Drug and Alcohol Dependence 160 (2016) 190–196

Contents lists available at ScienceDirect

Drug and Alcohol Dependence

journal homepage: www.elsevier.com/locate/drugalcdep

Full length article

Comorbid depression, antisocial personality, and substance dependence: Relationship with delay discounting

Lara Moody[a,b], Christopher Franck[a,c], Warren K. Bickel[a,*]

[a] Virginia Tech Carilion Research Center, Roanoke, VA 24016 USA
[b] Virginia Tech, Department of Psychology, Blacksburg, VA 24061 USA
[c] Virginia Tech, Department of Statistics, Blacksburg, VA 24061 USA

ARTICLE INFO

Article history:
Received 24 July 2015
Received in revised form 8 January 2016
Accepted 8 January 2016
Available online 22 January 2016

Keywords:
Delay discounting
Psychopathology
Depression
Antisocial personality disorder
Substance use

ABSTRACT

Background: Within the field of addiction, as many as four-fifths of individuals in treatment for substance use disorder have co-existing lifetime psychopathology and as high as two-thirds have current psychopathology. Among substance-dependent individuals, excessive delay discounting is pervasive. Despite evidence of excessive discounting across substance use disorders, few studies have investigated the impact of co-occurring psychopathologies and SUD on delay discounting.

Methods: We compared delay discounting in currently abstaining substance users with (a) SUD ($n = 166$), (b) SUD and managed major depressive disorder (MDD; $n = 44$), (c) SUD and antisocial personality disorder (APD; $n = 35$), (d) SUD and managed MDD and APD ($n = 22$) and (e) no SUD or co-occurring psychopathology ($n = 60$).

Results: All groups with SUD discounted future delayed rewards significantly more than healthy controls ($p < 0.001$ in each case, $d = 0.686$, 0.835, 1.098 and 1.650, respective to groups a–d above). Individuals with both APD and SUD and individuals with MDD, APD, and SUD discounted future rewards significantly more than substance users without comorbid psychopathology ($p = 0.029$, $d = 0.412$ and $p < 0.001$, $d = 0.964$, respectively).

Conclusions: Overall, individuals with multiple psychopathologies in addition to substance use have exacerbated deficits in discounting of the future, above and beyond that observed in substance use alone. Increased discounting in combined substance and psychopathology profiles suggest a greater chance of treatment failure and therefore may necessitate individualized treatment using adjunctive interventions to achieve better treatment outcomes.

1. Introduction

Excessive delay discounting, or the disproportionate devaluation of delayed rewards, is pervasive across substance use disorders (SUD; Coffey et al., 2003; García-Rodríguez et al., 2013; Heil et al., 2006; MacKillop et al., 2011; MacKillop and Kahler, 2009; Petry, 2001a; Vuchinich and Simpson, 1998). In SUD, increased delay discounting is tied to worsened treatment outcomes (Dallery and Raiff, 2007; Krishnan-Sarin et al., 2007; Passetti et al., 2008; Sheffer et al., 2012, 2014; Washio et al., 2011; Yoon et al., 2007). Moreover, substance users are more likely to have mental health problems than the non-dependent population (Farrell et al., 2001). Given that (1) SUD are associated with excessive rates of discounting, (2) excessive discounting is associated with worsened treatment outcomes, and (3) substance users have increased rates of mental health problems, the impact of comorbid psychopathology on discounting in substance using populations may be important to understand treatment outcomes and may suggest methods to improve treatment efficacy.

The extant literature is conflicting with respect to the impact of comorbidities on delay discounting. One report on attention deficit hyperactive disorder in combination with cocaine dependence did not observe increases in discounting of delayed rewards above the non-combined profile (Crunelle et al., 2013). Another study found that individuals with problem gambling and substance use disorders discounted significantly more than problem gamblers without substance use disorders (Andrade and Petry, 2012; Petry, 2001b). Yet another report found that individuals that smoked cigarettes, used alcohol, and gambled discounted significantly more than nonsmokers with alcohol and gambling problems (Andrade

* Corresponding author at: Addiction Recovery Research Center, Virginia Tech Carilion Research Institute, 2 Riverside Circle, Roanoke, VA 24016, USA.
E-mail address: wkbickel@vtc.vt.edu (W.K. Bickel).

http://dx.doi.org/10.1016/j.drugalcdep.2016.01.009
0376-8716/

et al., 2013). The heterogeneity of findings and paucity of systematic comparisons across comorbid group profiles highlights the importance of additional clarification within this area. Specifically, here we assess the impact of co-occurring depression and/or antisocial personality disorder in substance users.

Clinically depressed individuals exhibit increased delay discounting (Pulcu et al., 2013; Takahashi et al., 2011). Takahashi et al. (2011) reported increased delay discounting in combined psychopharmocologically medicated (e.g., managed) depressed and bipolar individuals compared to nonaffected controls. So too, Pulcu et al. (2013) reported increased discounting of large rewards in individuals with current MDD symptomology (approximately half of which were currently taking anti-depressants) compared to non-medicated remitted MDD and nonaffected controls. Together, the extant literature on delay discounting and depression indicates that individuals with current depression symptomology show atypical patterns of delay discounting compared to healthy controls such that they discount large rewards more steeply than individuals with past or never depression. However, the impact of combined substance use and depression has not been examined.

Conflicting results have been reported in studies of delay discounting among those with APD. In one study, delay discounting was not observed to differ between SUD with and without APD (Sargeant et al., 2012). However, an earlier study reported that the SUD group discounted delayed rewards more than healthy controls and the SUD with APD group discounted more than the SUD group (Petry, 2002). The heterogeneity in these studies suggests the value of obtaining additional data to clarify the prior findings. The contrary results regarding SUD and APD could indicate one of two competing hypotheses. Either, combined SUD and APD may result in an additive effect on discounting or combined SUD and APD may result in a ceiling effect such that discounting does not increase above that observed in substance users. Given the current study's findings, we will evaluate these competing hypotheses to bring clarity to the extant literature.

The extant literature on delay discounting in combined SUD and psychopathology profiles is largely heterogeneous. Here, we present data that addresses and systematically replicates previous findings to clarify and provide a unique comparison of comorbid MDD, APD, and SUD. Given that excessive discounting has been demonstrated to be associated with poorer treatment outcomes, any additive effect of discounting may suggest that supplemental treatment to improve future valuation may improve treatment outcomes. Of course, a competing hypothesis is that SUD results in such a degree of excessive discounting that additional psychopathology cannot engender any greater discounting in which case the implications for treatment would be nil.

2. Methods

In the current analysis, all participants provided written consent that was approved by either the IRB at University of Arkansas or Virginia Tech. Participants were community members from either the greater Little Rock metropolitan area in Arkansas or the greater Roanoke Valley region of Virginia. They were recruited via community outreach including flyers, postings on social media outlets including Facebook and Craigslist, and word of mouth. To participate, all participants had to (1) be at least 18 years of age, and (2) not have ADHD, epilepsy, mania, psychosis, or traumatic brain injury. Further, control participants had to be free from any form of drug dependence, recent drug use, or mental health disorder as screened with the Mini-International Neuropsychiatric Interview (MINI; Sheehan et al., 1998). Substance using participants had to (1) meet Diagnostic and Statistical Manual (DSM; American Psychiatric Association, 1994) criteria for cocaine or methamphetamine dependence and/or alcohol dependence. The current study was collected using DSM-IV criteria for substance dependence. The more recent DSM-V criteria merge what was previously substance abuse and substance dependence into substance use disorder with mild, moderate, and severe classifiers based on number of symptoms endorsed (American Psychiatric Association, 2003). Individuals that previously met diagnostic criteria for substance dependence would have met current DSM-V criteria for substance use disorder. In addition, the current study limited substances to stimulants and alcohol because these data were collected as part of a larger project examining the rehabilitation of executive function deficits with neurocognitive training. All substance-using participants were assessed by trained research associates using the MINI for MDD and APD. Participants that met current diagnostic criteria for MDD were required to provide a note from a health care professional indicating that the MDD was currently managed either through psychotherapy or psychopharmacology. Participants were not excluded for meeting current diagnostic criteria for APD unless they reported an inability to comply with laboratory rules and regulations. Participants that were substance users were required to be in treatment and/or to have not used in the past three weeks. We selectively sampled individuals that were not currently using substances or currently had unmanaged MDD to avoid an overestimation of dysfunction that may result from acute substance-induced or psychopathologic states; however, this sampling procedure does not capture the full populations of substance using and depressed individuals. Although different forms of substance use disorders may be differentially affected by comorbid psychopathology, in the current study, consistent with other research in this area (Petry, 2001b), we have grouped these two substance use disorders together to maintain adequate power to assess the relationship of delay discounting in comorbid substance users.

After consent was obtained, participants completed demographic information, as well as breathalyzer and urinalysis to confirm current abstinence from alcohol and drugs including cocaine, opiates, marijuana, amphetamines and benzodiazepines. Following confirmation of all eligibility criteria, the delay discounting task (described below in Section 2.2) was administered. Participants were compensated $20–40 for completion of consent and assessments based on amount of time spent in the laboratory with a rate of compenstation of $10 per hour spent in the research center.

2.1. Measures

A computer-based delay discounting task was used to assess participants' impulsive compared to self-controlled behavioral strategies. Participants were presented with hypothetical scenarios in which the extent of their discounting of a delayed "reward" (i.e., $1000) relative to an immediate "reward" was determined at seven delays (i.e., 1 day, 1 week, 1 month, 6 months, 1 year, 5 years, and 25 years) presented in chronological order. The smaller, more immediate amount titrates until an indifference point where the subjective value of the immediate reward is approximately equal to the value of the delayed reward (Du et al., 2002). The indifference points are then fit to the following equation:

$$V = \frac{A}{(1 + kD)} \quad (1)$$

where V is the subjective value of the objective monetary amount A, to be delivered after some delay, D (Mazur, 1987). The parameter k describes the hyperbolic function and is used as an index of the extent to which participants discount the value of future rewards. Taken together, higher k values indicate a tendency to