (but not negative urgency) were uniquely positively associated with frequency of nonprescription sedative use (Figure 1). Finally, we found a significant indirect relationship of BPD symptoms to frequency of nonprescription sedative use through ER difficulties, $F(5, 193) = 4.84$, $p < .001$, $ab = .04$, 95% CI [.003, .09], but not negative urgency, $ab = -.03$, 95% CI [-.08, .01], or lack of perseverance, $ab = .01$, 95% CI [-.02, .05].¹

Results of the model examining the indirect relationships of BPD symptoms to frequency of prescription sedative/opioid misuse are shown in Figure 2. Consistent with the proposed model, BPD symptoms were uniquely positively associated with ER difficulties, negative urgency, and lack of perseverance (see Figure 2). However, only negative urgency and lack of perseverance were uniquely positively associated with frequency of prescription sedative/opioid misuse (Figure 2). Finally, we found a significant indirect relationship of BPD symptoms to frequency of prescription sedative/opioid misuse through both lack of perseverance, $ab = .05$, 95% CI [.01, .11], and negative urgency, $ab = .03$, 95% CI [.002, .07], $F(5,184) = 10.45$, $p < .001$, but not ER difficulties, $ab = -.01$, 95% CI [-.07, .05]. Of note, results did not change when covariates were excluded from the models.

Discussion

The present study examined the relationships of BPD symptoms to sedative and opioid misuse, as well as the roles of ER difficulties and impulsivity facets in these relationships, within a clinical sample of patients with alcohol and/or cocaine dependence. Extending past research on the association between BPD and substance use problems, we found significant zero-order associations between BPD symptoms and frequency of nonprescription sedative use, nonprescription opioid use, and prescription sedative/opioid misuse. These findings provide further support for the relevance of BPD pathology to the misuse of both sedatives and opioids in particular – two classes of drugs associated with elevated risk for both abuse and accidental poisoning and overdose in general (Coben et al., 2010; Florence et al., 2016; Jann et al., 2014; O'Brien, 2005) and among patients with alcohol and cocaine dependence in particular (Gudin et al., 2013; Subramaniam et al., 2010). The results of this study suggest that the presence of BPD symptoms may increase use of these substances among SUD patients.

Results of this study also highlight the differential relevance of ER difficulties and impulsivity dimensions to the relationships of BPD symptoms to nonprescription sedative use and prescription sedative/opioid misuse, respectively, among patients with alcohol and/or cocaine dependence. Specifically, we found a significant indirect relationship of BPD symptoms to nonprescription sedative use through ER difficulties. This finding is consistent with theoretical literature suggesting that the maladaptive behaviors commonly observed in BPD (including substance misuse) stem from the difficulties in ER that underlie this disorder (Gratz et al., 2016; Linehan, 1993). The results of this study suggest that the ER difficulties associated with BPD may be most strongly linked to the use of substances that down-regulate emotional distress and provide a sense of calm (i.e., sedatives), at least among SUD patients with alcohol and/or cocaine dependence. Interestingly, ER difficulties did not explain the relationship of BPD symptoms to nonprescription opioid use or prescription sedative/opioid misuse. This pattern of results may reflect the particular relevance of ER

¹The indirect relationships of BPD symptoms to frequency of nonprescription sedative use through each subscale of the DERS were also examined in a model including all subscales simultaneously. Notably, and providing support for the use of the total DERS score in the primary analyses, there were no significant indirect relationships through any of the individual subscales, including emotional nonacceptance, $ab = .04$, CI [-.01, .09], lack of awareness, $ab = -.003$, CI [-.04, .03], lack of clarity, $ab = .01$, CI [-.01, .03], difficulties engaging in goal directed behaviors, $ab = .03$, CI [-.01, .08], difficulties controlling impulsive behaviors, $ab = .01$, CI [-.04, .07], and lack of access to effective ER strategies, $ab = -.01$, CI [-.07, .05].

difficulties to the use of sedatives versus opioids, perhaps due to their intended targets. Specifically, given the strong associations between ER difficulties and anxiety (Campbell-Sills, Ellard, & Barlow, 2014), panic (Tull & Roemer, 2007), and other intense negative emotional states (Gupta, Rosenthal, Mancini, Cheavens, & Lynch, 2008; Shorey, Cornelius, & Idema, 2011), SUD patients with heightened ER difficulties may be more likely to seek out substances that are generally advertised or described as methods for alleviating anxiety or down-regulating negative emotions (i.e., sedatives such as benzodiazepines) than to seek out opioids, which are generally prescribed to alleviate somatic pain (even though opioids also have the ability to down-regulate negative affect; Martel, Dolman, Edwards, Jamison, & Wasan, 2014).

Conversely, we found significant indirect relationships of BPD symptoms to prescription sedative/opioid misuse through two facets of impulsivity: lack of perseverance and negative urgency. This finding is consistent with previous research indicating significant associations of negative urgency with prescription opioid misuse and both negative urgency and lack of perseverance with substance use problems in general (Verdejo-García et al., 2007; Vest et al., 2016). This finding suggests that it is the heightened impulsivity associated with BPD (rather than the ER difficulties associated with this disorder) that explains the association between BPD symptoms and prescription sedative/opioid misuse. Given the high opioid and benzodiazepine prescribing rates across the U.S. (Centers for Disease Control, 2018; Curtis et al., 2006; Olfson, King, & Schoenbaum, 2015), this finding may speak to the relevance of impulsivity to the misuse of easily accessible (i.e., prescribed) drugs versus illegal drugs that may be more difficult to obtain. The built-in delay associated with obtaining illicit sedatives and opioids may attenuate the strength of the relationship of impulsivity to these less accessible substances. Furthermore, a lack of perseverance in particular may make it more difficult to take medications as prescribed or persist through the experience of withdrawal symptoms once the prescription has ended.

Finally, it is important to note that neither ER difficulties nor any impulsivity facet explained the relationship of BPD symptoms to nonprescription opioid use. Future research is needed to examine other factors that may underlie the use of heroin and other nonprescription opioids among individuals with greater BPD symptoms. In particular, previous research has identified several risk factors for the abuse of nonprescription opioids, including poly-drug use (Wu & Howard, 2007), early onset of drug use (Storr, Westergaard, & Anthony, 2005), and personality characteristics such as neuroticism and anger (Kornør & Nordvik, 2007; Suh, Ruffinns, Robins, Albanese, & Khantzian, 2008), all of which are relevant to BPD (Franken & Hendriks, 2000; Hiebler-Ragger, Unterrainer, Rinner, & Kapfhammer, 2016; Mancke, Herpertz, Kleindienst, & Bertsch, 2017; Samuel, Carroll, Rounsaville, & Ball, 2013).

Several limitations warrant consideration. First, this study is limited by the use of cross-sectional data. Prospective, longitudinal studies are needed to clarify how co-occurring BPD and sedative/opioid misuse develop among SUD patients, as well as the specific roles of ER difficulties and impulsivity in this co-occurrence. In particular, such research would clarify the extent to which the ER difficulties and impulsivity associated with BPD actually drive the development of sedative and/or opioid misuse within this population (vs. being a

consequence of the misuse of these substances). Indeed, although theory supports the direction of the associations examined here, the chronic use of sedatives and opioids could exacerbate ER difficulties and impulsivity, as well as BPD symptoms. Knowledge of the precise direction of the associations among BPD symptoms, ER difficulties, impulsivity, and sedative/opioid misuse among SUD patients would highlight relevant targets for prevention and early intervention efforts aimed at preventing the co-occurrence of BPD and sedative/opioid misuse among patients dependent on other substances.

This study is also limited by its reliance on a self-report measure of drug use frequency, which may be vulnerable to recall biases, social desirability concerns, and comprehension difficulties (Johnson & Fendrich, 2005). In addition, participants were asked to report on only the frequency with which they used each substance. Although substance use frequency and severity are likely highly correlated, our measure did not adequately assess specific substance use features that would provide a better index of substance use severity (e.g., cravings, drug-seeking behaviors). Future research would benefit from the use of more comprehensive interview-based measures of substance misuse, such as the Addiction Severity Index (McLellan et al., 1992), as well as ecological momentary assessment or timeline follow-back procedures, which may facilitate more accurate responding about the frequency and severity of drug use behaviors in daily life. Additionally, this study was conducted in a residential SUD treatment facility where the majority of patients were court-ordered to treatment; thus, findings may not generalize to other populations, including SUD outpatients, SUD patients voluntarily seeking treatment, non-SUD patients with BPD, or community samples. In addition, it is important to consider that patients in residential SUD treatment typically represent more severe SUD patient populations (Chen et al., 2011). Consistent with this, all participants in this study were dependent on alcohol and/or cocaine and many were dependent on multiple substances (including and/or instead of sedatives or opioids). Thus, it is possible that our findings are unique to this particular sample and may not generalize to individuals with primary sedative or opioid dependence (in the absence of alcohol or cocaine dependence). Future research examining the negative outcomes associated with opioid and sedative misuse among individuals with BPD pathology (e.g., risk-taking behavior, treatment failure, overdose, and relapse) should take into account the population in which these associations are examined, selecting the most applicable outcomes for the population in question. Moreover, future research is needed to examine the associations among BPD symptoms, ER difficulties, impulsivity dimensions, and sedative and opioid misuse within other relevant non-SUD samples, including individuals at risk for opioid and/or sedative misuse in particular (e.g., patients with severe anxiety disorders; chronic pain patients).

Despite these limitations, the results of this study add to the small body of literature on the relationship of BPD to the use of sedatives and opioids, providing preliminary evidence for significant associations between BPD symptoms and both nonprescription and prescription sedative and opioid misuse among residential patients with alcohol and/or cocaine dependence. Extending past research in this area, results also suggest the relevance of ER difficulties and two facets of impulsivity (i.e., negative urgency and lack of perseverance), respectively, to the relationships of BPD symptoms to two of these drug use outcomes: nonprescription sedative use and prescription sedative/opioid misuse. As such, these findings

highlight the potential role of emotional and behavioral dysregulation in sedative use and prescription sedative/opioid misuse among individuals with BPD pathology and co-occurring alcohol and/or cocaine dependence. Although in need of replication in larger and more comprehensive studies, further support for the role of ER difficulties, negative urgency, and lack of perseverance in nonprescription sedative use and prescription sedative/opioid misuse among individuals with BPD pathology could highlight the potential utility of targeting these mechanisms directly among alcohol and/or cocaine dependent patients with subthreshold or threshold BPD. Results also highlight the potential importance of assessing for BPD, ER difficulties, and impulsivity before prescribing sedatives or opioids to SUD patients dependent on other substances, as these factors may increase the potential for misuse of these drugs or contribute to other negative outcomes (e.g., increased risk for treatment failure or overdose).

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Highlights

- Borderline personality disorder (BPD) is associated with substance use problems.
- Little is known about the relation of BPD symptoms to sedative or opioid misuse.
- We examined the roles of emotion regulation (ER) difficulties and impulsivity.
- BPD symptoms were related to nonprescription sedative use through ER difficulties.
- BPD symptoms were related to prescription sedative/opioid misuse via impulsivity.

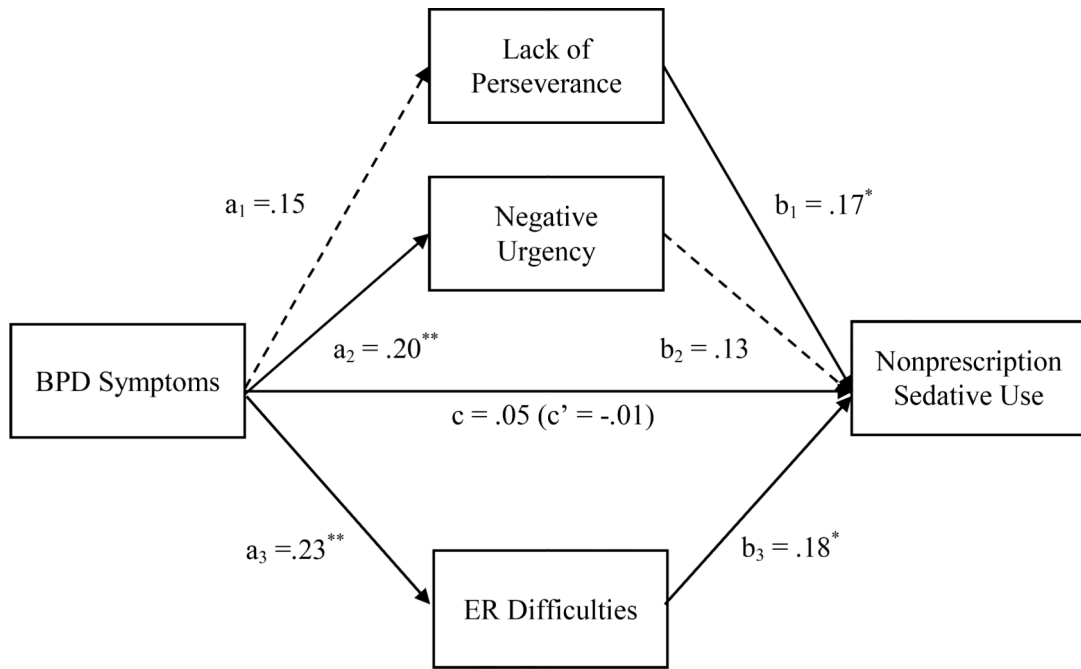


Figure 1. Indirect relationships of BPD symptoms to frequency of nonprescription sedative use through lack of perseverance, negative urgency, and ER difficulties
Note. β values are reported. Age, racial/ethnic background, income, depression symptoms, and anxiety symptoms were included as covariates in the model.
 $**p < .01$, $*p < .05$

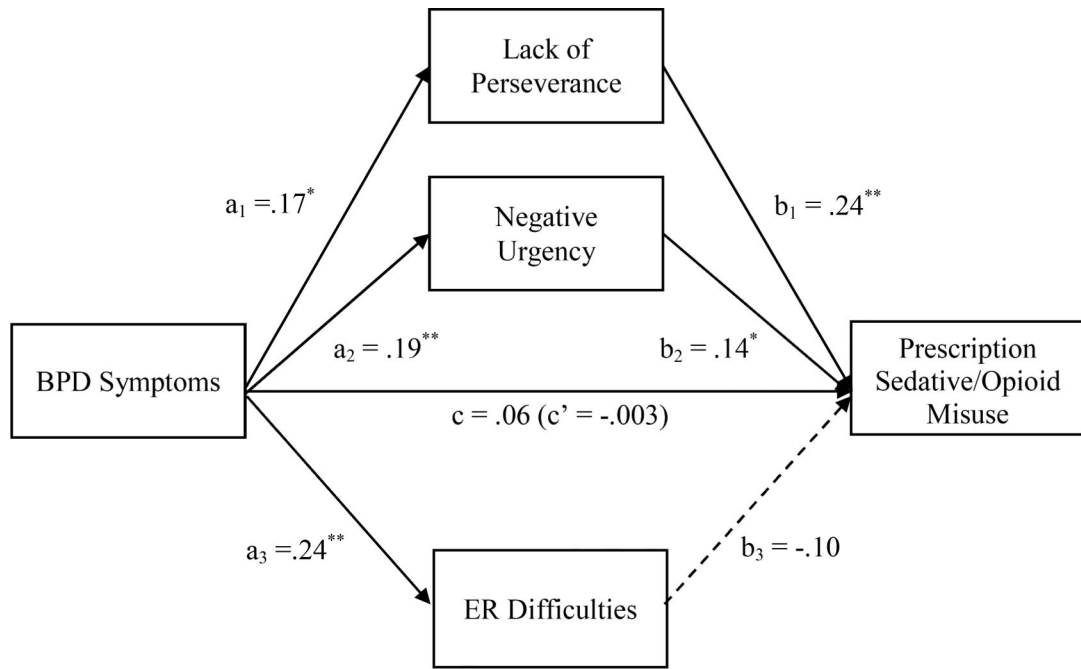


Figure 2. Indirect relationships of BPD symptoms to prescription sedative/opioid misuse through lack of perseverance, negative urgency, and ER difficulties
Note. β values are reported. Age, racial/ethnic background, income, depression symptoms, and anxiety symptoms were included as covariates in the model.
 $**p < .01$, $*p < .05$

Table 1.

Descriptive statistics for and correlations among primary study variables.

	Mean (SD)	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1. BPD	3.74 (2.41)	--	--	--	--	--	--	--	--	--	--
2. DERS	89.93 (24.99)	.34**	--	--	--	--	--	--	--	--	--
3. SS	43.66 (7.34)	.11	.18*	--	--	--	--	--	--	--	--
4. NU	45.21 (6.06)	.28**	.50**	.47**	--	--	--	--	--	--	--
5. PRE	24.73 (5.37)	.09	.26**	.06	.04	--	--	--	--	--	--
6. PER	24.05 (5.15)	.18*	.38*	-.02	.18*	.58**	--	--	--	--	--
7. Sedative	1.73 (1.96)	.14*	.21**	.25**	.25**	.25**	.22**	--	--	--	--
8. Opioid	.29 (1.01)	.19**	.01	.09	-.06	.19**	.09	.18*	--	--	--
9. Rx	2.26 (2.25)	.19*	.16*	.33**	.27**	.24**	.28**	.55**	.31**	--	--
10. Depression	12.28 (11.48)	.22**	.45**	.15*	.30**	.15*	.12	.11	.02	.10	--
11. Anxiety	10.27 (9.97)	.24**	.41**	.12	.34**	.15*	.09	.18**	.07	.18*	.75**

Note. BPD = BPD symptoms, DERS = emotion regulation deficits, SS = sensation seeking subscale of UPPS, NU = negative urgency subscale of UPPS, PRE = lack of premeditation subscale of UPPS, PER = lack of perseverance subscale of UPPS, Sedative = past-year frequency of nonprescription sedative use, Opioid = past-year frequency of nonprescription opioid use, Rx = past-year frequency of prescription sedative/opioid misuse.

** $p < .01$

* $p < .05$

Table 2.

Participant substance use disorder (SUD) diagnoses.

	% Present (n)
Alcohol Use Disorder	67.5% (131)
Cocaine Use Disorder	58.8% (114)
Cannabis Use Disorder	29.4% (57)
Opioid Use Disorder	22.7% (44)
Stimulant Use Disorder	20.6% (40)
Sedative Use Disorder	18.6% (36)
Polydrug Use Disorder	9.3% (18)
Hallucinogen Use Disorder	2.6% (5)
Two or more SUDs	64.4% (125)
Three or more SUDs	36.1% (70)

Note. All diagnoses are current.

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