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## Delay Discounting Interacts with Distress Tolerance to Predict Depression and Alcohol Use Disorders among Individuals Receiving Inpatient Substance Use Services

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### Abstract

Personality-linked psychological factors including distress tolerance and delay discounting have been shown to underlie both Alcohol Use and Major Depressive Disorders. Although these disorders commonly co-occur, especially among individuals seeking in-patient treatment, no study has examined the association between distress tolerance, delay discounting and dual diagnoses. This project evaluated these relations in a sample of 79 low-income adults receiving in-patient substance use treatment. It was hypothesized that individuals with low levels of distress tolerance and elevated discounting would be more likely to report co-occurring disorders. Utilizing structural equation modeling, we found that the interaction between distress tolerance and delay discounting was associated with co-occurring Alcohol Use and Major Depressive Disorders in the expected direction. Findings suggest these constructs could be used for targeting prevention efforts for vulnerable individuals as well as refining current interventions to improve treatment outcomes.

### Keywords

Distress Tolerance; Delay Discounting; Alcohol Use Disorder; Major Depressive Disorder; Comorbidity

## Introduction

Alcohol use disorders (AUD) and major depressive disorder (MDD) co-occur frequently in both the general population (Carton et al., 2018) and specifically among those seeking treatment for substance use (SU) (Grant et al., 2004). Individuals in SU treatment with co-occurring mood disorders experience worse outcomes (Torrens, Fonseca, Mateu, & Farré, 2005) and higher rates of relapse following treatment termination (Hasin et al., 2002). Identifying shared vulnerabilities associated with these disorders has the potential to improve identification of at-risk individuals entering SU treatment and could yield more effective and targeted intervention strategies. Thus, the current study examined the role of two psychological factors commonly implicated in the onset and maintenance of AUDs, delay discounting and distress tolerance, that may influence co-occurring MDD among a sample of individuals receiving inpatient SU treatment.

Delay discounting, or the tendency to perceive something as less valuable when its receipt is delayed, has been consistently linked to disordered alcohol use among adults (Bailey, Gerst, & Finn, 2018; Bickel, Koffarmus, Moody, & Wilson, 2014). Although less attention has been paid to the relation between delay discounting and depression, emerging research suggests that individuals with MDD also have higher rates of discounting (Pulcu et al., 2014). Indeed, depression has been shown to be associated with abnormal reward processing (Beddington et al., 2008), such that individuals high in anhedonia and hopelessness (two critical symptoms of MDD) are less likely to value rewards that take place in an uncertain future.

A large body of literature also shows links between distress intolerance (the inability to tolerate psychological distress), and both problematic alcohol use and depression (Khan et al., 2018; Allan, Macatee, Norr, & Schmidt, 2014). Nearly one in four adults who use alcohol report doing so as a method for coping with the distressing feelings associated with negative affect (Cooper, Russell, Skinner, Frone, & Mudar, 1992). Further, the tendency to become absorbed by negative emotions (a facet of distress tolerance) has been found to be associated with co-occurring AUD and internalizing disorders, suggesting that distress tolerance may be a specific risk factor for comorbidity (Bradizza et al., 2018).

Emerging research points to the role that distress tolerance and delay discounting may jointly play in bringing about maladaptive clinical outcomes. For instance, increases in delay discounting have been found after distress-inducing situations, such as forced abstinence among individuals who use substances (Yi & Landes, 2012; Field, Santarcangelo, Sumnall, Goudie, & Cole, 2006; Giordano et al., 2002); yet the interactive effects of distress tolerance and delay discounting on the occurrence of problematic alcohol use and depression are unknown. The current study attempts to address this gap by examining these constructs as predictors of AUD, MDD and co-morbid AUD and MDD in a sample of low-income adults in a residential substance use facility.

## Methods

### Participants and Procedures

Participants ( $n = 79$ ) were recruited from a larger study examining risk-taking and substance use in a low-income adult inpatient substance use facility in Washington, DC. Participants were 82.3% male and 87.3% identified as Black/African American (8.9% identified as white, and 3.8% identified as “other”). The majority of the sample were low income, with 53.8% of the sample reporting less than \$10,000 of annual income. Most participants (77.2%) reported meeting diagnostic criteria for at least one SU disorder and 64.6% met criteria for at least one psychiatric (non-SU) disorder. All measures were completed within one week of entering treatment. Study procedures were approved through the University of Maryland Institutional Review Board and participants provided informed consent before taking part in any part of the research.

### Measures

**Delay Discounting.**—Delay discounting was assessed using the Monetary Choice Questionnaire (Kirby, Petry, & Bickel, 1999). Participants were presented with 27 binary-choice items that asked them to choose between smaller, immediately available sums of money (e.g. \$11 today) and larger, delayed rewards (e.g. \$30 in 7 days). A log-transformed discounting index  $k$  (Mazur, 1987) was calculated to reflect the degree to which an individual prefers immediate vs. delayed rewards.

**Distress Tolerance.**—Participants completed the Distress Tolerance Scale (Simons & Gaher, 2005), a 15-item measure that taps distress tolerance, appraisal, absorption, and regulation. Items including “I can’t handle feeling distressed or upset” are rated on a 5-point scale ranging from (1) strongly agree to (5) strongly disagree, with higher scores reflecting greater tolerance for distressing emotions. Internal consistency in the current study was good (Cronbach’s  $\alpha = .90$ ).

**Alcohol Use and Major Depressive Disorders.**—All participants were given the Structured Clinical Interview for the Diagnostic and Statistical Manual of Mental Disorders IV (First, Spitzer, Gibbon & Williams, 1995) to assess the presence or absence of alcohol dependence and MDD. Given the severity of the sample, only alcohol dependence (rather than abuse) criteria was considered. Responses were coded as either 1 (disorder present) or 0 (disorder absent). Participants were assessed by trained graduate-level interviewers who were supervised by a doctoral-level clinical psychologist.

**Analysis:** A series of panel models utilizing *Mplus* 6.0 (Muthén & Muthén, 2015) were examined, which allow for the consideration of multiple dependent variables within the same model. We evaluated the main and interactive effects of delay discounting and distress tolerance (controlling for participant sex and age) on two binary outcomes: MDD and AUD. In order to probe the interaction, we ran a multigroup model, in which we examined the impact of distress tolerance on diagnoses among participants with either high or low levels of delay discounting (indexed as above or below the mean of delay discounting). Lastly, we

examined whether the interaction between distress tolerance and delay discounting predicted co-occurring alcohol dependence and MDD.

## Results

### Descriptive Analyses

Within our sample, 22% of participants reported AUDs only, 15% reported MDD only, and 23% reported co-occurring AUD and MDD (Table 1). Correlations between key variables suggest distress tolerance was associated with MDD, indicating individuals with higher tolerance for distress were less likely to be diagnosed with MDD. Further, MDD and alcohol dependence were positively correlated.

### Panel Models

In the main effects model, only distress tolerance significantly predicted AUD ( $b = -.013$ ,  $p = .003$ , 95% CI =  $-.021$  to  $-.004$ ), suggesting that less tolerance for distressing emotions was associated with greater likelihood of being diagnosed with alcohol dependence. Neither distress tolerance nor delay discounting significantly predicted MDD. The interaction between distress tolerance and delay discounting was a significant predictor of both AUD ( $b = -.006$ ,  $p < .001$ , 95% CI =  $-.010$  to  $-.003$ ) and MDD diagnoses ( $b = -.004$ ,  $p = .042$ , 95% CI =  $-.007$  to  $-.001$ ), indicating that higher levels of delay discounting and lower distress tolerance were associated with a greater likelihood of being diagnosed with MDD and AUD (considered as separate diagnoses). The interaction also was a significant predictor of group status ( $b = -0.018$ ,  $p = .032$ , 95% CI =  $-.035$  to  $-.002$ ), such that participants with higher rates of discounting and lower distress tolerance were significantly more likely to evidence co-occurring MDD and AUD.

## Discussion

This study examined the role of delay discounting and distress tolerance, and their conjoint effects, on the presence of AUD and MDD among adults in an inpatient substance use facility. These results are the first, to our knowledge, to demonstrate that lower levels of distress tolerance exacerbated the relation between delay discounting and both alcohol and depressive disorders independently, as well as their co-occurrence.

While prior research has examined distress tolerance and delay discounting separately, these findings highlight one way in which individuals' reaction to distress may exacerbate decision-making tendencies to impact rates of psychopathology. Results complement existing research suggesting stress increases individuals' preference for immediate rewards (e.g. Mellis et al., 2018; Simmen-Janevska, Forstmeier, Krammer, & Maercker, 2015) and indicates that stress intolerance intensifies the relationship between impulsive choice behaviors and subsequent mental and behavioral health disorders.

These findings also help expand our understanding of negative reinforcement cycles of psychopathology and substance use. These frameworks suggest that exposure to distress may cause individuals to alleviate negative emotional states with immediately available "rewards", including engaging in behavioral avoidance (associated with MDD; e.g.

Leventhal, 2008) and/or using intoxicifying substances (Koob, 2011). Consequently, they experience a decrease in distress and are reinforced for these actions, creating a pattern that increases the likelihood they will engage in behavioral avoidance or substance use in the future.

The current study has a number of strengths, such as using a vulnerable, low-income, clinical population and a variety of measurement approaches, including a behavioral task and clinical interview methods. However, these findings should also be viewed within the context of several important limitations. First, utilizing an inpatient sample may limit the generalizability of these findings to other populations with less-severe substance use. Second, our measure of delay discounting used hypothetical monetary rewards; future research should consider examining performance on real, alcohol-related rewards. Finally, future longitudinal research is needed to examine the causal pathways linking distress tolerance, delay discounting, and subsequent pathology. These limitations notwithstanding, these results suggest the utility of interventions that increase distress tolerance to potentially reduce the effect of delay discounting on negative outcomes in AUD treatment.

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## References

- Allan NP, Macatee RJ, Norr AM, & Schmidt NB (2014). Direct and Interactive Effects of Distress Tolerance and Anxiety Sensitivity on Generalized Anxiety and Depression. *Cognitive Therapy and Research*, 38(5), 530–540. 10.1007/s10608-014-9623-y
- Bailey AJ, Gerst K, & Finn PR (2018). Delay discounting of losses and rewards in alcohol use disorder: The effect of working memory load. *Psychology of Addictive Behaviors*, 32(2), 197–204. 10.1037/adb0000341 [PubMed: 29355332]
- Beddington J, Cooper CL, Goswami U, Huppert FA, Jenkins R, Jones HS, ... Thomas M (2008). The mental wealth of nations, 455, 3.
- Bickel WK, Koffarnus MN, Moody L, & Wilson AG (2014). The behavioral- and neuro-economic process of temporal discounting: A candidate behavioral marker of addiction. *Neuropharmacology*, 76, 518–527. 10.1016/j.neuropharm.2013.06.013 [PubMed: 23806805]
- Bradizza CM, Brown WC, Rusczyk MU, Dermen KH, Lucke JF, & Stasiewicz PR (2018). Difficulties in emotion regulation in treatment-seeking alcoholics with and without co-occurring mood and anxiety disorders. *Addictive Behaviors*, 80, 6–13. 10.1016/j.addbeh.2017.12.033 [PubMed: 29306117]
- Carton L, Pignon B, Baguet A, Benradia I, Roelandt J-L, Vaiva G, ... Rolland B (2018). Influence of comorbid alcohol use disorders on the clinical patterns of major depressive disorder: A general population-based study. *Drug and Alcohol Dependence*, 187, 40–47. 10.1016/j.drugalcdep.2018.02.009 [PubMed: 29626745]
- Cooper ML, Russell M, Skinner JB, Frone MR, & Mudar P (1992). Stress and alcohol use: Moderating effects of gender, coping, and alcohol expectancies. *Journal of Abnormal Psychology*, 101(1), 139–152. 10.1037/0021-843X.101.1.139 [PubMed: 1537960]
- Field M, Santarcangelo M, Sumnall H, Goudie A, & Cole J (2006). Delay discounting and the behavioural economics of cigarette purchases in smokers: the effects of nicotine deprivation. *Psychopharmacology*, 186(2), 255–263. 10.1007/s00213-006-0385-4 [PubMed: 16609902]

- First MB, Spitzer RL, Gibbon M, & Williams JBW (1995). The Structured Clinical Interview for DSM-III-R Personality Disorders (SCID-II). Part I: Description. *Journal of Personality Disorders*, 9(2), 83–91. 10.1521/pedi.1995.9.2.83
- Giordano L, Bickel W, Loewenstein G, Jacobs E, Marsch L, & Badger G (2002). Mild opioid deprivation increases the degree that opioid-dependent outpatients discount delayed heroin and money. *Psychopharmacology*, 163(2), 174–182. 10.1007/s00213-002-1159-2 [PubMed: 12202964]
- Grant BF, Stinson FS, Dawson DA, Chou SP, Dufour MC, Compton W, ... Kaplan K (2004). Prevalence and Co-occurrence of Substance Use Disorders and Independent Mood and Anxiety Disorders. *ARCH GEN PSYCHIATRY*, 61, 10.
- Hasin D, Liu X, Nunes E, McCloud S, Samet S, & Endicott J (2002). Effects of Major Depression on Remission and Relapse of Substance Dependence. *Archives of General Psychiatry*, 59(4), 375 10.1001/archpsyc.59.4.375 [PubMed: 11926938]
- Khan AJ, Pedrelli P, Shapero BG, Fisher L, Nyer M, Farabaugh AI, & MacPherson L (2018). The Association between Distress Tolerance and Alcohol Related Problems: The Pathway of Drinking to Cope. *Substance Use & Misuse*, 53(13), 2199–2209. 10.1080/10826084.2018.1464027 [PubMed: 29708456]
- Kirby KN, Petry NM, & Bickel WK (1999). Heroin addicts have higher discount rates for delayed rewards than non-drug-using controls. *Journal of Experimental psychology: general*, 128(1), 78, 10. [PubMed: 10100392]
- Koob GF (2011). Theoretical frameworks and mechanistic aspects of alcohol addiction: alcohol addiction as a reward deficit disorder In *Behavioral neurobiology of alcohol addiction*(pp. 3–30). Springer, Berlin, Heidelberg.
- Leventhal AM (2008). Sadness, depression, and avoidance behavior. *Behavior Modification*, 32(6), 759–779. [PubMed: 18403316]
- Mazur JE (1987). An adjusting procedure for studying delayed reinforcement. *Common ML; Mazur JE; Nevin JA*, 55–73.
- Mellis AM, Athamneh LN, Stein JS, Sze YY, Epstein LH, & Bickel WK (2018). Less is more: Negative income shock increases immediate preference in cross commodity discounting and food demand. *Appetite*, 129, 155–161. 10.1016/j.appet.2018.06.032 [PubMed: 29959952]
- Muthén LK, & Muthén BO (2012). *Mplus user's guide* (1998–2012). Los Angeles, CA: Muthén & Muthén, 6.
- Pulcu E, Trotter PD, Thomas EJ, McFarquhar M, Juhasz G, Sahakian BJ, ... & Elliott R (2014). Temporal discounting in major depressive disorder. *Psychological Medicine*, 44 (9), 1825–1834. 10.1017/S0033291713002584 [PubMed: 24176142]
- Simmen-Janevska K, Forstmeier S, Krammer S, & Maercker A (2015). Does Trauma Impair Self-Control? Differences in Delaying Gratification Between Former Indentured Child Laborers and Nontraumatized Controls. *Violence and Victims*, 30(6), 1068–1081. 10.1891/0886-6708.VV-D-13-00174 [PubMed: 26440574]
- Simons JS, & Gaher RM (2005). The Distress Tolerance Scale: Development and Validation of a Self-Report Measure. *Motivation and Emotion*, 29(2), 83–102. 10.1007/s11031-005-7955-3
- Torrens M, Fonseca F, Mateu G, & Farré M (2005). Efficacy of antidepressants in substance use disorders with and without comorbid depression. *Drug and Alcohol Dependence*, 78(1), 1–22. 10.1016/j.drugalcdep.2004.09.004 [PubMed: 15769553]
- Yi R, & Landes RD (2012). Temporal and Probability Discounting by Cigarette Smokers Following Acute Smoking Abstinence. *Nicotine & Tobacco Research*, 14(5), 547–558. 10.1093/ntr/ntr252 [PubMed: 22311959]

**Table 1.**

## Descriptive Statistics and Intercorrelations of Key Study Variables

	1	2	3	4	5	6
1. Age (years)	1.00					
2. Sex (male)	.19	1.00				
3. DTS	.01	.09	1.00			
4. MCQ	.13	-.01	.00	1.00		
5. AUD	-.14	.09	-.29 <sup>b</sup>	.06	1.00	
6. MDD	.08	-.03	-.18	-.02	.24 <sup>1</sup>	1.00
Mean ( <i>SD</i> )	42.78 (10.63)	.82 (.38)	44.21 (12.72)	-3.35 (2.51)	.45 (.50)	.39 (.49)

*Note.* DTS = Distress Tolerance Scale; MCQ = Monetary Choice Questionnaire; AUD = Alcohol Use Disorder; MDD = Major Depressive Disorder.

<sup>a</sup>  $p < .05$ ,

<sup>b</sup>  $p < .01$ .