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Implicit alcohol cognitions in risky drinking nicotine users with and without co-morbid major depressive disorder

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Abstract

Objective—Alcohol consumption, nicotine use, and major depressive disorder (MDD) are highly co-morbid. The negative reinforcement model of addiction would suggest that smokers may consume alcohol to relieve negative affective symptoms, such as those associated with MDD and withdrawal from nicotine. Over time, these behaviors may become so strongly paired together that they automatically activate a desire to use alcohol, even in the absence of conscious or deliberate intention. This study examined implicit alcohol cognitions in 146 risky drinking nicotine users ($n = 83$) and non-users ($n = 63$), to help uncover cognitive mechanisms that link drinking, nicotine use, and depression together. We proposed that nicotine users with a history of MDD would have stronger implicit motivations to drink than non-nicotine users without MDD.

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Contributors

Amy Cohn, Amy Cameron, and Brett Hagman designed the study and wrote the protocol. Caroline Cobb conducted literature searches, provided summaries of previous research studies, and assisted with conceptualization and writing of the current study findings. Amy Cohn conducted the statistical analysis. Jessica Mitchell, Sarah Ehlke, and Stephanie Bramm assisted with data collection, data entry, and initial data analysis. Author Cohn wrote the first draft of the manuscript and all authors contributed to and have approved the final manuscript

Conflict of Interest

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Method—Participants were assessed on lifetime MDD ($n = 84$) or no MDD ($n = 62$), and then completed an Implicit Association Task designed to test the strength of associations between alcohol pictures and “approach” words.

Results—Regression analyses showed that implicit alcohol-approach attitudes were stronger among risky drinking nicotine users than non-users. Alcohol-approach motivations were stronger among risky drinking nicotine users compared to non-users with a history of MDD; nicotine use was unrelated to implicit alcohol cognitions for risky drinkers without MDD.

Conclusions—Implicit cognitive processes may be targeted in behavioral and pharmacological treatments in risky drinking nicotine users, particularly those with depression comorbidity.

Keywords

Implicit attitudes; alcohol use; drinking; nicotine use; depression; comorbidity

1. Introduction

Alcohol involvement, major depressive disorder (MDD), and nicotine use have a high degree of co-occurrence (Grant et al., 2004; Hitsman, Borrelli, McChargue, Spring, & Niaura, 2003; Kessler, Chiu, Demler, & Walters, 2005; Lasser et al., 2000). The odds of nicotine dependence are almost 3 times greater among individuals with an alcohol use disorder (AUD) than those without (Hasin, Stinson, Ogburn, & Grant, 2007). Further, the odds of having MDD are 2.5 times greater among individuals with an AUD compared to those without (Grant et al., 2004), and rates of current smoking are nearly 3 times greater among individuals with MDD compared to the general population (Kessler, Berglund, et al., 2005; Kessler, Chiu, et al., 2005; Lasser et al., 2000). Heavy drinking and MDD are associated with persistent smoking, greater difficulty quitting, more intense nicotine withdrawal, and more severe nicotine dependence (Cook et al., 2012; Weinberger, Desai, & McKee, 2010; Weinberger, Maciejewski, McKee, Reutenauer, & Mazure, 2009).

Although several theories have been purported to explain associations among drinking, nicotine use, and MDD, there is strong theoretical reason to believe that motivation to drink may be increased by nicotine deprivation and symptoms of depression (Eissenberg, 2004; Palfai, Monti, Ostafin, & Hutchison, 2000). Negative reinforcement models of addiction would suggest that negative affect states associated with nicotine craving and withdrawal and symptoms of MDD may be common processes that activate the desire to use alcohol (Brandon, Wetter, & Baker, 1996; Wills & Hirky, 1996).¹ In this manner, nicotine users and those with MDD may engage in drinking behavior because it can lessen negative affective states that are commonly associated with both nicotine withdrawal, nicotine urge reduction, and MDD, such as anxiety, irritability, depressed mood/dysphoria, fatigue, and difficulty

¹Other potential mechanisms have been proposed to explain the links among smoking, depression, and alcohol use, including recurrence of a major depressive episode provoked by nicotine abstinence (Borrelli et al., 1996; Glassman, Covey, Stetner, & Rivelli, 2001), alleviation of major depressive episodes by alcohol intake (McCarty et al., 2009), alleviation of alcohol withdrawal symptoms via nicotine ingestion (Lajtha & Sershen, 2010), underlying genetic or neurobiological deficits that impact neurotransmitter systems implicated in the dopaminergic reward/deficit system (Hurley, Taylor, & Tizabi, 2012; Littleton, Barron, Prendergast, & Nixon, 2007), and a general tendency for persons with mental health to smoke and engage in other addictive behaviors (Hitsman, Moss, Montoya, & George, 2009; Kalman, Morissette, & George, 2005; Le Strat, Ramoz, & Gorwood, 2010; Mackowick, Lynch, Weinberger, & George, 2012).

concentrating, (American Psychological Association, 2013; Bradley et al., 2011; Dani & Harris, 2005; Hughes, Higgins, & Bickel, 1994; Kassel, Stroud, & Paronis, 2003; Rose et al., 2004). Over time, the learned association between alcohol use and the alleviation of negative affect may become so strongly paired that the desire to drink becomes automatically and unconsciously triggered when such symptoms or states arise (Cohn et al., 2012; Greenwald, McGhee, & Schwartz, 1998; Ostafin & Palfai, 2006; Palfai et al., 2000; Piasecki et al., 2011).

Previous investigations have tested the reinforcing properties of alcohol in relation to nicotine and depression. In an experimental paradigm, Kirchner and Sayette (2007) found that alcohol increased negative reinforcement expectancies for smoking among light tobacco users (5 cigarettes/day), and a more recent observational study of smokers who drink suggested that alcohol and nicotine co-use had a stronger effect on negative reinforcement ratings for drinking relative to those for cigarettes (Piasecki et al., 2011). Further, in this study, problem drinking predicted negative, but not positive, reinforcement ratings from both drinking and smoking (Piasecki et al., 2011). Several other studies have found that alcohol is related to smoking urge reduction, particularly under nicotine deprivation conditions (Palfai et al., 2000; Piasecki, McCarthy, Fiore, & Baker, 2008; Rose et al., 2004). The negative reinforcement model would also suggest that individuals at risk for depression would be more likely to develop alcohol use problems later in life than those with little or no risk (Gilpin & Koob, 2008; McCarty et al., 2009; McCarty et al., 2012). One prospective longitudinal study observed this pattern among women, with an MDD episode at age 27 increasing the risk of developing an AUD three years later (McCarty et al., 2009). Another longitudinal analysis among adolescents showed that depressive symptomology was a key predictor of alcohol use risk one year later (McCarty et al., 2012). However, evidence from other epidemiological and clinical studies is mixed. Some studies show that adult alcohol use develops “secondary” to childhood or adolescent depression vulnerability, while others indicate that depression develops in response to chronic drinking (Boden & Fergusson, 2011; Crum et al., 2008).

The Implicit Association Task (IAT) has increasingly been used to study the cognitive mechanisms that underlie drug and alcohol use behavior (Cohn et al., 2012; De Houwer, Custers, & De Clercq, 2006; Ostafin & Palfai, 2006; Tibboel et al., 2011; Wiers, Houben, & de Kraker, 2007), and may help tease apart the mechanisms linking nicotine use, drinking, and depression. The IAT is a performance-based categorization task that measures the strength of associations between two mental concepts (Greenwald et al., 1998). The primary assumption of the IAT is that individuals who exhibit regular substance use will be faster at categorizing stimuli into a category that are highly related to their substance use or frequently paired with substance use, rather than concepts that are hypothesized to be inherently incongruent with their substance use. For alcohol use or smoking, the pairing of “approach” or “pleasant” words with “alcohol” or “cigarette” stimuli has been posited to be a measurement of “desire” or “motivation” to drink or smoke. Results from this type of paradigm in drinking populations show that alcohol-approach associations are stronger for problem drinkers compared to non-problem drinkers and non-drinkers, are related to difficulty controlling alcohol use, are associated with alcohol craving, and predict heavy episodic drinking (Cohn et al., 2012; Ostafin & Palfai, 2006; Palfai & Ostafin, 2003). In

relation to smoking, DeHouwer and colleagues (2006) used the same IAT “approach-avoid” paradigm that has been applied in the alcohol field to examine implicit smoking-approach cognitions. They found that smokers were more likely to approach smoking-related stimuli than avoid them and had significantly higher smoking-approach cognitions compared to non-smokers. However, despite the high level of comorbidity among drinking, nicotine use, and depression, no studies have examined implicit reasons for alcohol use in nicotine users with and without co-occurring MDD histories.

In sum, one hypothesis for the high degree of association among nicotine dependence, MDD and heavy alcohol consumption is the strong paired association that develops between drinking and the alleviation of negative affect associated with features of each disorder. Given that alcohol serves to regulate symptoms associated with both MDD and nicotine withdrawal (Brandon, 1994), it is possible that risky drinking nicotine users who have a comorbid history of MDD would have stronger implicit attitudes to drink, relative to risky drinkers without such comorbidities (Brandon et al., 1996; Wills & Hirky, 1996). As yet, little is known about the implicit drinking motivations that differentiate risky drinking nicotine users with and without MDD. This is unfortunate given that cognitive-behavioral interventions for each behavior (problem drinking, nicotine dependence, MDD) focus on altering maladaptive thought patterns unique to each disorder, but do not often take into account co-morbidities that may impact these thought processes.

The aim of this study was to examine the association of nicotine use to implicit alcohol-approach cognitions in risky drinkers, and compare differences in implicit alcohol cognitions across risky drinking nicotine users and non-users with and without a history of MDD. We hypothesized that risky drinking nicotine users would exhibit significantly stronger implicit desires to drink relative to non-users. We also hypothesized that depression history would moderate the association between nicotine use and implicit alcohol motivations such that nicotine users with a MDD history would show significantly stronger implicit drinking motivations compared to nicotine users without MDD.

2. Methods

2.1. Participants

Participants were 146 risky drinkers (64% male; $n = 94$) recruited from two large universities, located in the southeastern and northeastern United States. Inclusion criteria were: 18 years of age or older ($M = 28.62$, $SD = 9.91$), consumed alcohol at risky levels (at least 4 standard drinks per occasion for men, 3 for women twice per month in the past 90-days), no cocaine or opiate dependence, and not currently in treatment. Half were single (57%, $n = 84$), employed full or part-time (47%, $n = 69$), and White (56%, $n = 82$).

2.2. Measures

2.2.1—Quantity/Frequency Index of Alcohol and Drug Use (Hagman, Noel, & Clifford, 2007) was used to assess quantity and frequency of beer, liquor, and wine. Frequency of non-product specific nicotine use in the past 90-days was also queried and then coded dichotomously into “yes” (1) for any use in the past 90-days or “no” (0) for no use in the past 90-days.

2.2.2—Structured Clinical Interview for DSM-IV (SCID; First, Gibbon, Spitzer, & Williams, 1996) was used to assess lifetime Major Depressive Disorder (MDD). SCIDs were administered by trained interviewers who met weekly with the first author. All cases were reviewed by the first author.

2.2.3—Temptation and Restraint Inventory (TRI; Collins & Lapp, 1992) is a 15-item measure of trait temptation to drink. It has two higher order factors: Cognitive and Emotional Preoccupation (TRI CEP) and Cognitive and Behavioral Control (TRI CBC). The CEP subscale measures the degree to which an individual is fixated on desire or craving to drink. The CBC subscale measures an individual's ability to resist actual drinking behavior. Items are rated on a 9-point Likert scale, ranging from 1 "Never" to 9 "Always". CEP and CBC represent distinct dimensions of drinking restraint and are correlated with different drinking outcomes. CEP has been shown to correlate with dependence severity, while CBC is associated with drinking frequency in heavy/dependent drinkers. (Collins, 1993; Collins & Lapp, 1992; Connor, Gudgeon, Young, & Saunders, 2004, 2007).

2.2.4—Reasons for Alcohol Use Questionnaire (RAUQ; Labouvie & Bates, 2002) is a 29-item, 3-point Likert scale questionnaire (0 = "Not at all" to 2 = "Very important"). The RAUQ yields three dimensions corresponding to social reasons, dis-inhibition reasons, and suppression reasons for drinking. The present study utilized the suppression subscale because it represents items related to the use of alcohol to cope with negative affect and to reduce stress and tension. The suppression subscale has been associated with increases in the intensity of alcohol consumption over time among young adults as well as alcohol-related problems (Labouvie & Bates, 2002).

2.2.5. Implicit Association Task (IAT)—The IAT paradigm was delivered in accordance with the recommendations of Greenwald, Nosek, and Banaji (2003). Participants were presented with word and picture categories on the computer and asked to correctly classify the stimuli into a target category (approach/avoid, alcohol/water) based on pre-defined rules by pressing either the "D" or "K" key on the keyboard. Reaction times for correctly classifying a word were recorded. Stimuli for the IAT consisted of eight approach-related words and eight avoidance-related words, six alcohol picture stimuli (pitcher, bottle, or glass of beer), and six water picture stimuli (pitcher, bottle, or glass of water). Participants had to correctly classify the word or picture before moving on to the next word or picture and could not skip a word (see Appendix A for stimuli).

The IAT paradigm consisted of: (a) a 20-trial target discrimination block (presented on the screen: left = alcohol pictures and right = water pictures); (b) a 20-trial attribute discrimination block (presented on the screen: left = approach words and right = avoid words); (c) a 20-trial practice congruent combination block (left = alcohol pictures + approach words and right = water pictures + avoid words); (d) a 40-trial critical/test block of the same combination in; (e) a 20-trial target discrimination block in which the target categories were reversed (left = water pictures and right = alcohol pictures); (f) an 20-trial practice incongruent combination block (left = water pictures + approach words and right = alcohol pictures + avoid words); and (g) a 40-trial critical/test block of the same combination in (f). The stimuli for the target and attribute discrimination blocks were

presented randomly, and the stimuli for the combination blocks were presented randomly with the restriction that the trials alternated between target and attribute stimuli. Each stimulus was presented twice in the critical combination blocks. Two lead-in trials proceeded each of the critical combination blocks and a 250-ms interval separated each trial after a response was made in all blocks. Two IAT orders were used: one with the alcohol and approach (and water and avoid) combination (the congruent block) presented first and one with the water and approach (and alcohol and avoid) combination (the incongruent block) presented first. IAT order was counterbalanced across participants and error feedback was provided.

2.3. Procedure

After a phone screen, eligible individuals were invited to a 1-hour experimental session, and were instructed not to consume alcohol on that day (to ensure that they were able to consent). Nicotine use prior to the session was not restricted. At the experimental session, written informed consent was obtained after participants demonstrated a BAC of .00, and then participants completed the QFI, SCID, TRI, and RAUQ and engaged in the IAT task, which lasted approximately 10 minutes.² Participants were compensated \$20 at the completion of the study. The study was approved by the university IRB at each institution.

2.4. Data Analysis

2.4.1. IAT Data—IAT data were transformed according to scoring guidelines set forth by Greenwald, Nosek, and Banaji (2003), which uses the *D* measure³. The *D* measure takes into account the number of errors and average response latency to account for general test proficiency and calculates the IAT score by dividing the difference between test block means by the standard deviation of all the response latencies in the two test blocks, thereby yielding a total “reaction time” variable. A larger IAT score reflects a stronger association between alcohol and approach.

No trials were deleted for extremely high or low response times (e.g., greater than 10,000 ms and less than 3,000 ms). An ANOVA indicated that there were differences between the

²Data for the present study were collected as part of a larger study designed to examine the effects of negative and positive mood on alcohol-approach cognitions in risky drinkers. For this larger study, participants were randomly assigned to either a negative or positive mood prime condition by viewing positive or negative picture sets before engaging in the IAT (See Cohn et al., 2012 for more information). Separate one-way ANOVAs revealed no differences between nicotine users and non-users, or between individuals with and without a history of MDD on positive or negative affect before or after the mood manipulation. IAT scores were also unaffected by changes in mood. Therefore, we collapsed across experimental conditions for the present analysis.

³The IAT score was calculated as a difference score between congruent (alcohol-approach/water-avoid block) and incongruent (water-approach/alcohol-avoid block) response times, with larger scores indicating stronger stimulus-affect associations (e.g., approach motivation toward alcohol). Of the seven steps outlined above (a–g), the “practice” steps (steps c and f) and the “test” steps (steps d and g) were utilized in the analysis. Trials were eliminated if there was indication of responding too quickly, anticipation, or if there was an indication of momentary inattention (Greenwald et al., 1998). The next step was to compute the mean of correct latencies for each step. Then, one pooled standard deviation was computed for the “practice” trials in steps c and f, and another for the “test” trials in steps d and g. Next, all error latencies were replaced with its respective step mean + 600 ms. Then, an average of the resulting values for each of the four steps was computed.

After the averages are computed, two difference scores are computed. The first difference that is calculated is for the “practice” trials, the second difference that is calculated is for the “test” trials. The following equations are used to compute the difference scores: (average of step f – average of step c) and (average of step g – average of step d). Next, each difference score is divided by its associated pooled-trials standard deviation that was calculated earlier. Finally, the IAT effect (*D* score) is determined by averaging the two quotients.

congruent first block and incongruent second block, $F(1, 145) = 7.92, p < .01$. Thus, IAT order was used a covariate in regression analyses (below).

2.4.2. Regression Analyses—Hierarchical regression analyses were used to examine the main and interactive association of nicotine use (yes/no) and depression history (yes/no) to implicit alcohol-approach cognitions, controlling for relevant covariates. Variables were entered in a hierarchical fashion to determine amount of variance accounted for by the Nicotine use x MDD history interaction, above and beyond main effects and covariates.

2.4.3. Post-Hoc Exploratory Analyses on Explicit Assessments—We took an approach similar to Ostafin and Palfai (2006) and examined differences between nicotine users and non-users, with and without MDD history on explicit measures of drinking motives (RAUQ-suppression subscale) and temptation to drink (TRI) (both measured before the IAT task) to further explicate the reasons/mechanisms that may link approach-alcohol cognitions to these various groups. To do this, we conducted ANOVA tests comparing group mean differences on the RAUQ and the TRI subscales across nicotine users and non-users and those with and without depression history. We also examined a Nicotine use x MDD history interaction.

3. Results

3.1. Characteristics of the Sample

Participants consumed an average of 6 standard drinks per weekday drinking episode ($SD = 10.92$), and 8 standard drinks per weekend drinking episode ($SD = 9.04$). They drank an average of 44 days out of the 90-day reporting period. Fifty-seven percent of the sample ($n = 83$) reportedly consumed any nicotine in the past 90-days (nicotine users). Nicotine users were significantly more likely to be male ($n = 61$) than non-users, $\chi^2 = 6.96, p < .01$, and were more likely to drink alcohol in greater quantities than non-users, $F(1, 145) = 5.58, p < .05$. As a result, alcohol use quantity and gender were used as covariates in subsequent regression models. Forty-one percent of the sample ($n = 61$) reported an MDD history. No differences across MDD history were found on any demographic factors or nicotine use.

3.2. Regression Analyses

Results revealed a significant Nicotine use x MDD history interaction, ($B = .28, p < .05$), accounting for an additional 3% of the variance in IAT scores above and beyond main and covariate effects (see Table 1). Explication of the interaction showed a positive and significant association between nicotine use and IAT scores among participants with MDD history ($B = .34, p < .01$), and no significant association between nicotine use and IAT scores for those without MDD ($B = .10, p = .50$). The main effect of nicotine use was significant and in the expected direction ($B = .18, p < .01$), while the main effect of MDD history was not ($B = .03, p = .69$).

3.3. Post-Hoc Exploratory Analysis of Reasons for Drinking and Drinking Restraint

Table 2 reports results of the ANOVA tests and Table 3 contains the means and standard for each of the measures across the two experimental groups. We found a significant main effect

of MDD on the RAUQ-suppression subscale ($p < .01$) such that those with MDD history had significantly higher ratings on drinking to suppress negative emotions (drinking to cope) relative to those without MDD history. Nicotine users and non-users were not significantly different from each other on RAUQ suppression scores, and the interaction of MDD history x Nicotine use was not significant.

In terms of group differences on temptation and restraint measures, results showed significant main effects of MDD history ($p < 0.05$) and nicotine use ($p < 0.05$) on the TRI CEP subscale. Nicotine user's ratings of preoccupation with drinking were significantly higher than non-users, and individuals with MDD history also had significantly higher ratings than those without MDD history; no interaction was found. There were no significant main effects or interactions on the drinking restraint subscale (TRI CBC).

4. Discussion

The goal of this study was to examine differences in implicit alcohol-approach cognitions among risky drinking nicotine users and non-users with and without a history of MDD. First, results showed that nicotine use (compared to non-use) was uniquely related to implicit alcohol cognitions, as might be expected based on prior research (Piasecki et al., 2011). Second, as hypothesized, depression history moderated the association between nicotine use and implicit alcohol cognitions. Specifically, alcohol-approach cognitions were stronger among risky drinking nicotine users with a history of MDD and weaker among risky drinking nicotine users without a history of MDD. Interestingly, depression history was not uniquely related to implicit alcohol cognitions; it was only in conjunction with nicotine use that depression history was significantly correlated to implicit motivations to drink. Perhaps nicotine use, which was measured in the past 90-days, was more proximally related to the dependent variable (alcohol cognitions), than depression history, the symptoms of which could have occurred at any point in the participants' lifetime. Finally, post-hoc ANOVAs revealed that nicotine use and MDD history singly, but not in conjunction with each other were associated with a greater emotional preoccupation with drinking. MDD history alone was indicative of higher ratings of using alcohol to suppress negative emotions relative to participants without MDD.

Our results are consistent with negative reinforcement models of addiction (Brandon et al., 1996; Piasecki et al., 2011; Wills & Hirsky, 1996). Over time, negative affect related to nicotine withdrawal and MDD may become paired together with alcohol use in a cognitive network, which automatically trigger the desire to drink when activated. Findings suggest that altering implicit alcohol-related schemas through attention-disengagement training may be a treatment target for nicotine users with depression vulnerability and problem drinking patterns because of the role implicit alcohol cognitions have been shown to play as a risk factor for alcohol consumption (Cohn et al., 2012; Ostafin & Palfai, 2006; Palfai & Ostafin, 2003), coping motives, AUD symptoms, and alcohol craving (Cohn et al., 2012; Ostafin & Palfai, 2006; Palfai & Ostafin, 2003).

There were several limitations of this study. First, causality among variables should be interpreted with caution. It could be that implicit attitudes to drink drive heavy alcohol

consumption, or that implicit cognitions develop as a function of heavy drinking. Additionally, because participants were not in a current state of nicotine withdrawal, one cannot conclude with certainty the role that acute nicotine withdrawal symptoms may play on drinking motivations. Second, this was a secondary analysis of existing data and results may be influenced by factors not included in the dataset, including drink type preference, impulsivity, reward responsivity, tobacco use history/dependence, social smoking status, smoking motivation, and acute nicotine withdrawal (to name a few). Moreover, it could be that regular alcohol and nicotine use lead to greater negative affect vulnerability and thus response to stress over time, which was not assessed in the current study. Third, we did not examine the predictive value of current MDD, which may be more proximally related to alcohol approach-cognitions than lifetime history of MDD, if said cognitions recently developed. Finally, the design of this study did not address underlying biological mechanisms that are potential moderators in the nicotine-alcohol-MDD link (Dani & Harris, 2005).

Findings from this study lay the foundation for developing interventions that capitalize on altering cognitive belief sets that impede cessation efforts among psychiatrically vulnerable groups of nicotine users. Additional empirical investigations are needed to identify differences between various sub-types of nicotine users with and without MDD history and problem drinking profiles in terms of their maladaptive implicit cognitions and adapt “integrated” treatments to suit the specific needs of these subtypes.

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Appendix A

Alcohol Stimuli (Pictures)

Glass of beer
 Bottle of beer
 Pitcher of beer
 Glass and bottle of beer
 Glass and pitcher of beer
 Bottle and pitcher of beer

Approach Stimuli (Words)

Approach
 Closer
 Forward
 Toward
 Near
 Want
 Desire
 Attract

Water Stimuli (Pictures)

Glass of water
 Bottle of water
 Pitcher of water
 Glass and bottle of water
 Glass and pitcher of water
 Bottle and pitcher of water

Avoid Stimuli (Words)

Avoid
 Escape

Avoid Stimuli (Words)

Further

Leave

Flee

Away

Repel

Reject

Highlights

- Risky drinking nicotine users with MDD had strongest implicit drinking motivations
- Risky drinkers without comorbid nicotine and MDD had weakest implicit cognitions
- There was a main effect of nicotine use on alcohol-approach cognitions
- Risky drinking nicotine users with MDD were most likely to report drinking to cope
- Results are consistent with negative reinforcement models of addiction

Figure 1.

Nicotine use x MDD history interaction on IAT scores. Scores closer to zero indicate faster reaction times pairing alcohol pictures with approach words.

Hierarchical Linear Regression for Moderating Effects of MDD History on the Association between Nicotine Use and Implicit Alcohol-Approach Motivations.

Table 1

Step	Variable	B	t	R ² change	F(df)
1					
	IAT Order	0.17	2.60**	0.10**	4.08 (3, 138)
	Alcohol quantity	0.10	2.08*		
	Gender	0.10	1.43		
2				0.05*	4.44 (5, 136)
	IAT Order	0.19	2.90**		
	Alcohol quantity	0.07	1.62		
	Gender	0.06	0.86		
	Nicotine use	0.18	2.68**		
3				0.03*	4.52 (6, 135)
	IAT Order	0.16	2.36*		
	Alcohol quantity	0.10	1.60		
	Gender	0.10	0.95		
	Nicotine use	0.10	0.68		
	MDD history	-0.14	-1.34		
	Nicotine use x MDD history	0.28	2.09*		

Note. Alcohol quantity = past 90-days standard drinks per drinking episode of wine, beer, and liquor; MDD history is coded as 0 for no history of MDD and 1 for history of MDD. Degrees of freedom do not add up to total score due to missing data. Data represent unstandardized regression coefficients.

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

Table 2

Analysis of Variance Results to Test Effects of MDD History and Nicotine Use on Reasons for Alcohol Use Questionnaire (RAUQ) and Temptation and Restraint Inventory (TRI) Ratings.

Measure	Mean squares	<i>F</i> (1, 141)	Partial η^2
RAUQ-suppression subscale			
MDD history	612.37	11.84**	0.077
Nicotine use	72.19	1.40	0.010
Nicotine use x MDD history	30.91	0.60	0.004
TRI CEP subscale			
MDD history	1366.50	4.89*	0.033
Nicotine use	1328.94	4.75*	0.033
Nicotine use x MDD history	22.82	0.08	0.001
TRI CBC subscale			
MDD history	0.01	<0.00	<0.000
Nicotine use	136.78	1.30	0.009
Nicotine use x MDD history	8.00	0.08	0.001

Note. CEP = Cognitive emotional preoccupation; CBC = Cognitive behavioral control

*
 $p < .05$

**
 $p < .01$

Table 3

Means (and standard deviations) for Reasons for Alcohol Use Questionnaire (RAUQ) and Temptation and Restraint Inventory (TRI) Ratings by MDD History and Nicotine Use.

	<u>Nicotine Use</u>		
<u>MDD History</u>	<u>Non-User</u>	<u>User</u>	<u>Total</u>
RAUQ-suppression subscale			
No MDD History	6.00 (6.18)	8.39 (6.73)	7.39 (6.57)
MDD History	11.15 (7.52)	11.65 (8.44)	11.43 (7.98)
Total	8.24 (7.21)	9.72 (7.60)	
TRI CEP subscale			
No MDD History	24.06 (13.08)	31.06 (16.25)	28.14 (15.32)
MDD History	31.15 (16.24)	36.53 (20.67)	34.15 (18.88)
Total	27.15 (14.84)	33.30 (18.27)	
TRI CBC subscale			
No MDD History	16.94 (8.32)	18.45 (10.40)	17.82 (9.57)
MDD History	16.44 (11.64)	18.91 (10.68)	17.82 (11.09)
Total	16.73 (9.82)	18.64 (10.45)	

Note. SD = standard deviation; CEP = Cognitive emotional preoccupation; CBC = Cognitive behavioral control