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Negative Urgency, Distress Tolerance, and Substance Abuse Among College Students

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Abstract

Objective—Negative affect has been consistently linked with substance use/problems in prior research. The present study sought to build upon these findings by exploring how an individual's characteristic responding to negative affect impacts substance abuse risk. Trait negative affect was examined in relation to substance abuse outcomes along with two variables tapping into response to negative affect: Distress Tolerance, an individual's perceived ability to tolerate negative affect, and Negative Urgency, the tendency to act rashly while experiencing distress.

Method—Participants were 525 first-year college students (48.1% male, 81.1% Caucasian), who completed self-report measures assessing personality traits and alcohol-related problems, and a structured interview assessing past and current substance use. Relations were tested using Zero-Inflated Negative Binomial regression models, and each of the personality variables was tested in a model on its own, and in a model where all three traits were accounted for.

Results—Negative Urgency emerged as the best predictor, relating to every one of the substance use outcome variables even when trait negative affect and Distress Tolerance were accounted for.

Conclusions—These findings suggest that Negative Urgency is an important factor to consider in developing prevention and intervention efforts aimed at reducing substance use and problems.

Keywords

negative urgency; substance abuse; distress tolerance; negative affect; alcohol

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Contributors

Ms. Kaiser and Drs. Milich and Lynam designed the study. Ms. Kaiser and Dr. Charnigo conducted the statistical analyses. Ms. Kaiser conducted literature searches and wrote the first draft of the manuscript, and Drs. Milich, Lynam and Charnigo provided feedback and revisions. All authors have approved of the final manuscript.

Conflict of Interest

All authors declare that they have no conflicts of interest.

1. Introduction

The experience of negative affect is associated with a variety of maladaptive outcomes, including substance abuse and problems. In considering the relation between negative affect and problematic substance use, the specific operationalizations of negative affect have varied [e.g. personality traits, DSM-IV (Diagnostic and Statistical Manual, American Psychiatric Association 2000) diagnoses and symptoms] but the general conclusion remains the same: higher levels of negative affect are associated with increased risk. For example, the Five-Factor Model domain of Neuroticism, which encompasses the tendency to experience a variety of negative affective states (e.g. anxiety, depression, anger), has been found in meta-analyses to be associated with alcohol involvement and alcohol related problems (Malouff, Thorsteinsson, Rooke, & Schutte, 2007) and with DSM-IV substance use disorders (Kotov, Gamez, Schmidt, & Watson, 2010). Substance abuse and problems have been found to co-occur with both mood (Grant, 1995; Grant et al., 2004) and anxiety disorders (Compton, Thomas, Stinson, & Grant, 2007; Grant et al., 2004).

As illustrated above, negative affect is not a single trait, but rather appears to be a multidimensional construct. For example, one can refer to negative emotional states (e.g. sadness, anger) or to more enduring personality characteristics, like Neuroticism. Within the broad domain of negative affect, one useful factor to examine in relation to substance use and problems may be how the individual responds to feelings of distress. It may be the case that how individuals respond to negative affect provides additional predictive information beyond knowing the degree to which they tend to experience such affect. Indeed, it seems likely that some individuals may be more prone to engaging in maladaptive coping strategies, while other individuals may be more likely to respond to negative affect in adaptive ways. Consistent with this idea, prior research has identified relations between different ways of responding to negative affect and substance use problems. For example, in a meta-analysis of 114 studies examining the link between emotion regulation strategies and psychopathology, rumination and emotion suppression were found to relate to substance use disorders, while acceptance and reappraisal strategies did not (Aldao, Nolen-Hoeksema, & Schweizer, 2010). These findings suggest that, in predicting problematic substance use, it is useful to look not only at levels of negative affect, but also at variation in how an individual responds to feelings of distress.

1.1. Distress Tolerance

Traits tapping into individual differences in responding to negative affect have been identified, and these traits have demonstrated relations with negative outcomes, including substance use and problems. One potentially useful affective response variable is Distress Tolerance, which is generally understood as an individual's ability to tolerate unpleasant internal states (e.g., Zvolensky, Vujanovic, Bernstein, & Leyro, 2010). Within the literature, Distress Tolerance has been understood in different ways, and is sometimes considered to encompass tolerance of a variety of negative internal states, including negative emotion, ambiguity, uncertainty, frustration and physical discomfort (Zvolensky et al., 2010). In considering the negative affect-substance use relation, examining an individual's ability to tolerate negative affect (as opposed to various other unpleasant states) may be most relevant. This conceptualization of Distress Tolerance seems to be captured well by the Distress Tolerance Scale (DTS), a self-report measure that assesses an individual's perceived ability to tolerate negative emotional states (Simons & Gaher, 2005). Individuals with low levels of Distress Tolerance as indicated by the DTS tend to experience negative affect as intense, disruptive, and unacceptable, and tend to engage in behaviors aimed at reducing feelings of distress. It has been suggested that low levels of trait Distress Tolerance may potentially lead to negative outcomes (e.g. substance abuse) as individuals attempt to use maladaptive behaviors to cope with negative affect (Simons & Gaher, 2005). Consistent with this

understanding, low levels of Distress Tolerance as measured by the DTS have demonstrated relations with a number of problematic substance use outcomes, including coping motives for substance use (i.e. using substances as a means of coping with negative affect) (Simons & Gaher, 2005; O’Cleirigh, Ironson, & Smits, 2007; Zvolensky et al., 2009), alcohol related problems (Simons & Gaher, 2005), alcohol and marijuana use among college students (Buckner, Keough, & Schmidt, 2007) and alcohol and cocaine use among HIV positive individuals (O’Cleirigh et al., 2007). It is important to note that the conceptualization of Distress Tolerance measured by the DTS is not the only conceptualization. Behavioral measures such as the computerized Paced Auditory Serial Addition Task (PASAT; Lejuez, Kahler, & Brown, 2003) and breath-holding (e.g., Brown, Lejuez, Kahler, & Strong, 2002; Hajek, Belcher, & Stapleton, 1987) have also been used as indicators of Distress Tolerance. Studies examining self-report versus behavioral measures have found a lack of overlap (Marshall-Berenz, Vujanovic, Bonn-Miller, Bernstein, & Zvolensky, 2010; McHugh et al., 2011) suggesting that distinct constructs are being assessed with different measures of Distress Tolerance.

1.2. Negative Urgency

A second variable tapping into an individual’s response to negative affect is Negative Urgency, one of five distinct pathways to impulsive behavior assessed by the UPPS Impulsive Behavior Scale (Whiteside & Lynam, 2001; Lynam, Smith, Whiteside, & Cyders, 2006). Negative Urgency refers to an individual’s tendency to engage in impulsive behavior while experiencing feelings of distress, and has been linked with a number of problematic behaviors in prior research, including bulimic symptoms (Anestis, Selby, & Joiner, 2007), risky sexual behavior (Simons, Maisto, & Wray, 2010), and pathological gambling (Fischer & Smith, 2008). Similarly, Negative Urgency has also demonstrated a consistent relation with substance use and problems. In a study comparing substance dependent individuals to non-dependent controls, of the four UPPS facets, Negative Urgency differed most between the two groups and was the best predictor of various problems among the substance dependent individuals (Verdejo-García, Bechara, Recknor, & Pérez-García, 2007). Another study found that women diagnosed with alcohol dependence had significantly higher levels of Negative Urgency compared to both a control group of women, and a group of women diagnosed with depression (Settles et al., 2012). Negative Urgency has also been found to relate to alcohol use and alcohol related problems (Fischer, Anderson, & Smith, 2004; Magid & Colder, 2007; Settles, Cyders, & Smith, 2010), cigarette smoking (Miller, Flory, Lynam, & Leukefeld, 2003) and illegal drug use (Settles et al., 2012).

In considering how Negative Urgency relates to substance abuse and other risky behaviors, at least two distinct mechanisms are possible. Similar to Distress Tolerance, it has been suggested that Negative Urgency leads to maladaptive behavior as individuals attempt to cope with negative affect (e.g., Fischer et al., 2004); however, a second possibility is that, rather than impulsive behavior being an instrumental response, Negative Urgency instead involves the disruption of behavioral constraint by negative affect.

Although the other impulsive personality traits assessed by the UPPS-P have also been found to relate to substance use and problems in prior research (Cyders, Flory, Rainer & Smith, 2009; Lynam & Miller, 2004; Magid & Colder, 2007; Miller et al., 2003; Settles et al., 2010), Negative Urgency was of particular interest for the present study based on its conceptual relation with negative affect. Negative Urgency is the only one of the five UPPS-P facets that by definition occurs in the context of negative emotion, suggesting that it may be the most relevant for understanding the negative affect-substance use relation. Additionally, previous research suggests that Negative Urgency is more related to substance related problems (as opposed to substance use frequency) than the other personality traits assessed by the UPPS-P (Verdejo-García et al., 2007).

1.3. Cognitive versus Behavioral Responding to Negative Affect

In trying to better understand the relation between negative affect and problematic substance use, both Negative Urgency and Distress Tolerance seem to be useful variables to consider, as both have demonstrated relations with substance abuse and problems. Additionally, both traits appear to represent maladaptive responding to negative affect, and it may be the case that this response tendency contributes to the link between the experience of negative affect and problematic outcomes like substance abuse. However, despite their conceptual similarity, what makes these two variables particularly interesting to study together is the conceptual distinction between them. One main difference between the two appears to be the mode of responding, with Distress Tolerance representing a mainly cognitive response and Negative Urgency representing a behavioral response. Although Distress Tolerance does include a behavioral component, specifically behaviors aimed at regulating negative affect, the other three components assessed by the Distress Tolerance Scale—an individual's appraisal of the experience of negative affect, his or her perceived ability to tolerate negative affect, and how absorbing the experience of distress is—are purely cognitive. Thus, mode of responding may be an important distinction between the two variables. As mentioned earlier, the conceptualization of Distress Tolerance assessed by the DTS is not the only one. Thus, it is important to note that, while the characterization of Distress Tolerance as a primarily cognitive response is applicable to Distress Tolerance as measured by the DTS, it is not equally fitting for other conceptualizations. For example, Distress Tolerance as indicated by task performance (e.g., the PASAT; Lejuez et al., 2003) clearly includes a significant behavioral component, and therefore does not seem to be primarily cognitive.

Additionally, although Distress Tolerance as measured by the DTS includes a behavioral component, the specific behavior is undefined. It may be the case that this action is impulsive or risky, for example engaging in heavy substance use, however it is also possible that this action may be neutral or even adaptive, for example leaving an upsetting situation. On the other hand, Negative Urgency by definition implies impulsive, potentially risky behavior. Thus, a second important distinction between the two variables seems to be the role of impulsivity; that is, whether impulsivity is the defining feature (Negative Urgency) or if it is instead a potential correlate of a more general cognitive response (Distress Tolerance). The inclusion of impulsivity in Negative Urgency seems particularly important, as impulsivity has been extensively linked to substance use in past literature (e.g., Horvath, Milich, Lynam, Leukefeld, & Clayton, 2004; Lynam & Miller, 2004).

1.4. The Role of Responding in Substance Abuse Risk

To our knowledge, no prior studies have examined Distress Tolerance and Negative Urgency together in the prediction of substance abuse. Doing so may serve a number of purposes. At a general level, it may allow for a better understanding of how individuals' characteristic responding to negative affect may lead to differences in substance abuse risk, thus contributing to a better understanding of why individuals who tend to experience negative affect are also more likely to experience substance abuse problems. Similarly, if it is the case that characteristic responding provides information beyond the tendency to experience negative affect, it may be possible to better identify and intervene with at-risk individuals.

Examining Distress Tolerance and Negative Urgency together may also allow for a better understanding of each trait and the mechanisms linking them to risky behaviors like substance use. Research on the relation between Distress Tolerance, as measured by the DTS, and maladaptive outcomes such as problematic substance use is unfortunately limited, and thus the current study will contribute to further knowledge in this area. Additionally, as pointed out by Leyro, Zvolensky, and Bernstein (2010), the relations between Distress

Tolerance and conceptually similar constructs need to be further explored in order to better understand the relation between Distress Tolerance and psychopathology. Thus, the current study can contribute more generally to our understanding of Distress Tolerance and the processes linking it to outcomes of interest. Similarly, the present study will also allow for a better understanding of Negative Urgency. As pointed out above, it has been suggested that Negative Urgency represents a maladaptive means of coping with negative affect, and it may be the case that both Negative Urgency and Distress Tolerance increase risk by increasing the probability that an individual will use substances as a means of coping. On the other hand, the mechanisms through which each trait leads to problematic substance use may differ if Negative Urgency instead involves a disruption of behavioral constraint. By examining the two traits together, we may begin to gain a better understanding of how high levels of Negative Urgency put individuals at an increased risk for problematic substance use.

1.5. The Current Study

The main purpose of the present study is to examine whether characteristic responding to negative affect allows for improved prediction of substance abuse risk beyond trait negative affect. Doing so will allow for a better understanding of the mechanisms linking Negative Urgency and Distress Tolerance to substance use behaviors, and can contribute more generally to our understanding of how negative affect impacts substance use behaviors. Two specific questions will be examined.

1. How do trait negative affect (i.e. Neuroticism) and characteristic responding (i.e. Distress Tolerance and Negative Urgency) relate to a variety of substance use outcomes? It is expected that all three of these constructs will be related to substance use/problems based on prior research findings. Additionally the relations of the three traits to substance abuse outcomes will be compared in order to determine whether one is a stronger predictor.
2. When Neuroticism, Distress Tolerance, and Negative Urgency are all included in a model, how does each contribute to substance use outcomes? Answering this question will provide information on whether one or more of the variables have predictive ability above and beyond the other(s).

2. Methods

2.1. Participants

Participants were 525 first-year college students (48.1% male; mean age = 18.95 years, $sd = 0.77$; 81.1% Caucasian, 12.4% African-American, 2.5% Asian, 1.5% Hispanic/Latino, 1.9% Biracial, 0.2% American Indian/Alaska Native, 0.2% Native Hawaiian/Pacific Islander, 0.2% Other), recruited from the introductory psychology subject pool. In examining factors that put individuals at risk for substance abuse and problems, a college-aged sample seems to be particularly useful because of the high rates of substance use among young adults (e.g. Substance Abuse and Mental Health Services Administration, 2007). Additionally, the transition to college life may be the first time in which many individuals have such a high degree of autonomy, and are able to make independent decisions regarding substance use.

“High risk” participants were oversampled to ensure sufficient variability in substance use, and made up 23.1% of the sample. Screening procedures are described in more detail below. Although these “high risk” subjects were specifically invited to participate, any first-year student enrolled in introductory psychology was eligible to participate. To enroll in the study, students signed up using an online recruitment system.

2.2. Screening Procedure

Students in introductory psychology courses were administered a screening questionnaire during a mass screening, which took place in each of the introductory psychology classes during the first two weeks of the semester. The screening measure consisted of 3 demographic items, and 19 items on which participants were asked to indicate their agreement using a dichotomous rating form (“yes” or “no”). Twelve of these 19 items assessed antisocial or delinquent behaviors, such as skipping school, stealing, lying and participating in physical fights. Seven of the items assessed positive or neutral behaviors, such as volunteering, babysitting and traveling to another country. Additionally, participants were asked to indicate their gender, race and home state and county. A composite based on responses to the twelve delinquent items was used to determine the distribution of scores for predicted substance use risk, and the males and females whose scores fell within the top 25% for their gender were invited to participate through email. The goal of the screening procedure was to ensure that the sample contained enough participants with high levels of substance use in order to have sufficient variability to answer the research questions of interest. Delinquent behavior during adolescence was used to identify “high risk” participants based on previous research findings linking disruptive behavior in childhood and adolescence with later substance use and abuse (e.g., Harford & Muthén, 2000; Kuperman et al., 2001). It should be noted that the participants identified as “high risk” were not clinically diagnosed as antisocial, but rather reported higher levels of delinquent behavior relative to their peers.

2.3. Procedure

Participants were administered the experiment individually, with the whole protocol lasting between two and three hours. At the beginning of the session, a saliva drug test and a field sobriety test were administered. The saliva drug screens tested for the presence of methamphetamine, cocaine, benzodiazepines, marijuana, and opiates, and yielded a dichotomous outcome of either positive or negative (a line in a test panel indicated that the substance was not present). During the field sobriety test, participants were asked to walk forward and backward in a straight line (“heel to toe”), touch their noses with their eyes closed, and count backward from 100 by 5s. Research assistants observed for signs of impairment. Participants whose results indicated the presence of alcohol or drugs were not allowed to continue, as substance use could have impacted performance on behavioral tasks, and were asked to reschedule. Two participants in total were asked to reschedule based on a positive drug screen, and none was asked to reschedule based on performance on the sobriety test.

Next, participants completed computer-based questionnaires, computer-based behavioral tasks, and a structured interview assessing their substance use. Questionnaires and tasks were alternated during the protocol, so as to minimize participant boredom. A five-minute break was given at the halfway point in the study. At the end of the session, participants were given a debriefing form, which provided information regarding the purposes of the study. In exchange for their participation, subjects received three hours of research credit for their psychology class and \$30.

The current study is part of a larger project, and additional questionnaires and tasks were administered that are not relevant to the current research questions. Thus, these questionnaires and tasks are not listed here, but are available upon request. The project has been approved by the Institutional Review Board (IRB) of the University of Kentucky.

2.4. Measures

2.4.1. UPPS-P Impulsive Behavior Scale—The UPPS-P Impulsive Behavior Scale (Lynam et al., 2006) is a 59-item measure that assesses five pathways to impulsive behavior: Negative Urgency, Positive Urgency, (lack of) Premeditation, (lack of) Perseverance, and Sensation Seeking. Negative Urgency refers to the tendency to act rashly when experiencing distress, possibly as a way of alleviating negative affect (e.g. “When I feel bad, I will often do things I later regret in order to make myself feel better now”). Participants are asked to rate their agreement with each statement using a four point Likert scale, with agree strongly at one end and disagree strongly at the other. Participant scores on the Negative Urgency subscale were of interest for the present study. Reliability for Negative Urgency in the sample was good, with an internal consistency alpha of .882.

2.4.2. Distress Tolerance Scale—The Distress Tolerance Scale (DTS), developed by Simons and Gaher (2005), is a self-report measure consisting of fifteen items on which participants are asked to rate their agreement using a five-point Likert scale, with responses ranging from strongly agree to strongly disagree. Four facets of Distress Tolerance are assessed: Tolerance (e.g. “Feeling upset is unbearable to me”), Appraisal (e.g. “Being distressed or upset is always a major ordeal for me”), Absorption (e.g. “My feelings of distress are so intense that they completely take over”) and Regulation (e.g. “When I feel distressed or upset, I must do something about it immediately”). Reliability estimates for the subscales in the present sample were good, with internal consistency alphas ranging from .783 to .845. For the current study, the total DTS score made up of all four subscales was used for analyses. Reliability of the overall scale was good, with an internal consistency alpha of .922.

2.4.3. Five Factor Model Rating Form—The Five Factor Model Rating Form (FFMRF) (Mullins-Sweatt, Jamerson, Samuel, Olson, & Widiger, 2006) was developed as a brief measure of the Five-Factor Model. It assesses the same five domains and 30 facets measured by the NEOPI- R (Costa & McCrae, 1992) using only 30 items, with each item representing one of the facets. The measure has been found to have good convergent and divergent validity (Mullins-Sweatt et al., 2006). Within the present study, scores on the Neuroticism domain, which assesses the general tendency to experience negative affect, were of interest. Neuroticism scores were made up of scores on six items, each representing one of the six Neuroticism facets (Anxiety, Angry Hostility, Depression, Self-Consciousness, Impulsiveness and Vulnerability). Although Impulsiveness is conceptually similar to Negative Urgency, as it gets at an individual’s ability to resist strong urges, it was left in for the analyses in order to ensure that the Neuroticism was fully represented.¹ Reliability of the Neuroticism scale in the present sample was satisfactory, with an internal consistency alpha of .725.

2.4.4. Alcohol Use Disorders Identification Test—The Alcohol Use Disorders Identification Test (AUDIT; Babor, Higgins-Biddle, Saunders, & Monteiro, 2001) is a screening instrument for identifying individuals at risk for hazardous drinking. It consists of 10 questions that produce a composite score representing the individual’s risk. Questions assess alcohol consumption (e.g. “How often do you have a drink containing alcohol?”), drinking behavior (e.g. “How often during the last year have you found that you were not able to stop drinking once you had started?”), adverse psychological reactions (e.g. “How

¹Due to conceptual overlap between the items assessing Neuroticism and Negative Urgency, correlations between the individual items and overall scores for both variables were examined. All of the values of the correlations across the scales (individual items with individual items, and individual items with total scores) were lower than the overall correlation of Neuroticism and Negative Urgency, and thus it seemed acceptable to leave in all items for the analyses.

often during the last year have you been unable to remember what happened the night before because of your drinking?") and drinking-related consequences (e.g. "Have you or someone else been injured as a result of your drinking?"). For eight of the questions, participants are asked to rate frequency on a five-point scale. For the remaining two questions, which assess the presence of drinking-related consequences, participants are asked to select a response from a three-point scale. The minimum and maximum scores on the full AUDIT scale are zero and 40 respectively, with a score of 8 or above indicating a strong likelihood of harmful or hazardous drinking. In the present study, the AUDIT composite score was used as an outcome measure of problematic drinking. In the present sample, the AUDIT was found to have good reliability, with an internal consistency alpha of .793.

2.4.5. Life History Calendar—The Life History Calendar (LHC; Caspi, Moffitt, Thornton, & Freedman, 1996) is a method used to obtain reliable retrospective data regarding life events, and can be modified to fit the purpose of an individual study. In the present research, it was utilized to assess participants' usage of different types of substances: tobacco, alcohol, marijuana, cocaine, inhalants, amphetamines, acid/LSD, ecstasy/MDMA and club drugs. The LHC was filled out in collaboration with an experimenter, and was formatted as a large grid, with columns representing four-month periods of time, and the rows representing the various substances. In the present study, the LHC was presented in a computerized format. The LHC assessed time periods beginning with the participant's 7th grade year, and continuing to the present day. Participants were first asked to provide information on where they were living and whom they were living with for the various time periods. They were then asked about whether they had used the various substances and the time periods during which they had used them, as well as questions assessing frequency of use, average amount used, and highest amount used. In the present study, participants' average weekly alcohol, marijuana, and tobacco use for the current time period were of interest. Average weekly use was calculated by multiplying the participant's reported weekly frequency (number of occasions using a given substance during an average week) by the reported average amount during a day in which the substance is used (in number of drinks, "hits," or cigarettes). For participants who reported use that was less than weekly, frequency was converted in to a decimal value. For example, for a participant who reported using alcohol once a month, drinking frequency was coded as 0.25 times per week. Also of interest was the total number of hard drugs (illegal drugs not including marijuana) tried across the lifetime. Hard drugs were combined into a composite variable in order to ensure adequate variability, as only a small proportion of participants reported using any one of the substances.

3. Results

3.1. Preliminary Data Analyses

Descriptive statistics were calculated for each of the substance use variables. Table 1 lists the means and standard deviations for each of the substance use variables for the whole sample, and for males, females, African-American participants, and Caucasian participants. Table 2 lists the percentage of the whole sample, and of the male, female, African-American, and Caucasian participants, who reported current use of alcohol, marijuana, and tobacco, and who reported any hard drug use (illegal drugs other than marijuana). Next, the variables of interest were first correlated in order to examine how they relate to one another (see Table 3). As was expected, both Negative Urgency ($r = .51, p < .001$) and Distress Tolerance ($r = -.46, p < .001$) were found to significantly relate to Neuroticism. Negative Urgency and Distress Tolerance also demonstrated significant association with one another ($r = -.47, p < .001$), as was predicted based on their conceptual similarity. As can be seen in Table 1, the correlations of the personality variables of interest (Negative Urgency, Distress

Tolerance, and Neuroticism) to AUDIT total scores are larger in magnitude than the correlations between the personality variables and average weekly alcohol use. Negative Urgency's correlations with each of the substance use variables also are larger in magnitude than those of Distress Tolerance and Neuroticism. Differences in correlations were tested for statistical significance using a Z-test (Steiger, 1980). For each of the personality variables, the correlations with AUDIT scores and average weekly alcohol use were found to be statistically different. Negative Urgency's correlations were found to be significantly larger in magnitude than Distress Tolerance's and Neuroticism's for all five substance abuse variables.

3.2. Overview of Main Analyses

Zero-Inflated Negative Binomial regression models were used (Hall, 2000) to examine the relations of the personality variables to the substance use outcomes. All of the analyses controlled for participant race and gender. Dummy-coded variables for gender (female—yes/no), Caucasian status (yes/no), and African-American status (yes/no) were entered in as predictors in each analysis.² Caucasian and African-American were the only races controlled for due to the small numbers of participants of other races in the sample. In the first set of analyses, one of the centered predictor variables (Neuroticism, Negative Urgency, or Distress Tolerance) was entered into a model along with race and gender. In the second set, all three centered predictor variables were entered into a model simultaneously with race and gender. Analyses were completed in SAS PROC COUNTREG, and hypotheses were tested with a significance level of .05.

Unlike a coefficient in a standard regression model, which represents the additive change in the dependent variable based on a one-unit increase in an independent variable, the coefficient in a negative binomial regression model represents, after exponentiation, the multiplicative change in the dependent variable. Symbolically:

$$\text{Exponential (coefficient)} = \frac{\text{Mean DV value when IV of interest is 1}}{\text{Mean DV value when IV of interest is 0, holding fixed all other IVs}}$$

Thus, if the exponentiated coefficient is equal to 1, this suggests no change in the mean value of the dependent variable when the value of the independent variable increases from 0 to 1. An exponentiated coefficient equal to 1.5 would indicate that as the independent variable value increases from 0 to 1, the dependent variable mean increases by 50%, while one equal to .5 would indicate a 50% decrease in the dependent variable mean. When the model includes more than one independent variable, the above interpretations assume that the other independent variables are held constant. Also, the above interpretations hold true with IV values of 1 and 2, or −1 and 0, or more generally any two IV values differing by one unit.

To facilitate interpretation of the results, we present exponentiated coefficient estimates in Table 4. Entries are the estimated factors by which the mean substance use outcome score changes when the corresponding independent variable increases by one unit. Numbers in brackets are 95% confidence intervals. For each substance use outcome variable, numbers in the first row do not adjust for other independent variables, while numbers in the second row do. In considering these estimates, it is important to keep in mind that the three predictor variables had different ranges of scores. Before centering, Neuroticism had a range of 1 to 4.5 ($M = 2.46$, $SD = 0.61$) Negative Urgency had a range of 12 to 47 ($M = 26.76$, $SD =$

²Correlations for demographic characteristics and substance use outcomes were tested in preliminary analyses. Being Caucasian was positively associated with AUDIT scores and average weekly alcohol use. Being African-American was negatively associated with AUDIT scores and average weekly alcohol use, and positively associated with average weekly marijuana use. Being female was negatively associated with average weekly alcohol use and average weekly marijuana use.

6.65), and Distress Tolerance had a range of 1 to 5 ($M = 3.39$, $SD = 0.79$). This implies that conceptually one-unit changes in the variables have different meanings; for example, a one-unit difference in Negative Urgency scores represents a smaller difference in the level of the trait than a one-unit difference in Distress Tolerance scores. To convert an estimate in Table 4 to apply to a C-unit rather than 1-unit change in a predictor, where C is an arbitrary positive number, simply take the estimate in Table 4 and raise it to the C power. This also applies to the 95% confidence limits.

3.3. AUDIT Scores

When entered into the model separately, all three variables were significant predictors, such that the mean AUDIT score was estimated to increase by 21% for each one-unit increase in Neuroticism ($p < .001$), increase by an estimated 4% for every one-unit increase in Negative Urgency ($p < .001$), and decrease by an estimated 15% for each one-unit increase in Distress Tolerance ($p < .001$). When all three variables were entered simultaneously, only Negative Urgency was a significant predictor of AUDIT total scores, such that the mean AUDIT score was estimated to increase by 4% for each one-unit increase in Negative Urgency ($p < .001$) when results were adjusted for Neuroticism and Distress Tolerance scores.

3.4. Average Weekly Alcohol Use

When entered individually into the model, Negative Urgency was a significant predictor of average weekly alcohol use, such that the mean number of drinks per week was estimated to increase by 4% for every one-unit increase in Negative Urgency ($p < .001$), while Neuroticism and Distress Tolerance were not significant predictors. When entered simultaneously, only Negative Urgency was a significant predictor, such that the mean number of drinks per week was estimated to increase by 6% for every one-unit increase in Negative Urgency ($p < .001$).

3.5. Average Weekly Marijuana Use

When each independent variable was entered into the model separately, Negative Urgency and Neuroticism were both significant predictors, such that the mean amount of marijuana used per week was estimated to increase by 14% for every one-unit increase in Negative Urgency ($p < .001$) and by 76% for every one-unit increase in Neuroticism ($p = .048$). When all three variables were entered simultaneously, Negative Urgency was the only significant predictor. It was estimated that the mean amount of marijuana used per week increased by 17% for every one-unit increase in Negative Urgency ($p < .001$) when scores adjusted for levels of Distress Tolerance and Neuroticism.

3.6. Average Weekly Tobacco Use

When entered into the model separately, all three variables were significant predictors, with the mean amount of tobacco used per week estimated to increase by 249% for every one-unit increase in Neuroticism ($p = .001$), increase by 11% for every one-unit increase in Negative Urgency ($p < .001$), and decrease by 48% for every one-unit increase in Distress Tolerance ($p = .013$). When all three variables were entered into the model together, Negative Urgency was the only significant predictor of the three, with mean amount of tobacco used per week estimated to increase by 11% for every one-unit increase in Negative Urgency ($p = .003$).

3.7. Total Number of Hard Drugs Tried

When entered into the model separately, all three variables were significant predictors of the total number of hard drugs tried, such that the mean number of hard drugs tried was estimated to increase by 55% for every one-unit increase in Neuroticism ($p = .002$), increase

by 7% for every one-unit increase in Negative Urgency ($p < .001$), and decrease by 33% for every one unit increase in Distress Tolerance ($p < .001$). When all three variables were entered together, only Negative Urgency was a significant predictor, such that the mean number of hard drugs tried was estimated to increase by 7% for every one-unit increase in Negative Urgency ($p < .001$).

4. Discussion

The overall aim of the present research was to examine whether knowing how an individual tends to respond to distress enables better prediction of substance abuse risk than only knowing an individual's level of trait negative affect (i.e. Neuroticism). Consistent with prior research (e.g., Buckner et al., 2007; Kotov et al., 2010; Settles et al., 2010), Neuroticism, Negative Urgency, and Distress Tolerance all demonstrated significant relations with substance use outcomes. Distress Tolerance and Neuroticism performed fairly similarly in the present study, relating to alcohol problems and the total number of hard drugs tried. Neuroticism also related to average weekly tobacco use. Neither Neuroticism nor Distress Tolerance was associated with any of the substance use outcomes when results were adjusted for the other two variables. Negative Urgency was the only one of the three personality variables examined to achieve statistical significance as a predictor of all of the substance use outcome variables when examined alone and when entered in to a ZINB model with Distress Tolerance and Neuroticism. These results are consistent with the idea that it is important not only to consider an individual's tendency to experience negative affect, but also his or her characteristic responding, in relation to substance abuse risk. More specifically, knowing that an individual tends to respond to negative affect with rash behavior provides more information than only knowing that the individual tends to experience negative affect frequently. It is perhaps not surprising that this is the case, given that both negative affect and disinhibition increase substance abuse risk, and Negative Urgency integrates components of both. Negative Urgency's significant relations with a variety of substance use outcomes is consistent with prior findings demonstrating its relation with alcohol use (Fischer et al., 2004; Fischer & Smith, 2008), cigarette smoking (Miller et al., 2003), illegal drug use (Settles et al., 2012), and substance dependence (Verdejo-Garcia et al., 2007). Negative Urgency's prediction of substance use risk above and beyond trait negative affect is consistent with a recent study which found that, whereas women diagnosed with alcohol dependence do not differ from women diagnosed with depression on trait anxiety and trait depression, they are significantly higher on Negative Urgency (Settles et al., 2012).

The present findings also suggest that when considering the relation between characteristic responding to negative affect and substance abuse risk, response mode matters. Negative Urgency related to all substance use outcomes, whereas Distress Tolerance did not. This suggests that knowing an individual's typical external, behavioral response to negative affect (i.e. Negative Urgency) provides more predictive information than knowing his or her typical internal, cognitive response (i.e. Distress Tolerance). This finding makes sense, given that individuals with a similar cognitive response may nonetheless behave in any number of ways. Although Distress Tolerance is conceptualized as including efforts to reduce or avoid distress (i.e. the Regulation subscale), within the construct there is still room for substantial variability in behavior (e.g. drug use versus leaving a distressing situation). In contrast, Negative Urgency by definition includes impulsive action. For college students, this impulsive action may manifest as substance use, as alcohol and drugs may be readily available and socially acceptable.

4.1. Clinical Implications

The findings of the present study may inform prevention and intervention efforts for individuals experiencing or at risk for substance use disorders. One implication is that, when considering an individual's level of risk, it may be important to take into account not only level of trait negative affect, but also characteristic responding. Within the realm of responding, Negative Urgency seems to be particularly important based on the current findings, and recent work linking Negative Urgency to substance use disorders (Settles et al., 2012; Verdejo-García et al., 2007). In the present study, Negative Urgency was the only one of the three personality variables to achieve statistical significance as a predictor for all of the outcome variables, both when considered alone and when entered in a ZINB model with Neuroticism and Distress Tolerance. This finding makes sense given Negative Urgency's inclusion of impulsivity and the consistent link between impulsive personality traits and problematic substance use in prior research (e.g., Horvath et al., 2004; Lynam & Miller, 2004).

How might knowledge of the impact of Negative Urgency on substance use and problems inform prevention or mental health treatment? In order to best answer this question, it seems necessary to better understand how Negative Urgency leads to impulsive behavior in the moment. Although past research consistently links Negative Urgency with risky behavior, it is unclear why negative affect causes individuals high in the trait to act rashly. It may be the case that these individuals engage in risky behaviors (e.g. substance use, risky sexual behavior) as a means of coping with negative affect. On the other hand, impulsive action may not serve a coping purpose, but may instead be a result of negative affect interfering with other cognitive processes, for example evaluating risk. It seems important to understand the process or processes through which Negative Urgency impacts behavior under conditions of negative affect, as treatment implications for individuals high in Negative Urgency may differ. If Negative Urgency represents the use of risky behavior as a way of coping with or reducing negative affect, it may be helpful to work on alternative coping strategies as a means of reducing problem substance use. On the other hand, if these individuals have difficulty engaging in certain cognitive processes while distressed, it may be beneficial to work with them on becoming more mindful of emotions and impulses (e.g. Witkiewitz & Bowen, 2010) or on problem-solving skills.

4.2. Limitations and Future Direction

The present study had several limitations that should be addressed in future research. The sample lacked racial and ethnic diversity, making it important to replicate the findings using diverse samples. Additionally, while oversampling of "high risk" subjects based on self-reported delinquent behavior allowed for adequate variability in terms of substance use, it may also limit the generalizability of the findings to other populations. Next, although high rates of substance use among young adults made a college student sample fitting for the questions being asked, it will be important to examine these relations in other samples in order to better understand the role of context in the link between Negative Urgency and problematic substance use. In comparison to individuals in other age groups and/or contexts (e.g. high school students or middle-aged adults) young adults in college seem to experience a unique context in terms of the opportunities and social acceptability of substance use. Within this environment, Negative Urgency may be more likely to lead to problematic substance use, as compared to environments where substance use is less convenient or normative.

Another limitation of the present study was the use of cross-sectional data. It will be useful to examine the effects of Negative Urgency and Distress Tolerance across time using a longitudinal sample. The sample was made up of first-year college students, and it may be

the case that Negative Urgency and Distress Tolerance demonstrate greater effects in later college years, as substance use patterns may change across time. Given that Negative Urgency had strong effects in the present study, another potentially useful pathway for future research would involve exploring the developmental pattern of Negative Urgency across time. Just as Negative Urgency is likely manifested differently depending on an individual's context, it also undoubtedly looks different depending on an individual's age. Understanding the different ways in which Negative Urgency may manifest itself across time may allow for an exploration of the developmental trajectories of the trait across the lifespan. This will allow for a number of interesting questions to be answered. How stable is Negative Urgency across time? Do mean population levels of Negative Urgency differ with age? Given the strong evidence linking Negative Urgency with a number of problematic outcomes, answering these questions may be quite helpful in the development of useful intervention efforts.

An additional limitation of the study was the use of an abbreviated measure of the Five-Factor Model trait Neuroticism. Although the measure demonstrated satisfactory reliability, each of the facet items was measured using only one item. As discussed earlier, the Impulsiveness facet of Neuroticism is conceptually similar to Negative Urgency, suggesting that it may be useful to examine relations with this facet not included. The use of an abbreviated measure of Neuroticism made it unfeasible to remove facet items reliably, thus these analyses were not performed. Use of Neuroticism derived from the full NEO-PI-R (Costa & McCrae, 1992) would also allow for an examination of how each of the facets relates to substance use outcomes, and how Negative Urgency and Distress Tolerance impact these relations. Although Impulsiveness is conceptually similar to Negative Urgency, as it gets at an individual's ability to resist strong urges, it was left in for the analyses in order to ensure that the Neuroticism was fully represented. Another limitation in terms of measurement was that Distress Tolerance was only assessed using a self-report measure, the DTS (Simons & Gaher, 2005). Past research indicates discordance among self-report versus behavioral measures of Distress Tolerance (Marshall-Berenz et al., 2010; McHugh et al., 2011), and thus conclusions in the present study are limited to only the specific conceptualization of Distress Tolerance assessed by the DTS.

Lastly, as discussed in reference to clinical implications, it is important for future studies to clarify the mechanism linking Negative Urgency to risky behavior in the moment. Treatment implications may vary depending on whether Negative Urgency represents a means of coping with negative affect, a disturbance of cognitive processes, and/or some other process, thus it is essential that future research further explore this issue. Doing so will likely contribute to the development of more effective substance abuse prevention and intervention approaches for individuals who display high levels of Negative Urgency.

4.3. Conclusions

Although they are conceptually similar, to our knowledge no prior studies have examined Negative Urgency and Distress Tolerance together in relation to substance abuse risk. The present study examined them together with Neuroticism with the goal of better understanding how characteristic responding (behavioral and cognitive) relates to substance use/problems. The present study found that Distress Tolerance, Negative Urgency and Neuroticism all related to substance abuse outcomes, but that Negative Urgency was consistently the best predictor among the three variables, relating to all five substance abuse outcomes of interest. This suggests that characteristic responding to negative affect provides additional information about substance abuse potential beyond only knowing how often individuals tend to experience negative affect. The finding that Negative Urgency performed better than Distress Tolerance suggests that behavioral response tendencies, in comparison to more cognitive response tendencies, are particularly important. With this in mind, future

studies may want to further consider the mechanisms linking Negative Urgency to risky behavior such as substance use, with the goal of informing prevention and intervention programs.

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Highlights

- We examined the relations of three negative affect traits with substance use.
- Distress Tolerance and Neuroticism related to some substance use outcomes.
- Relations were no longer significant when Negative Urgency was accounted for.
- Negative Urgency related to all substance use outcomes.
- Relations remained even when other traits were accounted for.

Descriptive Statistics for Substance Use Outcomes

Table 1

	All Participants	Male Participants	Female Participants	African-American Participants	Caucasian Participants
AUDIT Total Score	7.65 (6.25)	7.87 (6.30)	7.45 (6.21)	3.28 (5.10)	8.42 (6.12)
Average Weekly Alcohol Use	5.41 (7.40)	6.69 (8.55)	4.24 (5.93)	1.98 (4.28)	6.03 (7.66)
Average Weekly Marijuana Use	3.78 (16.61)	5.35 (20.11)	2.33 (12.45)	8.70 (28.14)	3.14 (14.57)
Average Weekly Tobacco Use	5.85 (21.43)	6.79 (24.96)	5.01 (17.61)	2.67 (11.77)	6.41 (22.31)
Total Number of Hard Drugs Tried	0.48 (0.93)	0.55 (0.97)	0.40 (0.88)	0.29 (0.74)	0.50 (0.94)

Means are listed first, with standard deviations in parentheses. Note that average weekly alcohol use indicates the number of drinks, average marijuana use indicates the number of "hits," and average weekly tobacco use indicates the number of cigarettes.

Table 2

Percentage of the Sample Reporting Substance Use

	All Participants	Male Participants	Female Participants	African- American Participants	Caucasian Participants
Current Alcohol Use	75%	75%	74%	53%	80%
Current Marijuana Use	23%	27%	20%	27%	23%
Current Tobacco Use	19%	23%	15%	13%	20%
Any Hard Drug Use	29%	34%	24%	18%	30%

Table 3

Correlations for Main Variables of Interest

	1.	2.	3.	4.	5.	6.	7.	8.
1. Negative Urgency	-	-.47**	.51**	.35**	.18**	.16**	.23**	.24**
2. Distress Tolerance		-	-.46**	-.17**	.04	-.02	-.11*	-.15**
3. Neuroticism			-	.15**	.02	.05	.12**	.13*
4. AUDIT Total Score				-	.60**	.08	.29**	.37**
5. Avg. Weekly Alcohol Use					-	.14**	.20**	.24**
6. Avg. Weekly Marijuana Use						-	.28**	.35**
7. Avg. Weekly Tobacco Use							-	.29**
8. Number of Hard Drugs Tried								-

* indicates significance at the .05 level

** indicates significance at the .01 level

Table 4**Predicting Substance Use Outcome Scores**

	Neuroticism	Distress Tolerance	Negative Urgency
AUDIT Total Score	1.21 [1.09, 1.35] **	0.85 [0.79, 0.92] **	1.04 [1.03, 1.05] **
	1.05 [0.93, 1.18]	0.99 [0.90, 1.08]	1.04 [1.03, 1.05] **
Avg. Weekly Alcohol Use	1.02 [0.82, 1.27]	1.02 [0.86, 1.20]	1.04 [1.02, 1.06] **
	0.83 [0.64, 1.09]	1.21 [.99, 1.47]	1.06 [1.04, 1.09] **
Avg. Weekly Marijuana Use	1.76 [1.00, 3.11] **	0.57 [0.31, 1.04]	1.14 [1.08, 1.20] **
	0.59 [0.31, 1.12]	1.09 [0.62, 1.94]	1.17 [1.11, 1.24] **
Avg. Weekly Tobacco Use	3.49 [1.63, 7.50] **	0.52 [0.31, 0.87] **	1.13 [1.07, 1.19] **
	1.14 [0.39, 3.30]	0.73 [0.39, 1.38]	1.11 [1.04, 1.20] **
Number of Hard Drugs Tried	1.55 [1.16, 2.05] **	0.67 [0.57, 0.83] **	1.07 [1.05, 1.10] **
	0.88 [0.68, 1.13]	0.98 [0.70, 1.37]	1.07 [1.04, 1.10] **

** indicates significance at the .01 level

Entries are the estimated factors by which the mean substance use outcome score (AUDIT, average weekly alcohol use, average weekly marijuana use, average weekly tobacco use, and number of hard drugs tried) is multiplied when the corresponding independent variable increases by one unit. Numbers in brackets are 95% confidence intervals. For each substance use outcome, numbers in the first row do not adjust for the other independent variables; numbers in the second row do.