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# Self-reported attentional and motor impulsivity are related to age at first methamphetamine use

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## HIGHLIGHTS

- Impulsivity may be a risk factor for and a consequence of methamphetamine (MA) use.
- Attentional and motor impulsivity are negatively related to age at first MA use.
- Impulsivity should be examined as a risk factor for earlier onset of MA use.

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## ABSTRACT

*Introduction:* Methamphetamine (MA) users report higher levels of impulsivity relative to healthy controls, which may either result from, or precede, their substance use. Further, there is evidence that female MA users may be more impulsive than male MA users prior to MA use. Thus, the goal of the current study was to determine whether different subtraits of self-reported impulsivity are significantly related to age at first MA use, controlling for total years of MA use.
*Methods:* A community sample of MA users was recruited for this study (N = 157; 113 males, 44 females). The Barratt Impulsiveness Scale (BIS-11) was used to assess self-reported impulsivity on three subscales (Attentional, Motor, Non-planning). Age at first MA use served as the dependent variable in a series of multiple regression models with BIS-11 subscales, sex, and their interaction as independent variables, controlling for total years of MA use.
*Results:* Attentional and Motor impulsivity were significantly related to age at first MA use when controlling for total years of MA use (Attentional: $p = 0.008$; Motor: $p = 0.003$).
*Conclusions:* Individuals who reported higher Attentional and Motor impulsivity started using MA at an earlier age, which could suggest that impulsivity levels may be an important marker of vulnerability towards MA use. These findings indicate that prevention efforts may be targeted towards individuals who report high levels of Attentional and Motor impulsivity, as they may be at greatest risk for earlier initiation of MA use.


## 1. Introduction

Methamphetamine (MA) use has been associated with serious psychiatric and medical health issues at the individual level and is highly costly to society (for reviews see Courtney & Ray, 2014; Rawson, 2013). According to the Monitoring the Future Survey (Johnston, O'Malley, Meich, Bachman, & Schulenberg, 2016), approximately 1% of 12th graders report MA use in their lifetime, which increases to 6.2% (Center for Behavioral Health: Statistics and Quality, 2015) by the time individuals are age 26 or older. First use of MA occurs at about 22 years of age (Center for Behavioral Health: Statistics and Quality, 2015), during the transition between late adolescence and emerging adulthood. While many factors may be associated with the initiation and maintenance of MA use, impulsivity is a personality trait found to be higher in MA users relative to healthy controls (Ballard et al., 2015; Ellis et al., 2016; Hoffman et al., 2006).

Impulsivity is considered to be a multidimensional personality trait in which individuals have an urge to perform a goal-directed behavior in pursuit of a reward; different forms of impulsivity may include lack of inhibition, risky decision making, and delay discounting (for review

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see Jentsch et al., 2014). For example, MA dependent individuals are more likely to select small immediate rewards relative to larger delayed rewards on a delay discounting task compared with controls (Ballard et al., 2015; Hoffman et al., 2006). They also display deficits in inhibiting pre-potent responses indicated by longer stop-signal reaction times on the Stop-Signal Task (Monterosso, Aron, Cordova, Xu, & London, 2005) relative to healthy controls. These objective measures of impulsivity suggest MA users have difficulties in multiple domains of impulsivity, including those involving impulsive choice (i.e. delay discounting), and those involving impulsive action (i.e. motor impulsivity; Grant & Chamberlain, 2014).

Furthermore, when subjectively assessing impulsivity, MA users cite impulsivity as the second highest reason for using MA, following the pleasurable effects they experience from using the drug (Newton, De La Garza, Kalechstein, Tziortzis, & Jacobsen, 2009). A recent study supports this finding, as not only were treatment-seeking MA dependent individuals less behaviorally inhibited on objective measures of impulsivity, but they also had higher levels of subjective impulsivity relative to controls (Ellis et al., 2016). A common measure used to assess subjective impulsivity is the Barratt Impulsiveness Scale (BIS-11), which has been divided into three second-order factors, including Attentional, Motor, and Non-planning impulsiveness (Patton, Stanford, & Barratt, 1995). Attentional impulsiveness has been defined as "an inability to focus attention or concentrate", Motor impulsiveness has been characterized as "as acting without thinking", while Non-planning impulsiveness has been conceptualized as a "lack of futuring or forethought" (Stanford et al., 2009). Understanding which of these components of impulsivity may be related to MA use would allow for more targeted intervention programs focused on improving specific subtraits of inhibitory control.

Sex differences in impulsivity and its subtraits may also be present in MA users, such that lack of behavioral inhibition in females, as assessed by retrospective reporting, could render them more vulnerable to engaging in MA use (Winhusen & Lewis, 2013). Additionally, a recent neuroimaging study examining sex differences in impulsivity and brain structure in MA users reported that age at first MA use was significantly negatively related to Behavioral impulsivity in female MA users, while this relationship was not present in male MA users (Kogachi, Chang, Alicata, Cunningham, & Ernst, 2016). Furthermore, in other stimulant users, such as those using crack/cocaine, female users were more impulsive than male users, and impulsivity served as a risk factor for the relationship between gender and crack/cocaine dependence (Lejuez, Bornovalova, Reynolds, Daughters, & Curtin, 2007). Finally, beyond behavioral inhibition, decision making deficits have been shown to be greater in female cocaine and MA users than male users of these substances (van der Plas, Crone, van den Wildenberg, Tranel, & Bechara, 2009), suggesting that executive functioning deficits may be present to a greater extent in female relative to male MA users.

### 1.1. Current study

It remains unclear whether higher impulsivity is a premorbid risk factor for initiating MA use or if heightened impulsivity is largely a consequence of MA use (Grant & Chamberlain, 2014). The current study of non-treatment seeking MA users expands upon recently reported findings (Kogachi et al., 2016) by examining the relationships between Attentional, Motor, and Non-planning subtraits of impulsivity and age at first MA use, while accounting for number of years of MA use in a sample of non-abstinent MA users over twice as large as previously investigated (Kogachi et al., 2016). The current study will help clarify the types of behavioral disinhibition that may be related to early initiation of MA use and whether sex and sex-by-impulsivity interactions are associated with age at first MA use. While, previous reports suggest objectively measured impulsivity in MA users is not associated with years of MA use (Ballard et al., 2015; Hoffman et al., 2006; Monterosso et al., 2005), it is unclear whether self-reported impulsivity could be related to chronicity of MA use, making it an important covariate for the current analyses.

We hypothesized that higher self-reported Motor impulsivity in MA users (Monterosso et al., 2005) would be associated with earlier initiation of MA use, controlling for total years of MA use. Further, we hypothesized that this effect would be more pronounced in female MA users relative to male MA users (Kogachi et al., 2016). By examining age at first use, this study investigates whether impulsivity may be associated with MA use initiation in a primarily MA-using community sample.

## 2. Material and methods

### 2.1. Participant recruitment and exclusionary criteria

A community sample of non-treatment seeking MA users (N = 203) was recruited through online and print advertisements as part of a medication study (Ray et al., 2015). As part of the parent behavioral pharmacology study, participants were included in the study if they were between 18 and 50 years old (to ensure a healthy sample without confounds of aging associated medical conditions), fluent in English, and reported using MA in the past month. Exclusionary criteria at the initial phone screening (N = 984) for the study included 1) major psychiatric disorders, including major depressive disorder with suicidal ideation, or psychotic disorders such as bipolar I and schizophrenia, 2) any other current self-reported substance use in order to recruit a primarily MA as opposed to polysubstance-using sample (excluding alcohol, tetrahydrocannabinol (THC), or nicotine), 3) currently seeking or in treatment for MA use (in order to avoid confounds with medication aim of the study), 4) presence/treatment of major medical conditions (to enroll a medically healthy sample of participants) and 5) use of medications contraindicated for the behavioral pharmacology study (Ray et al., 2015). Furthermore, exclusionary criteria for the current analyses were the following, 1) absence of urine toxicology test (N = 8), 2) positive urine toxicology test for any substance other than MA or THC (N = 10), 3) missing data for age at first MA use (N = 5), and 4) incomplete data on the Barratt Impulsiveness Scale [BIS-11 (Patton et al., 1995); N = 23)]. Following the implementation of the exclusionary criteria described above, 157 (113 males/44 females) participants were included in the final analyses for the current study. All study procedures were approved by the University of California, Los Angeles Institutional Review Board and were in accordance with the Declaration of Helsinki.

### 2.2. Study measures

The Structured Clinical Interview for DSM-IV Disorders (SCID-IV) was used to assess whether participants met criteria for MA abuse and/or dependence and asked participants to report their age at first MA use. Total years of MA use was calculated by subtracting age at first MA use from age at the time of study participation. The Timeline Followback (TLFB) calendar-assisted interview (Sobell & Sobell, 1992) asked participants to recall the amount of MA (in grams) they used in the past 30 days. Participants completed one of the most commonly used self-report measures of impulsivity, the 30-item BIS-11 (Patton et al., 1995; Stanford et al., 2009). Items were scored and divided into three different second-order subscales, including Attentional, Motor, and Non-planning impulsivity, and a total impulsivity score was calculated. Participants read each of the statements on the questionnaire and responded on a scale of 1 = Rarely/Never to 4 = Almost Always/Always, as to whether the statement applied to them. Sample items from the subscales include "I often have extraneous thoughts when thinking" (Attentional), "I act on the spur of the moment" (Motor), and "I am more interested in the present than the future" (Non-planning). While not correlated with behavioral measures of impulsivity, all subscales have been shown to highly correlate with other self-report measures of impulsivity (Stanford et al., 2009). Internal consistency (Cronbach's $\alpha$) for the BIS-11 total score and subscales has been reported to be: