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Assessing impulsivity: Relationships between behavioral and self-report measures in individuals with and without self-reported ADHD

Wesley R. Barnhart, Melissa T. Buelow *

The Ohio State University Newark, USA

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ABSTRACT

The present study examined relationships between self-report and behavioral measures of impulsivity, a personality characteristic linked to diagnostic criteria for multiple psychological disorders, in individuals who either self-reported ($n = 28$) or did not self-report ($n = 147$) a history of Attention-Deficit/Hyperactivity Disorder (ADHD) diagnosis. Undergraduate student participants completed several self-report measures of impulsivity (Barratt Impulsiveness Scale, Impulsive Sensation Seeking subscale, BIS/BAS Scale, Conner's Adult ADHD Rating Scale, and Frontal Systems Behavior Rating Scale) and three behavioral measures of impulsivity (Balloon Analogue Risk Task, Delay Discounting Task, Stroop). A principal components analysis indicated three components encompassing attentional impulsiveness, reward sensitivity, and behavioral and motor impulsiveness; however, none of the behavioral measures factored with the self-report measures. Logistic regressions found attentional impulsiveness to distinguish between individuals with and without a self-reported history of ADHD diagnosis. Impulsivity is a multi-faceted construct, and the utilization of multiple measures, both self-report and behavioral, can aid to more fully and accurately assess the construct in both research and clinical settings.

1. Introduction

1.1. Background

Impulsivity is a widely-used term that is often associated with increased involvement in health-risk behaviors including various addictions (Brown, Benoit, Juhas, Lebel, et al., 2015; Cyders et al., 2007; Mishra & Lalumiere, 2011). Additionally, impulsivity is included in the diagnostic criteria for a number of psychological disorders, including borderline personality disorder, attention-deficit/hyperactivity disorder (ADHD), bipolar disorder, and the impulse control disorders (Evenden, 1999; Seidl, Pastorek, Troyanskaya, & Scheibel, 2015; Smith et al., 2007). Higher rates of impulsivity are even seen in individuals with bipolar disorder who are in a euthymic state, but with variability seen across self-report and behavioral measures of impulsivity (Lijffijt, Lane, Moeller, Steinberg, & Swann, 2015). Accurate assessment of impulsivity is crucial for clinicians, as information from self-report and/or behavioral measures can aid in the diagnostic and treatment processes. The present study sought to examine relationships between self-report and behavioral measures of impulsivity in individuals with and without a self-reported history of ADHD diagnosis.

Although no universally-accepted definition exists, there are commonalities among current definitions of impulsivity. Some components include: early/anticipatory responding, inattention, hyperactivity, discounting of future (delayed) rewards, disinhibition, failure to consider alternatives before acting, inhibitory control, non-planning, reward sensitivity, risk taking, and sensation seeking (Bechara, Damasio, Damasio, & Anderson, 1994; Cloninger, Svrakic, & Przybeck, 1993; Dalley, Everitt, & Robbins, 2015; Dawe, Gullo, & Loxton, 2004; Depue & Collins, 1999; Winstanley, Eagle, & Robbins, 2006). Impulsivity can be thought of as a failure to plan ahead, including both acting without thinking and failure to show constraint (Bechara, et al., 1994; Duckworth & Kern, 2011; Tellegen, 1982; Zuckerman, Kuhlman, Joireman, Teta, & Kraft, 1993). Additionally, impulsivity can include choices of smaller, more immediate rewards over larger but distant rewards, reflecting an inability to inhibit behaviors that may—in the long run—hold negative consequences (Fino, Melogno, Iliceto, D'Aliesio, et al., 2014; Gullo & Potenza, 2014; Horn, Dolan, Elliott, Deakin, & Woodruff, 2003).

Research investigating relationships between different measures of impulsivity has been mixed. Significant (Hamilton, Sinha, & Potenza, 2014; Leshem & Glicksohn, 2012; Meule, 2013) and non-significant correlations (Fino et al., 2014; Meda et al., 2009) were found among self-report measures. Self-report and behavioral measures may represent different components of impulsivity, as evidenced by limited relationships among measures (Cyders & Coskunpinar, 2012; Dally, 2011; Hopko, Lejuez, Daughters, Aklin, et al., 2006; Horn et al., 2003; Kraplin

* Corresponding author at: Department of Psychology, The Ohio State University Newark, 1179 University Drive, Newark, Ohio, USA, 43055.
E-mail address: buelow.11@osu.edu (M.T. Buelow).

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et al., 2014; Reynolds, Ortengren, Richards, & de Wit, 2006; Reynolds, Penfold, & Patak, 2008). However, correlations between self-report and behavioral measures of impulsivity have been found in several studies (Bayard, Raffard, & Gely-Nargeot, 2011; Buelow & Suhr, 2013; Cheung, Mitsis, & Halperin, 2004; Keilp, Sackeim, & Mann, 2005).

Recent factor and meta-analyses support a multidimensional approach to impulsivity, with the exact number of factors depending on the number of measures included. For example, Sharma, Kohl, Morgan, and Clark (2013) reported a 3-factor structure based on self-report measures of impulsivity: behavioral dyscontrol, distractibility/urgency, and sensation seeking. In a follow-up study, Sharma, Markon, and Clark (2014) found a 3-factor structure, again based on self-report measures of impulsivity that included extraversion/positive emotionality, disinhibition versus constraint, and neuroticism/negative emotionality. As a secondary component of this study, few correlations were found between behavioral and self-report measures. Smith et al. (2007) found a 4-factor model of impulsivity, including urgency, sensation seeking, lack of planning, and lack of persistence. Finally, a recent meta-analysis (Duckworth & Kern, 2011) found relationships between self-report and some behavioral measures of impulsivity (Balloon Analogue Risk Task [BART], Lejuez, Read, Kahler, Richards, et al., 2002; Delay Discounting Task [DDT], Kirby, Petry, & Bickel, 1999). These inconsistent findings led to speculation that self-report measures may assess stable, underlying personality traits of impulsivity, whereas behavioral measures may be more state-dependent and transient, with performance varying depending on the current situation (Cyders & Coskunpinar, 2012; Meule, 2013).

Much of the research to date has focused on self-report measures such as the Barratt Impulsiveness Scale (BIS-11; Patton, Stanford, & Barratt, 1995) and the UPPS Impulsive Behavior Scale (UPPS; Whiteside & Lynam, 2001). However, the Conner's Adult ADHD Rating Scale (CAARS; Conners, Erhardt, & Sparrow, 1998) and Frontal Systems Behavior Rating Scale (FrSBe; Grace & Malloy, 2001), self-report measures of impulsivity and disinhibition, respectively, are commonly used as part of the diagnostic process. To date, only the FrSBe has been examined in conjunction with the BIS-11 (LoBue, Cullum, Braud, Walker, et al., 2014; Lyvers, Duff, Basch, & Edwards, 2012), leaving correlations between the CAARS and other self-report measures, as well as between the CAARS and FrSBe, unknown. The utilization of multiple measurements, such as multiple self-report or behavioral measures of impulsivity, allows for a more nuanced assessment of a construct. Knowledge of relationships among these and other measures of impulsivity will inform future clinical and experimental research, as it would allow for more accurate assessment of the construct across different clinical populations.

1.2. Objectives and hypotheses

The present study sought to examine relationships between self-report and behavioral measures of impulsivity. Two groups were compared: individuals self-reporting a history of ADHD diagnosis and individuals self-reporting no history of ADHD diagnosis. We first examined relationships between self-report and behavioral measures of impulsivity with a principal components analysis (PCA). We hypothesized a multi-component solution, given previous research suggesting a 3- or 4-factor solution depending on the number of measures examined (Duckworth & Kern, 2011; Sharma et al., 2013, 2014; Smith et al., 2007). We also hypothesized that, in general, self-report and behavioral measures would load on different components given previous research showing little overlap between measures (e.g., Cyders & Coskunpinar, 2012; Hopko et al., 2006; Horn et al., 2003; Kraplin et al., 2014; Reynolds et al., 2006, 2008). Next, we utilized a logistic regression to predict group assignment (self-report/no self-report of ADHD diagnosis) based on the components derived from the PCA. We hypothesized that those measures assessing attentional impulsivity, one of the diagnostic criteria for ADHD, would predict group assignment.

2. Methods

2.1. Participants

The university's Institutional Review Board approved the study. We utilized a convenience sample of 195 undergraduates who received partial course credit. Twenty participants were removed from analyses due to self-report of a psychiatric disorder other than ADHD. Analyses were conducted on the final sample of 175 participants (95 females, 78.9% Caucasian, $M_{age} = 19.06$, $SD_{age} = 1.72$). Twenty-eight participants (12 females) self-reported a previous diagnosis of ADHD (median age = 13) by a physician/psychiatrist ($n = 20$) or psychologist ($n = 8$). Current prescription use included Adderall ($n = 16$), Concerta ($n = 10$), and Ritalin ($n = 7$). There were no differences in gender ratio between the two subgroups, $\chi^2(1,N = 175) = 1.75$, $p = 0.19$. Some participants were included in a previous analysis of risky decision making (BLINDED).

2.2. Procedure and measures

All participants provided written informed consent. Data were compiled from other studies of personality and decision making in our lab. The BIS-11 (Patton et al., 1995), Behavioral Inhibition/Behavioral Approach System scale (BIS/BAS; Carver & White, 1994), CAARS (Conners et al., 1998), FrSBe (Grace & Malloy, 2001), Impulsive Sensation Seeking subscale (ImpSS; Zuckerman et al., 1993), BART (Lejuez et al., 2002), DDT (Kirby et al., 1999), and Stroop Color Word Interference Task (Golden, 1978) were administered. Participants completed all tasks, except the BART, in a random order before being debriefed. The BART was always conducted last due to the nature of the overall study assessing correlates of decision making processes.

2.2.1. Self-report measures

The BIS-11 considers impulsivity as a multifaceted construct, encompassing both first- and second-order factors (Patton et al., 1995). The present analyses focused on the second-order factors (αs = 0.61–0.69; attentional [AI]: $M = 17.85$, $SD = 3.61$; motor [MI]: $M = 22.83$, $SD = 4.61$; nonplanning [NPI]: $M = 25.34$, $SD = 4.48$). The BIS/BAS assesses two behavioral systems: high BIS is associated with risk-avoidant behavior in response to threat while high BAS is associated with approach behaviors in response to signals of reward (Carver & White, 1994). Scores were calculated for BIS ($M = 20.09$, $SD = 4.09$) and the BAS subscales (drive: $M = 10.98$, $SD = 2.85$; fun seeking: $M = 12.01$, $SD = 2.54$; reward responsiveness: $M = 17.27$, $SD = 2.89$; αs = 0.71–0.80). The 19-item ImpSS examines impulsivity ($M = 2.92$, $SD = 2.45$) and sensation seeking ($M = 6.26$, $SD = 2.83$) separately (αs = 0.75–0.80; Zuckerman et al., 1993). The 66-item CAARS assesses the presence and severity of ADHD symptoms in adulthood (Conners et al., 1998). Only the Impulsivity/Emotional Lability (Scale C; $M = 11.14$, $SD = 6.52$) and Diagnostic and Statistical Manual-IV Hyperactivity/Impulsivity (Scale F; $M = 9.45$, $SD = 4.84$) scores were calculated (αs = 0.80–0.86). The 46-item FrSBe (Grace & Malloy, 2001) was administered, and scores were only calculated for the disinhibition subscale ($\alpha = 0.68$; $M = 39.66$, $SD = 7.17$). The UPPS Impulsive Behavior Scale (UPPS; Whiteside & Lynam, 2001) was also administered; however, it was removed from further analyses due to low internal consistency (αs = 0.16–0.35).

2.2.2. Behavioral measures

The BART assesses real-world risk-taking behaviors by having participants pump up 30 balloons, one at a time, earning money for each pump (Lejuez et al., 2002). However, balloons may pop at any time, and accumulated money will be lost unless it is banked. Each pump shows both increased reward (money) and increased risk (balloon popping; Lejuez et al., 2002), with risk-taking evidenced by a higher average number of pumps per balloon on only the unexploded balloons ($M =$