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Distinct Facets of Impulsivity Exhibit Differential Associations with Substance Use Disorder Treatment Processes: A Cross-Sectional and Prospective Investigation Among Military Veterans

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Abstract

Impulsivity, a multi-faceted construct characterized by rash, unplanned actions and a disregard for long-term consequences, is associated with poor substance use disorder (SUD) treatment outcomes. Little is known though about the influence of impulsivity on treatment process variables critical for initiating and maintaining behavioral change. This knowledge gap is important as different aspects of impulsivity may be susceptible to diverse cognitive, behavioral and pharmacological influences. The present study examined two distinct facets of impulsivity (lack of planning and immoderation - a proxy of urgency) as predictors of processes that impact SUD treatment success (active coping, avoidant coping, self-efficacy, and interpersonal problems). Participants were 200 Veterans who completed impulsivity and treatment process assessments upon entering a SUD treatment program and treatment process assessments at treatment discharge. Results from multivariate models revealed that lack of planning was associated with lower active coping and higher avoidant coping and interpersonal problems at intake, though not with lower self-efficacy to abstain from substances. Immoderation was associated with higher avoidant coping and lower self-efficacy to abstain from substances at intake, but not with lower active coping or higher interpersonal problems. Higher immoderation, but not lack of planning, predicted lower self-efficacy to abstain from substances at treatment discharge. These findings suggest that different facets of impulsivity confer risk for different SUD treatment process indicators and that clinicians should consider the behavioral expression of patients' impulse control problems in treatment planning and delivery.

Keywords

Impulsivity; Substance Use Disorder; Treatment; Executive Functioning; Treatment Processes; Veterans

1. Introduction

Impulsivity, a hallmark and trans-diagnostic feature of many clinical disorders, is a multifaceted construct characterized by rash, poorly conceived and unplanned actions and a disregard for long-term consequences (Dawe & Loxton, 2004; de Wit, 2009; Evenden, 1999). Higher levels of impulsivity tend to signify poor executive functioning and control, which is seated in the prefrontal cortex and broadly implicated in goal-directed behavior and self-regulation (Bickel, Jarmolowicz, Mueller, Gatchalian, & McClure, 2012; Crews & Boettiger, 2009; Lezak, 1995; Miller & Cummings, 2007). There is substantial evidence to suggest that impulsivity is both a determinant and consequence of substance use disorders (SUD; Crews & Boettiger, 2009; Dawe & Loxton, 2004; de Wit, 2009; Verdejo-Garcia, Lawrence & Clark, 2008). In addition, difficulties with aspects of impulsivity such as poor inhibition, decision-making and planning can represent a major obstacle for SUD patients across many aspects of the recovery process (e.g., medication management, treatment adherence, safety planning) and ultimately subvert intentions to achieve and maintain abstinence (Loree, Lundahl, & Ledgerwood, 2014; Stevens et al., 2014). Among clinical samples, impulsivity is associated with factors that can contribute to relapse including craving and SUD severity and is a potential mediator of SUD treatment effectiveness and response (Loree et al., 2014; Stevens et al., 2014). Accordingly, impulsivity is a potentially high-impact target for empirical study and clinical intervention among individuals seeking SUD treatment (Stevens et al., 2014).

Historically, the study of impulsivity has been limited by conceptual obscurity and lack of consistency in defining and assessing the construct (de Wit, 2009; Evenden, 1999; Whiteside & Lynam, 2001). However, there is growing consensus in the literature that various aspects of impulsivity reflect separate underlying processes (Cyders & Smith, 2008; de Wit, 2009). For instance, Whiteside and Lynam (2001) conducted a factor analysis of extant impulsivity measures to clarify inconsistencies in previous research. Results indicated support for four dimensions of personality that are related differentially to impulsive behaviors: (1) Lack of Planning - tendency to engage in immediate action instead of careful thinking and planning; acting on the spur of the moment and disregarding consequences; (2) Urgency – difficulty resisting strong impulses and tendency to act rashly when experiencing negative (i.e., Negative Urgency) or positive (i.e., Positive Urgency) affect, (3) Sensation Seeking – tendency to seek excitement and adventure; (4) Lack of Perseverance – difficulty sustaining attention and staying on task and failure to tolerate boredom. This multi-dimensional conceptualization of impulsivity has been confirmed and validated in several follow-up studies (e.g., Lynam & Miller, 2004; Magid & Colder, 2007; Miller, Flory, Lynam, & Leukefeld, 2003; Whiteside, Lynam, Miller, & Reynolds, 2005). Guided by this newer conceptual model of impulsivity, researchers are finding that different facets of

impulsivity have varying degrees of relatedness to clinically significant addictive behaviors and tendencies (Cyders & Smith, 2008; Dick et al., 2010; Smith et al., 2007).

Identification and study of the distinct processes that underlie the construct of impulsivity is clinically important as these processes likely recruit different brain circuitries and may be susceptible to diverse behavioral, cognitive, and pharmacological influences (Dick et al., 2010; Robbins, 2000; Winstanley, 2007). Indeed, different facets of impulsivity have been shown to relate to different aspects of risky behaviors (Coskunpinar, Dir, & Cyders, 2013; Cyders & Smith, 2008; Dick et al., 2010; Smith et al., 2007), as well as poor substance use treatment outcomes in clinical samples (Loree, Lundahl, & Ledgerwood, 2014; Moeller et al., 2001b; Patkar et al., 2004; Steven et al., 2014; Streeter et al., 2008). For instance, lack of planning, but not urgency, has been associated with alcohol use and drinking to cope in nonclinical samples of college students (Anestis, Selby, & Joiner, 2007; Lynam & Miller, 2004; Miller et al., 2003). In addition, negative urgency has been associated with severity of problems involved in a variety of risk behaviors (i.e., alcohol use, binge-eating, gambling), but has not been an exclusive predictor of frequency of engagement in the behavior (Coskunpinar et al. 2013; Fischer & Smith, 2008; Fischer, Smith, Annus, & Hendricks, 2007; Smith et al., 2007). Further, compared to healthy controls, alcohol abusers demonstrated significantly higher levels of urgency, but not lack of planning (Whiteside & Lynam, 2003). Finally, among a sample of individuals with substance dependence, negative urgency emerged as the strongest predictor (above and beyond lack of planning) of severity of medical, employment, alcohol, drug, family, social, legal and psychiatric problems (Verdejo-García, Bechara, Recknor, & Pérez-García, 2007).

To date, little research has examined the role of impulsivity and its facets on processes that impact SUD treatment success. If different facets of impulsivity confer risk for different SUD treatment process indicators, clinicians might benefit from considering the behavioral expression of patients' impulse control problems in treatment planning and delivery. The primary objective of the current study is to examine the extent to which two distinct facets of impulsivity – lack of planning and immoderation (a proxy of urgency; Johnson, 2014; Whiteside & Lynam, 2001; Whiteside et al., 2005) – explain variance in four key treatment process indicators (active coping, avoidant coping, self-efficacy to abstain from substances, and interpersonal problems) among Veterans in SUD treatment, both cross-sectionally and prospectively. Coping processes, self-efficacy, and interpersonal problems were selected as the target outcomes, given that they have been consistently linked with poor SUD treatment outcomes (Boden et al., 2014; Dumas, Blasey, & Thacker, 2005; Ilgen, McKellar, & Tiet, 2005; Maisto, Connors, & Zywiak, 2000; McKay, Rutherford, Cacciola, Kabasakalian-McKay, & Alterman, 1996; Moggi, Ouimette, Moos, & Finney, 1999). For example, Boden and colleagues (2014) reported that avoidant coping covaried with SUD symptom severity throughout the course of SUD treatment among a sample of military veterans. In addition, these four treatment process indicators have been identified as active ingredients and mechanisms of change in effective treatments for SUD (Moos, 2007a; Moos, 2007b; Witkiewitz, Marlatt, & Walker, 2005).

It is hypothesized that after accounting for covariates, impulsivity will be negatively associated with active coping and self-efficacy and positively associated with avoidant

coping and interpersonal problems both at treatment intake and at discharge. In line with the work of Whiteside and Lynam (2001) and Coskunpinar et al., (2013), we expect that lack of planning and immoderation will have differential relations with outcomes. Specifically, based on past research, lack of planning is hypothesized to demonstrate a negative relationship with active coping and a positive relationship with avoidant coping (Elliot & Thrash, 2002; Gagnon, Daelman, McDuff, & Kocka, 2013) and interpersonal problems (Wright et al., 2012). Indeed, implementation of active coping skills and suppression of avoidant coping tendencies requires forethought, planning and consideration of potential threats that may compromise a relapse prevention plan (e.g., Sharma, Markon, & Clark, 2014). In addition, distress from interpersonal problems is expected to be positively associated with lack of planning as optimization of this treatment process domain requires developing and executing a plan of action to correct and override maladaptive interpersonal tendencies and behavioral scripts. As a proxy of urgency (a tendency to act rashly in the context of intense emotion), immoderation is hypothesized to demonstrate a positive relationship with avoidant coping (Cyders & Smith, 2008) and interpersonal problems (Wright et al., 2012) and a negative relationship with self-efficacy to abstain from substances as these particular struggles are usually encountered in more intense and emotionally-laden contexts (Sharma et al., 2014).

2. Method

2.1. Participants

Participants were 193 male and 7 female military veterans (mean age = 50.14, SD = 9.00; 47% Caucasian; 31% African American; 12% Hispanic; 4% Asian; 6% other) enrolled in residential SUD treatment at the Palo Alto VA Health Care System. Participants received abstinence-based SUD treatment that had a combined Cognitive Behavioral Therapy/ Twelve-Step Facilitation orientation. Veterans in this program were involved in therapeutic activities (individual- and group-based) approximately seven hours per day, five days per week, which included individual case management.

2.2. Procedures

Participants were recruited using fliers and program announcements. Patients expressing interest in the study were contacted by a research assistant via phone to schedule an assessment at treatment entry. Participants completed semi-structured interviews and self-report questionnaires during an in-person assessment session that occurred within the first week of treatment entry. At discharge, participants completed self-report questionnaires focused on the measurement of treatment process indicators (see below). This investigation was approved by the institutional review board at the Stanford University School of Medicine.

2.3. Measures

2.3.1. Covariates: Alcohol and Drug Use Severity and Length of Stay in Treatment—The Addiction Severity Index (ASI; McLellan et al., 1992) is a structured clinical research interview designed for use in SUD treatment-outcome research. The ASI has demonstrated good psychometric properties in residential populations (McLellan et al.,

1992) and was used in the current study to collect demographic information (age, ethnicity) and assess severity of alcohol and drug use. Specifically, the drug and alcohol composite scores of the ASI are derived with complex algorithms (McLellan et al., 1992) and can be used as indices of alcohol and drug use severity in the past 30 days. Composite scores are highly reliable and valid (McLellan et al., 1992) and include questions assessing use of all major classes of drugs of abuse, substance-related problems, and SUD treatment. Composite scores range from 0 to 1, with higher scores indicating greater severity. Length of stay in treatment (i.e., number of days) was determined from patient medical charts.

2.3.2. Impulsivity

2.3.2.1 Lack of Planning: The Control subscale of the Multidimensional Personality Questionnaire (MPQ) – Brief Form (Patrick, Curtin, & Tellegen, 2002), a factor-analytically derived personality measure, was used to measure the lack of planning facet of impulsivity in the present study. The MPQ has excellent psychometric properties and has been used extensively in veteran and other high-risk psychiatric populations (DiLalla, Gottesman, Carey, & Vogler, 1993; Miller et al., 2003; Tellegen & Waller, 2008). Individuals who score high on the Control subscale tend to describe themselves as reflective, cautious, careful, plodding, rational, sensible, level-headed, and preferring to plan activities in detail (Tellegen & Waller, 2008). The subscale is comprised of 12 True/False items (e.g., “I almost never do anything reckless,” “I often act on the spur of the moment,” “When faced with a decision I usually take time to consider and weigh all possibilities”). The MPQ yields norms based on studies conducted with three mixed-gender community samples (see Patrick et al., 2002). Responses are summed and converted into T-scores that can range from 22–66, with a mean of 50 and a standard deviation of 10. In a comprehensive factor analysis of extant impulsivity measures (Whiteside & Lynam, 2001), the MPQ Control subscale loaded strongly on the lack of planning dimension (Whiteside & Lynam, 2001), which tends to involve low conscientiousness rather than emotion (Cyders & Smith, 2008). Thus, the MPQ Control subscale is considered a valid index of the lack of planning facet of impulsivity. To facilitate interpretation of results, the MPQ Control subscale was reverse scored so that higher scores indicated higher impulsivity.

2.3.2.2. Immoderation: The 4-item Immoderation subscale of the International Personality Item Pool–NEO-120 (IPIP-NEO-120; Johnson, 2014) was used as a proxy of the urgency facet of impulsivity. Individuals use a 5-point Likert-scale to rate how well items (e.g., “go on binges,” “rarely overindulge,” “easily resist temptations,” “am able to control my cravings”) describe how they generally tend to be (1 = “very inaccurate”, 5 = “Very accurate”). High scorers on this scale tend to feel strong cravings and urges, which they experience difficulty resisting and tend to be oriented toward short-term pleasures and rewards rather than long-term consequences. In contrast, low scorers on this subscale do not experience strong, irresistible cravings and consequently do not find themselves tempted to overindulge. The Immoderation subscale of the IPIP-NEO-120 is correlated at .65 with the impulsivity facet of the NEO-PI-R (Johnson, 2014) – a key personality-based indicator of urgency. Thus, the IPIP-NEO-120 Immoderation subscale may be considered a proxy of the urgency facet of impulsivity.

2.3.3. Treatment Process Indicators

2.3.3.1. Active and Avoidant Coping—The Brief Coping Orientations to Problems Experienced inventory (Brief-COPE; Carver, 1997; Carver, Scheier, & Weintraub, 1989) is a 24-item measure of the typical strategies that individuals use to respond to stress. The measure assesses use of adaptive strategies that are active- and problem-focused (e.g., active coping), as well as maladaptive strategies marked by avoidance (e.g., behavioral disengagement, denial). For each item, respondents are asked to indicate how frequently they use a particular type of coping style when they experience stressful events, using a 4-point Likert scale (1 = “I haven’t been doing this at all”; 4 = “I’ve been doing this a lot”). The Brief-COPE includes 12 subscales each comprised of two items (self-distraction, active coping, denial, substance use, emotional support, behavioral disengagement, positive reframing, planning, venting, acceptance, humor, religion). Two factors, active and avoidant coping, were derived from the Brief-COPE as described by Boden, Bonn-Miller, Vujanovic, and Drescher (2012) and these factors are commonly used in the coping literature (Litman, 2006). The active coping sub-scale was derived from the mean of 12 items from the active coping, positive reframing, planning, acceptance, religion, and emotional support subscales, and the avoidant coping subscale was derived from the mean of 6 items from the denial, behavioral disengagement, and substance use subscales.

2.3.3.2. Self-efficacy—The Situational Confidence Scale (SCQ; Annis & Davis, 1988; Miller, Ross, Emmerson, & Todt, 1989) assesses an individual’s perceived self-efficacy surrounding their ability to control and abstain from substance use across a variety of tempting situations. Fourteen items were adapted from the SCQ, which represented seven different types of situations (Negative Emotional States, Negative Physical States, Positive Emotional States, Testing Personal Control, Urges and Temptations, Interpersonal Conflict, and Social Pressure). For each item, the participant is asked to indicate what percentage of confidence they have that they could maintain abstinence in that situation. Items are rated on a 6-point scale (0% = not at all confident; 100% = very confident). The percentages are summed and divided by 14 to obtain a mean level of self-efficacy.

2.3.3.3. Interpersonal Problems—The Interpersonal Inventory of Problems (IIP; Alden, Wiggins, & Pincus, 1990) includes 64 items that measure distress due to interpersonal problems. Participants use a 5-point rating scale (0 = “not at all”, 4 = “Extremely”) to respond to items asking how distressed they are by a variety of interpersonal problems. The eight, 8-item subscales of the IIP (Domineering, Vindictive, Cold, Socially Avoidant, Nonassertive, Exploitable, Overly-Nurturant, Intrusive) are summed to yield a total interpersonal problem composite score, often referred to as ‘elevation’ (e.g., Tracey, Rounds, & Gurtman, 1996). Internal consistency for the 8 octant scales ranged from .74 to .88 at intake and .72 to .88 at discharge. The IIP has shown excellent psychometric properties in terms of reliability (Horowitz, Alden, Wiggins, & Pincus, 2000) and construct validation (e.g., prediction of patient and therapist ratings of therapeutic alliance and treatment outcomes; Gurtman, 1996; Muran, Segal, Samstag, & Crawford, 1994).

2.4. Data Analyses

Descriptive statistics and alpha reliability coefficients were calculated for each measure. ASI alcohol and drug composite scores were positively skewed and thus, were log transformed prior to statistical analysis (skewness and kurtosis between -1 and 1). Discharge assessments were conducted with 136 participants (68%). T-tests revealed that participants who did not return for the discharge assessment did not differ significantly from those who did return on any predictors (impulsivity facets, ASI alcohol and drug composite scores) at treatment intake. Zero-order correlations were conducted to assess relations between the primary predictors at treatment intake, which included two different facets of impulsivity (lack of planning - MPQ Control subscale; immoderation - IPIP-NEO Immoderation subscale) and covariates of alcohol and drug use severity (ASI composite scores) and length of stay in treatment (days), and the primary outcomes, which included treatment process indicators at treatment intake and discharge (active coping and avoidant coping [Brief-Cope], self-efficacy [SCQ] and interpersonal problems [IIP]).

2.4.1. Hierarchical Multiple Regression (HMR)—Eight HMR models were tested to determine the extent to which the two distinct facets of impulsivity (lack of planning, immoderation) and covariates explained variance in treatment process indicators both cross-sectionally and prospectively. All continuous variables were standardized prior to entry (Cohen, Cohen, West, & Aiken, 2003). Drug use severity was trimmed from the model because it was not associated with outcomes at intake or discharge in any of the multivariate models. Active coping, avoidant coping, self-efficacy, and interpersonal problems at intake and discharge were entered separately as the dependent variable in each model. Alcohol use severity was entered on Step 1 and the two facets of impulsivity were entered on Step 2. For the four models in which the treatment process indicators at discharge served as the dependent variable, levels of these outcome variables at treatment intake, along with alcohol use severity and length of stay (days) in treatment, were entered as covariates in Step 1 of the model. The two impulsivity variables at treatment intake were entered on Step 2.

3. Results

Descriptive statistics for all study variables and estimates of internal consistency for measures are presented in Table 1. Patients remained in treatment for an average of over three months, and scores on the treatment process indicators appeared to improve from intake to discharge (i.e., lower clinical severity). The sample demonstrated average T-scores for the MPQ Control subscale well below the mean of 50 indicating that they were more impulsive relative to the general population. In terms of substance use, 64% and 65% of patients reported past-30 day abstinence from alcohol and other drugs at treatment intake, respectively.

3.1 Zero-order associations between covariates, impulsivity and treatment process indicators

3.1.1. Intake—Pearson product-moment correlations revealed that alcohol use severity was positively correlated with drug use severity, immoderation, and avoidant coping, and was negatively associated with self-efficacy to abstain from substances. Drug use severity was

positively correlated with lack of planning and interpersonal problems. The two facets of impulsivity, lack of planning and immoderation, were moderately and positively correlated with each other ($r = .34$). Both lack of planning and immoderation were positively correlated with avoidant coping and interpersonal problems and negatively correlated with active coping and self-efficacy to abstain from substances.

3.1.2. Discharge—Higher alcohol use severity at intake and shorter length of stay in treatment was associated with more avoidant coping at discharge. Lack of planning at intake was positively correlated with avoidant coping and interpersonal problems and was negatively correlated with active coping at discharge. Immoderation at intake was positively associated with avoidant coping and interpersonal problems and negatively correlated with self-efficacy to abstain from substances at discharge. Please see Table 2 for details.

3.2 Hierarchical Multiple Regression (HMR)

Eight independent HMR analyses were conducted to examine primary hypotheses. At intake, greater alcohol use severity was associated with higher avoidant coping ($\beta = .15, p < .05$) and lower self-efficacy to abstain from substances ($\beta = -.26, p < .01$). After accounting for alcohol use severity at intake, higher scores on the lack of planning facet were associated with lower active coping ($\beta = -.41, p < .01$) and higher avoidant coping ($\beta = .31, p < .01$) and interpersonal problems ($\beta = .47, p < .01$) at intake, though not with lower self-efficacy to abstain from substances. Higher scores on the immoderation facet were associated with higher avoidant coping ($\beta = .23, p < .01$) and lower self-efficacy to abstain from substances ($\beta = -.25, p < .01$) at intake, but not with lower active coping or higher interpersonal problems. After controlling for intake levels of treatment process indicators, length of stay in treatment, and alcohol use severity at intake, higher scores on the immoderation facet, but not lack of planning facet, predicted lower self-efficacy to abstain from substances ($\beta = -.20, p < .05$) at treatment discharge. In addition, alcohol use severity at intake predicted lower active coping at treatment discharge ($\beta = -.18, p < .05$). For details, please see Table 3.

4. Discussion

The aim of the present study was to examine the extent to which two distinct facets of impulsivity were associated with key treatment process indicators (active coping, avoidant coping, self-efficacy, and interpersonal problems) among military veterans at SUD treatment intake and discharge. Consistent with hypotheses, at treatment intake, lack of planning was associated with higher avoidance coping and interpersonal problems and lower active coping, but not with self-efficacy to abstain from substance use. Immoderation (a proxy for the urgency facet from the impulsivity literature) was associated with higher avoidant coping and lower self-efficacy to abstain from substances in tempting situations; however, it was not associated with active coping or interpersonal problems. At treatment discharge, immoderation, but not lack of planning, predicted lower self-efficacy to abstain from substance use. This profile of relations highlights that examination of different structural components of impulsivity within a treatment context can help refine theory and promote advances in clinical prediction (Verdejo-Garcia et al., 2007). Specifically, the current

findings suggest that addressing immoderation and lack of planning may optimize different treatment processes that can influence recovery outcomes. In addition, the majority of participants reported past-month abstinence from alcohol and drugs at intake demonstrating that impulsivity can help explain unique variance in treatment process indicators in the absence of active substance use.

Results indicate that in our sample, impulsivity appeared to hold more relevance for treatment process indicators upon treatment intake rather than after treatment. This may be due to the fact that the impulsivity and treatment process variables were measured concurrently at intake. An alternative and plausible interpretation is that impulsive patients may enter treatment with suppressed coping skills and greater interpersonal problems, and interventions should focus on improving these markers in patients with higher levels of impulsivity. Of note, our proxy for urgency (immoderation) predicted confidence to remain abstinent in tempting situations at treatment discharge. This finding is in line with previous research showing that emotional lability and impulsivity synergistically function to increase the risk for substance abuse and related problems (Simons, Carey, & Gaher, 2004; Simons, Oliver, Gaher, Ebel, & Brummels, 2005). In addition, the role of [negative] urgency is well-reflected in predominant models of addiction that emphasize negative reinforcement and the allostatic cycle whereby users shift from engaging in reward-seeking behavior to predominately avoiding negative, aversive states (Everitt & Robbins, 2005; Koob & Le Moal, 2001).

Results were predominantly consistent with hypotheses. However, we expected that both immoderation and lack of planning would be linked to interpersonal problems, given past research indicating an association between impulsivity and interpersonal problems (Wright et al., 2012), and because in higher-order factor models of personality, traits akin to both immoderation (e.g., high neuroticism) and lack of planning (e.g., low conscientiousness) load together with traits related to interpersonal problems (e.g., low agreeableness; see Digman, 1997; Markon, Krueger, & Watson, 2005). In our sample, a significant link emerged only between lack of planning and interpersonal problems. This finding may indicate that lack of planning is experienced as a more frustrating quality than immoderation by others, and/or may speak to the incremental distress associated with lack of planning among individuals already high in impulsivity and interpersonal problems. In addition, lack of planning was negatively associated with active coping, but no such association emerged with immoderation. Active coping strategies often require thoughtful planning, and thus individuals with poor planning skills may tend to deal with negative emotions by avoiding, for instance, social experiences. However, if avoided impulsively, others may view these individuals as unreliable and perhaps passive-aggressive, thus maintaining the cycle between poor active coping, lack of planning, and interpersonal problems.

Finally, immoderation, but not lack of planning, was negatively associated with self-efficacy. As measured in this study, self-efficacy entails the ability to control and abstain from substance use in a variety of situations including positive and negative emotional states. In contrast to lack of planning, proxies of urgency (such as immoderation) are marked by difficulty in controlling one's impulses during periods of emotional arousal. Although it is not a direct index of urgency per se, the immoderation scale used here is highly correlated

with a key personality correlate of urgency (i.e., the impulsivity facet of the NEO-PI-R; Johnson, 2014) that indexes problems resisting urges when faced with negative affect. This notwithstanding, it must be acknowledged that the immoderation scale used here is not fully isomorphic with the construct of urgency as conceptualized in the impulsivity literature.

4.1 Implications for SUD treatment

The current findings hold a number of important implications for SUD treatment. With regard to immoderation, when individuals react rashly in the face of distress, they ostensibly miss important opportunities to employ and practice new coping skills. As such, strategies to increase patient's cognitive and emotional bandwidth in affectively-intense situations could render a significant positive impact on functioning and recovery (e.g., reducing drive to automatically react to trained cues). For instance, several elements of Dialectical Behavior Therapy would be appropriate including skill building in interpersonal effectiveness, distress tolerance, mindfulness and emotion regulation (Linehan, 1993).

A number of clinical strategies may also be effective in addressing lack of planning and helping patients to re-appraise the expected value of immediate gratification. These include engaging in episodic future thinking (Bickel, Quisenberry, Moody & Wilson, 2014), voucher-based contingency management (e.g., Bickel et al., 2010; Heinz, Lilje, Kassel, & de Wit, 2013), relapse prevention and safety planning (Marlatt & Donovan, 2005), and motivational interviewing whereby patients identify alternative options with better long-term consequences and build self-efficacy to change behavior (Miller & Rollnick, 2002). Results of our study also suggest that lack of planning may be linked to problems in relationships. Such a pattern could interfere with interpersonally-oriented treatment processes such as client-therapist alliance (Muran et al., 1994); however, if therapists attend to this aspect of their client's personality and are able to assist clients in their ability to plan, alliance and treatment outcomes may improve more broadly. These implications aside, the most consistent findings in this study were from cross-sectional correlations. Consequently, the extent to which impulsivity has a causal impact on the treatment process indicators (and vice versa) requires further study before determining which constructs should be viewed as the key "mechanisms" to be targeted in treatment.

Finally, impulsivity is considered a clinical manifestation of poor executive functioning and control (Bickel et al., 2012). Indeed, executive functions help pump the breaks (i.e., red-light) on impulsive, reward-driven behavior and serve as a steering wheel to change course towards actions with better long-term consequences. Lower executive functioning, as indexed by neuropsychological measures, has been associated with a host of negative treatment process outcomes among individuals with SUD. These include, but are not limited to, higher levels of emotional distress (Johnson-Greene, Adams, Gilman, & Junck, 2002), lower self-efficacy for negotiating high-risk drinking situations (Blume & Marlatt, 2009; Morgenstern & Bates, 1999), poorer coping skills (Kiluk, Nich, & Carroll, 2011; Tapert, Ozyurt, Myers, & Brown, 2004), and greater addiction denial (Rinn, Desai, Rosenblatt, & Gastfriend, 2002) - all of which are critical factors involved in the initiation and maintenance of behavioral change. Accordingly, cognitive training interventions to remediate and strengthen disrupted executive functions may offer a high-yield adjunctive

treatment approach among individuals with SUD (Bates, Buckman, & Nguyen, 2013; Bickel et al., 2014; Vinogradov, Fisher, & de Villers-Sidani, 2012).

4.2 Limitations and Future Directions

Despite several strengths, including a clinically and theoretically-informed multivariate model and a prospective design, limitations of the current study should be mentioned. First, the current study employed a sample of patients in residential treatment, which may limit generalizability of findings to patients seeking treatment in outpatient settings. Residential SUD programs were chosen because they entail extensive patient-staff and patient-patient interactions in which associations between personality (i.e., impulsivity facets) and interpersonally-related treatment processes are likely to be expressed. Second, impulsivity was limited to self-report, and individuals with higher levels of impulsivity may have less insight and may give less consideration to their responses. However, self-report measures may be more apt to capture the social implications of impulsivity that objective neuropsychological measures cannot (Moeller, Barratt, Dougherty, Schmitz, & Swann, 2001a). Third, internal consistency for the Immoderation subscale was modest and may be a function of the small number of items that comprised the subscale. Fourth, underrepresentation of women in the current study, while typical for military veteran samples, precluded our ability to examine potential sex differences concerning the relation between impulsivity and treatment process indicators. Given that men are overrepresented in the expression of impulsive behaviors and tend to score higher than women across various aspects of impulsivity (Cross, Copping, & Campbell, 2011), valuable information could be yielded from determining how impulsivity affects treatment processes among women and among non-veteran clinical samples.

Study results highlight several fruitful areas for future research. First, impulsivity is a multidimensional construct that includes other facets, which were not measured among participants in the current study. Although lack of planning and urgency are two of the most common conceptualizations of impulsivity in the literature (Whiteside and Lynam, 2001), it is critical to determine the extent to which other facets (e.g., sensation seeking, lack of perseverance, positive urgency) impact these treatment process indicators. For instance, one might hypothesize that lack of perseverance, the tendency not to finish tasks, would predict lower self-efficacy to abstain from substances. Second, maladaptive personality characteristics (i.e., impulsivity) can influence not only individuals who possess them, but also those with whom they interact. Indeed, traits related to disinhibition and impulsivity are commonly experienced as aversive in close relationships (Williams, Thomas, Donnellan, & Hopwood, 2014). Elevated levels of impulsivity can complicate treatment not only by making it difficult for individuals to plan for treatment and tolerate the distress involved in making changes, but also because such behaviors may frustrate the group members and treatment providers who are trying to help them. Accordingly, future research should continue to examine how aspects of impulsivity impact interpersonal effectiveness in treatment settings. Finally, impulsivity can be assessed using a multi-modal approach including computerized behavioral tasks and observer-reports (e.g., Aragues, Jurado, Quinto, & Rubio, 2011), in addition to self-report. Given that correlations between self-report and behavioral measures of impulsivity tend to be small (Cyders & Coskunpinar,

2011), investigation of how different measurement modalities relate to outcomes of interest would help advance clinical science (Sharma et al., 2014).

In conclusion, the current findings represent a novel contribution to the SUD treatment literature as no previous studies have examined how different facets of impulsivity impact a variety of critical treatment process outcomes. In addition, findings hold direct implications for clinicians and researchers to reduce the negative impact of impulsivity on SUD treatment. Specifically, more formalized assessment of impulsivity could help inform case conceptualization and treatment planning with recommendations and behavioral exercises that target maladaptive impulsive tendencies and foster improvements in self-control (e.g., Inzlicht, Legault, & Temper, 2014). Finally, assessment of impulsivity in combination with other risk-factors, may help identify individuals at high-risk for poor treatment response, and ultimately chronic relapse, who may benefit from these adjunctive treatment approaches (Stevens et al., 2014).

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Table 1

Descriptive statistics for substance use severity, impulsivity, and treatment process indicators at treatment intake and discharge.

	M(SD)	n	Alpha (α)
Treatment Intake			
Alcohol Use Severity	.19 (.21)	200	
Drug Use Severity	.08 (.08)	200	
Lack of Planning*	43.34 (10.45)	200	.78
Immoderation	3.51 (.85)	199	.62
Active Coping	2.60 (.56)	197	.83
Avoidant Coping	2.47 (.61)	198	.68
Self-Efficacy	4.49 (1.28)	195	.96
Interpersonal Problems	83.00 (34.68)	200	.94
Treatment Discharge			
Length of Stay in Treatment (Days)	109.27 (64.00)	200	
Active Coping	2.82 (.56)	135	.84
Avoidant Coping	1.70 (.62)	136	.74
Self-Efficacy	5.24 (.80)	136	.93
Interpersonal Problems	71.73 (38.47)	130	.96

* indicates standardized T-score (lower scores indicate higher impulsivity).

Table 2

Correlations between predictors and covariates at treatment intake and treatment process indicators at intake and discharge.

	1	2	3	4	5	6	7	8	9	10	11	12
1. Alcohol Use Severity	-											
2. Drug Use Severity	.16*	-										
3. Length of Stay in Treatment	-.10	-.11	-									
4. Lack of Planning	-.02	.18*	.00	-								
5. Immoderation	.19**	.12	-.13	.34**	-							
6. Active Coping	.06	.01	.03	-.45**	-.24**	-						
7. Avoidant Coping	.19**	.11	-.01	.39**	.37**	-.27**	-					
8. Self-Efficacy	-.31**	-.10	.01	-.15*	-.33**	.24**	-.23**	-				
9. Interpersonal Problems	.06	.16*	-.06	.49**	.22**	-.40**	.44**	-.24**	-			
10. Active Coping Discharge	-.14,	.00	-.03	-.25**	-.13	.43**	-.16	.06	-.30**	-		
11. Avoidant Coping Discharge	.21*	-.01	-.22**	.21*	.27**	-.10	.33**	-.11	.18*	-.35**	-	
12. Self-Efficacy Discharge	-.12	-.01	.07	-.15	-.28**	.08	-.26**	.18*	-.25**	.25**	-.49**	-
13. Interpersonal Problems Discharge	.08	.10	-.14	.33**	.18*	-.33**	.31**	-.10	.65**	-.35**	.35**	-.27**

Note.

**
 $p < .01$;*
 $p < .05$.

N = 192–200 at treatment intake; N = 129–136 at discharge.

Table 3

Results from hierarchical multiple regression analyses with treatment process indicators at treatment intake and discharge.

Intake	Predictor Variables	Active Coping			Avoidant Coping			Self-Efficacy			Interpersonal Problems		
		β	R^2	R^2	β	R^2	R^2	β	R^2	R^2	β	R^2	R^2
Step 1			.00			.04			.10			.00	
	Alcohol Use Severity	.06			.19**			-.31**			.07		
Step 2			.21	.21**		.23	.20**		.17	.08**		.24	.24**
	Alcohol Use Severity	0.07			.15*			-.26**			0.07		
	Lack of Planning	-.41**			.31**			-0.07			.47**		
	Immoderation	-0.11			.23**			-.25**			0.04		
Discharge													
Discharge	Predictor Variables	Active Coping			Avoidant Coping			Self-Efficacy			Interpersonal Problems		
		β	R^2	R^2	β	R^2	R^2	β	R^2	R^2	β	R^2	R^2
Step 1			.22			.19			.03			.44	
	Outcome Variable Intake	.45**			.31**			0.12			.64**		
	Length of Stay	-0.05			-.23**			0.08			-0.11		
	Alcohol Use Severity	-0.01			0.15			-0.07			0.08		
Step 2			.22	.01		.20	.02		.08	.05*		.44	.00
	Outcome Variable Intake	.42**			.25**			0.05			.65**		
	Length of Stay	-0.04			-0.01			0.03			-0.11		
	Alcohol Use Severity	-0.18*			0.15			-0.07			0.08		
	Lack of Planning	-0.08			0.10			-0.10			-0.02		
	Immoderation	0.05			0.07			-.20*			.00		

**
p .01;

*
p < .05;

n = 194–199 at treatment intake; n = 129–133 at treatment discharge. Across all models, predictor variables in Steps 1 and 2 were assessed at intake.