Mood and Personality-Based Models of Substance Use

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Mood and personality-based vulnerabilities have been extensively examined in patients with substance use disorders, but their relevance as models of etiology remains to be fully investigated. The present investigation examined mood and personality-based models of substance use in a nonclinical sample of young adults. Two-hundred and twelve individuals were assessed for personality and clinical characteristics and participated in computerized ambulatory monitoring of mood states and substance use over a 1-week period. Personality factors were strong predictors of substance use frequency over the previous 30 days, as well as of substance use in daily life using ambulatory monitoring. A linear increase was also observed in the intensity of novelty seeking and antisocial personality traits as a function of the social deviance of substances used. However, mood disorder history was related only to the use of illicit drugs other than cannabis, and fluctuations in mood states did not prospectively predict daily use of substances in a manner consistent with self-medication. Moreover, there was little evidence that personality characteristics moderated relations between mood states and substance use in daily life. The relevance of results for mood and personality models of substance use etiology is discussed.

Keywords: young adult substance use, social deviance model, self-medication hypothesis, experience sampling methodology

An extensive literature has accumulated from both clinical and general population samples demonstrating the frequent comorbidity of substance use disorders with mood syndromes (Burns & Teesson, 2002; Grant et al., 2004; Hasin, Goodwin, Stinson, & Grant, 2005; Kandel et al., 1999; Kessler et al., 1997; Merikangas et al., 1998). Although these associations may be explained by diverse mechanisms (Mueser, Drake & Wallach, 1998), particular attention has been given to the hypothesis that certain substances may be used as a means of alleviating unpleasant or negative emotional states (Conger, 1956; Khantzian, 1985, 1997). Some support for this notion of self-medication has been provided by investigations of comorbidity onset patterns (Merikangas et al., 1998), analyses of syndrome severity as a function of comorbidity type (Swendsen et al., 1998), and prospective studies of mood states and substance use behavior (Armel, Tennen, Affleck, & Kranzler., 2000; Flynn, 2000; Swendsen et al., 2000). However, as substance use problems or disorders may also induce mood disorders (Fergusson, Boden & Horwood, 2009; Schuckit, 2006), evaluating the relevance of mood states in the etiology of substance use disorders would be best achieved in nonclinical samples of young substance users who have yet to exceed the median age of onset for these disorders.

Mood and emotional processes may be contrasted with other forms of psychiatric vulnerability that are also present in the early phases of substance use and that may explain the transition toward abuse and dependence. Temperament and personality characteristics are among the most widely documented of these factors and have been shown to account for a large portion of variance in both normal and problematic substance use. In particular, increased consumption of diverse substances has been observed among individuals high in novelty or sensation-seeking and antisocial personality (e.g., Chakroun, Doron, & Swendsen, 2004; Conway, Kane, Ball, Poling, & Rounsaville, 2003; Franques, Auricambe, & Piquemal, 2003; Jaffe & Archer, 1987; Teichman, Barnea, & Rahav, 1989; Vukov, Baba-Milkic, Lecic, Mijalkovic, & Marinkovic, 1995). Prospective investigations of personality traits have also demonstrated their capacity to influence the onset of alcohol and drug use disorders (Caspi et al., 1997; Cloninger, Sigvardsson, & Bohman, 1988). In contrast to the self-medication hypothesis which assumes that the pharmacological properties of a given substance are sufficient to alleviate negative mood states, explanations for the role of personality variables more often emphasize the social significance of substances used. In particular, research in clinical samples (Conway, Swendsen, Rounsaville, & Merikangas, 2002) has shown that maladaptive personality traits increase by the degree to which the use of a given substance is “socially deviant” (i.e., of decreased prevalence and social acceptability in the general population). Despite the accumulation of research concerning both emotional and personality-based risk factors, or the fact that they may be simultaneously active within a same individual, their respective roles in the early stages of substance use remain largely unknown.

An important methodological consideration for comparisons of mood and personality risk factors for substance use is that most research has been conducted using cross-sectional designs or, less frequently, with longitudinal protocols spanning months or years. These methods provide information concerning risk factors and
patterns of comorbidity onset, but they are unable to examine the rapid moment-to-moment interplay between psychological states and substance use behavior. This issue has been a particular limitation for investigations of self-medication, as fluctuations in mood states for a given individual are hypothesized to constitute a relatively immediate risk to substance use over subsequent hours of the day. Ambulatory monitoring techniques such as the Experience Sampling Method (ESM) or Ecological Momentary Assessment (EMA) overcome many of these constraints, and a limited number of studies using these novel methods have examined substance use behaviors following changes in mood or specific symptoms (Hussong, Hicks, Levy, & Curran, 2001; Hussong, Galloway, & Feagans, 2005; Hussong, 2007; Simons, Gaer, & Oliver, 2005; Swendsen et al., 2000; Tournier, Sorbara, Gindre, Swendsen, & Verdoux, 2003). However, many of these investigations have utilized paper-based methods that cannot verify the timing of assessments and that are often discordant with electronically-verified reports (Broderick, Schwartz, Shiffman, Hufford, & Stone, 2003; Stone, Shiffman, Schwartz, Broderick, & Hufford, 2003).

The goal of the present investigation is to examine mood and personality-based models of substance use in a nonclinical sample of young adults, and to consider interactions between them. Self-medication and personality-based models are often treated as competing explanations, however it is also possible that the most appropriate conceptualization is one that posits interactions between them. For this reason, the current study also considers whether personality characteristics moderate mood—substance use relations in daily life. In addition to standard clinical assessments and characterization of general substance use patterns, computerized ambulatory monitoring techniques are applied to assess the dynamic relationships between mood states and subsequent substance use over a 7-day period. To aide in comparison across models, we examine both models in relation to general frequency of substance use over the previous 30 days as well as prospectively relative to substance use assessed through ambulatory monitoring. Following the notion of self-medication, it is hypothesized that 30-day substance use will be associated with lifetime mood disorder, and that increases in negative mood states in daily life will predict increased use of substances over subsequent hours. Personality traits are hypothesized to be associated with both 30-day substance use as well as substance use in daily life, and should increase in severity as a function of the deviance of substances consumed.

Method

Participants

A total of 1517 young adults (≥18 years) enrolled in a large French university were screened to participate in an investigation of daily life behavior and experiences. Using a high-risk design, 644 participants were then identified as eligible from among the screening sample based on their frequent or infrequent use of different psychoactive substances. A sub-sample of participants from each of these groups was then selected based on the presence or absence of personality vulnerabilities for depression. Following the identification of eligible participants through the crossing of substance use and depression vulnerability criteria, 242 individuals were randomly contacted and 224 agreed to participate in the ambulatory monitoring phase. This final sample was composed of 212 individuals who completed the ambulatory data collection phase (64% women; M age = 19.5 years, SD = 1.1).

Procedure

The procedures for assessment and data collection were previously validated among samples of substance users (Johnson, Barrault, Nadeau & Swendsen, 2009; Johnson et al., 2009) and were divided into three phases. During the first phase, university students from diverse academic disciplines were invited to participate in the investigation. As approximately three-fourths of French high school graduates pursue higher education (Lixi, 2003) and no selection criteria exist for the first year of university studies, only freshmen were selected to maximize comparability to the general population. After providing written informed consent, participants completed a screening battery concerning recent substance use and other demographic or clinical measures.

Based on the frequency of substance use over the previous month, four hierarchical groups of participants were formed (abstinent or low-frequency users of any substance, alcohol users, cannabis users, or users of other illicit substances). Alcohol users (n = 73) were those who consumed alcohol with a frequency from once a week to several times a day, and who consumed no additional substance. Cannabis users (n = 144) included those who consumed cannabis from once a week to several times a day, regardless of alcohol consumption, but with no additional substance use. Users of other illicit substances (n = 78) were those who consumed at least one illicit substance (cocaine, heroin, ecstasy, amphetamines, hallucinogens, or other illegal drug) at least once during this 30-day period, regardless of alcohol or cannabis use status. Finally, the low-frequency substance use group (n = 369) was composed of individuals having consumed no more than 1 alcoholic beverage over the previous 30 days, and no additional substance. This selection strategy led to the identification of eligible participants based on frequent or infrequent recent use of diverse psychoactive substances and ensured an adequate frequency of use during the ambulatory monitoring phase of the study. As vulnerabilities to mood disorders may exist even in the absence of diagnosed mood disorder, we further selected participants within each substance use group to ensure equal proportions of individuals possessing high and low scores for personality vulnerabilities (attributional style or sociotropy—autonomy) for depression and negative mood states in daily life (Husky, Mazure, Maciejewski, & Swendsen, 2007; Swendsen, 1997; 1998). This strategy allowed for the control of personality confounds when testing mood-based models, and the selection of high and low risk groups on these variables resulted in mean scores that were not significantly different from those of the overall screening sample.

Participants were then contacted by telephone to participate in the ambulatory monitoring phase of the study by members of the research team blind to the initial selection criteria. Recruitment from the eligible groups continued until predetermined cell sizes were obtained. Eighteen individuals (8.78% of the contacted eligible participants) declined to participate. Contacted individuals were scheduled for a 15-minute interview during which they were given a brief training concerning the ambulatory phase of the
study. During this session, participants were instructed to carry a personal digital assistant (PDA) with them throughout the assessment week and to complete a computerized questionnaire at each signal concerning their consumption of any substance since the last signal (spanning the previous 3 hours, on average), their principal activity, social and physical environments, and mood states at the moment of the assessment.

At the end of the training interview, participants were given a PDA and were asked to fill out a self-report personality questionnaire. On each of the next 7 consecutive days, 5 signals were administered at fixed intervals. Several different fixed-signal schedules were utilized, all of which included a signal between each of the following time periods: 8:00 am to 11:00 am; 11:00 am to 2:00 pm; 2:00 pm to 5:00 pm; 5:00 pm to 8:00 pm; and 8:00 pm to 11:00 pm. Signal schedules were randomized across participants. The PDAs were programmed to administer a brief electronic interview of approximately 2 minutes in duration at each signal. Each entry was time-stamped and all responses completed after a 45-minute delay were coded as missing data for that assessment. For reasons of confidentiality, responses entered by the participants were rendered inaccessible until the PDA was returned to the research center. The start day of the study was counterbalanced across the different workdays of the week, and all participants were contacted by telephone approximately halfway through the assessment period to monitor and encourage compliance. In the final phase of the study, the PDA was returned and its databases uploaded. Participants were then administered a structured diagnostic interview by a clinical psychologist blind to the selection criteria and ambulatory data collected for each participant. A financial compensation was provided to participants at the end of the study.

Clinical Measures

Substance use frequency. Thirty-day substance use frequency was assessed once during a single laboratory visit by a self-report questionnaire concerning 11 different psychoactive substances including tobacco, alcohol, cannabis, ecstasy, amphetamines, heroin, cocaine, LSD, and other hallucinogens. For each substance, participants were asked to specify the frequency with which he or she used the substance in the last 30 days, with scores ranging from 1 (Never in the past 30 days) to 7 (Several times a day).

Personality assessment. Personality traits were assessed once during a single laboratory visit using a French translation of the 125-item Temperament and Character Inventory (TCI –125; Cloninger et al., 1993) that has demonstrated good reliability (Chakroun-Vinciguerra, Faytou, Pélisholo, & Swedsen, 2005). The TCI-125 is a self-report questionnaire that measures four traits of temperament and three traits of character. The present study focused on the novelty seeking (NS) and harm avoidance (HA) dimensions of the temperament subscale. Harm avoidance and novelty seeking were modestly negatively correlated ($r = -0.33$, $p = .00$), suggesting the appropriateness of examining them separately in the analyses. Scores on these continuous variables were then combined to create an index of the intensity of antisocial personality following Pélisholo & Lépine (2000) which corresponds to high novelty seeking, low harm avoidance, and low reward dependence.

Diagnostic status. Trained psychologists, blind to both the risk status of participants as well as to their responses collected during the ambulatory monitoring phase of the study, provided clinical interviews using the Mini International Neuropsychiatric Interview (MINI, 4.4 version) for DSM–IV criteria. The MINI is a short diagnostic interview designed for use with non-clinical populations (Lecrubier et al., 1997). Agreement with diagnoses based on the International Diagnostic interview was good or very good for most diagnoses except for simple phobia and generalized anxiety disorders. Inter-rater reliability is high (kappa coefficients range from 0.88 to 1.0) and test-retest reliability is acceptable (kappa coefficients between 0.76 to 0.93; Lecrubier et al., 1997; Sheehan et al., 1997; Wittchen, Lachner, Wunderlich, & Pfister, 1998). The modules administered include past and current major depression, dysthymic disorder, mania, anxiety disorders, and substance use disorders.

Ambulatory Repeated Measures

State affect. Positive and negative mood states were assessed separately in the electronic interview on 7-point scales that asked participants to evaluate their mood at that moment. Depressive and anxious mood scales ranged from 1 (not at all depressed or anxious) to 7 (extremely depressed or anxious). The happy mood scale ranged from 1 (extremely happy) to 7 (extremely unhappy), but was reverse-coded for the analyses such that a higher score indicates more happiness, and is therefore inversely correlated with depressed mood.

Substance use. Substance use was assessed in the electronic interview by asking participants to report whether they consumed any substances since the previous signal. Participants responding affirmatively were then prompted to select the substances they consumed from a list that included wine, beer, strong alcohol, mixed drinks, tobacco, marijuana, cocaine, heroin, ecstasy, amphetamines, LSD, solvents, poppers, and “others substances.” After identifying specific substances, participants were asked to indicate the quantity of each substance they consumed.

Statistical Analyses

Mood as predictors of substance use. The self-medication hypothesis was first explored by considering whether a lifetime diagnosis of mood disorder was related to 30-day alcohol, cannabis, or illicit substance use. Ambulatory monitoring data were then used to examine the prospective relationship between emotional states (anxious, depressed, and happy mood) and daily reports of substance use. Analyses of the ambulatory monitoring data were conducted for alcohol and cannabis use only, as very few instances of other illicit substance use were reported during the electronic interviews. Ambulatory monitoring data were also time-lagged to permit the analysis of within-day prospective relationships between mood states and substance use at the subsequent assessment period. This approach involved restructuring the data such that information provided during electronic interviews at $T_1$ were prospectively linked to information provided during electronic interviews completed at $T_2$. Thus, mood states reported on the first assessment of the day were linked to substance use reported on the second assessment of the day, mood states reported on the second assessment of the day were linked to substance use reported on the
third assessment of the day, and so on. To prevent across-day carryover effects that may introduce disparities in the length of time lags between mood and substance use assessments, analyses were only performed only on mood and substance use measured on the same day. For the present investigation, ‘self-medication’ effects were defined as positive prospective associations between depression or anxiety and subsequent substance use, or negative prospective associations between happy mood and subsequent substance use. Reverse associations for any of these mood states are in turn referred to as ‘festive’ effects.

Data were analyzed using Hierarchical Linear Modeling 6.03 (HLM; Raudenbush, Bryk, & Congdon, 2005) to accommodate the multilevel structure of the repeated assessments in daily life and to model between-person differences in mood–substance use relations. At the observation level, the i-th substance use score for person j was modeled as a function of mood at the prior assessment point and an error term:

\[ \text{Substance Use}_{ij} = \beta_{0j} + \beta_{1j} \text{Mood State}_{ij} + r_{ij} \]

where \( \beta_{0j} \) represents the expected substance use score for person j when the mood score is zero, \( \beta_{1j} \) Mood State \( j \) represents the expected change in substance use score of person j as a function of prior mood state, and \( r_{ij} \) is the error term associated with observation \( i \) for person \( j \). The observation-level intercepts and slopes were then modeled at the person-level using the following equations:

\[ \beta_{0j} = \gamma_{00} + \gamma_{01} \text{Female}_{j} + \gamma_{02} \text{SU Problem}_{j} + u_{0j} \]
\[ \beta_{1j} = \gamma_{10} + \gamma_{11} \text{Female}_{j} + \gamma_{12} \text{SU Problem}_{j} + u_{1j} \]

where \( \gamma_{00} \) is the overall intercept, \( \gamma_{01} \) Female \( j \) is the main effect of gender, \( \gamma_{10} \) is the main effect of mood state, \( \gamma_{02} \) SU Problem \( j \) is the main effect of a current substance use problem, \( \gamma_{11} \) Female \( j \) is the cross-level interaction term for gender and mood state or the difference between the mood–substance use gradient for men and women.

Self-medication models were first estimated with a dichotomous variable that indicated whether any alcohol or cannabis were consumed since the previous assessment, and then re-estimated with continuous variables indicating the quantity of alcohol or cannabis consumed since the previous signal. Finally, an additional set of analyses was conducted with only the last three assessments of each day (corresponding to the late afternoon and evening hours) to examine whether self-medication processes are in evening hours) to examine whether self-medication processes are involved in the presence of a current substance use disorder.

Mood and personality as predictors of substance use. A final set of analyses examined whether personality characteristics (harm avoidance, novelty seeking, and antisocial personality) moderated relations between mood states and substance use assessed in daily life. These analyses were performed in HLM, and involved adding each personality characteristic on the mood–substance use slopes. Models were estimated separately for alcohol and cannabis use, and each personality variable was entered in a separate model.

Results

Descriptive Statistics

Between-person measures. The final sample of 212 participants was comprised of 64% women, who ranged in age from 18 to 25.7 (\( M = 19.5, SD = 1.3 \)). Based on 30-day substance use reports, 76 individuals (36% of the sample) were classified as nonconsumers. Nonconsumers were predominantly women (72%), and ranged in age from 18 to 25.7 (\( M = 19.5, SD = 1.3 \)). Forty-three individuals were classified as alcohol users (20%). Alcohol users ranged in age from 18 to 21.6 (\( M = 19.4, SD = 0.9 \)) and were also predominately women (63%). Fifty-two individuals (25% of the sample) were classified as cannabis users, 28 of whom were women (54%). Cannabis users ranged in age from 18 to 22 (\( M = 19.6, SD = 1.1 \)). Nineteen percent of the sample (41 individuals) was characterized as a consumer of other illicit substances. This group ranged in age from 18 to 22 (\( M = 19.5, SD = 1.00 \)), and included 25 women.

Current alcohol abuse or dependence was detected in 20% of the sample, cannabis abuse or dependence in 25% of the sample, and lifetime mood disorder in 43% of the sample (of which 86% were major depression). No gender differences were observed in the proportion of the sample with current alcohol abuse or dependence, \( \chi^2(1, N = 212) = 2.00, p > .05 \), current cannabis abuse or dependence, \( \chi^2(1, N = 212) = 2.96, p > .05 \), or lifetime mood disorder, \( \chi^2(1, N = 212) = 0.78, p > .05 \). Mean scores on novelty seeking, harm avoidance, and antisocial personality for the overall sample were 10.3 (\( SD = 4.02 \)), 9.73 (\( SD = 5.1 \)), and 30.8 (\( SD = 7.5 \)), respectively.

Within-person measures. The final sample for the prospective self-medication analyses consisted of 212 individuals who generated a total of 4,682 ambulatory monitoring assessments with complete data on all mood and substance use variables. Aggregated across the observation period, alcohol use was reported on an average of 1.1 \( T_2 \) assessment occasions, with a range from 0 to 10 (\( SD = 1.72 \)). Cannabis use was reported on average of 2.1 \( T_2 \) assessment occasions across the observation period, with a range from 0 to 23 instances (\( SD = 4.2 \)). Quantity of alcohol consumed ranged from 0 to 5 or more drinks, with a mean of .08 (\( SD = .44 \)).
Quantity of cannabis consumed ranged from 0 to 3 marijuana cigarettes, with a mean of 0.18 (SD = .57). Ratings of mood states ranged from 1 to 7, and mean scores on happy, depressed and anxious moods were 5.26 (SD = 1.24), 2.01 (SD = 1.36), and 2.23 (SD = 1.51), respectively.

**Mood Disorder and Mood States as Risk Factors for Substance Use**

*Lifetime mood disorder and 30-day substance use.* Preliminary analyses indicated that selection variables assessing personality vulnerabilities for depression were not significantly associated with either 30-day substance use variables or substance use in daily life, and were therefore excluded from further analysis. There were no significant differences in the share of individuals with and without lifetime mood disorder who reported recent alcohol, $\chi^2(1, N = 119) = 2.17, p > .05$, or cannabis use, $\chi^2(1, N = 128) = 0.75, p > .05$, however a larger share of individuals who met diagnostic criteria for lifetime mood disorder were in the illicit substance use group, $\chi^2(1, N = 117) = 8.58, p < .01$.

*Daily mood states and substance use.* Results of the prospective analyses of mood states and substance use assessed during the ambulatory monitoring phase of the study are presented in Table 1. Contrary to the self-medication hypothesis, negative mood states assessed at T1 were not positively associated with substance use assessed at T2. Specifically, there were no statistically significant relationships between alcohol use and prior depressed mood states (OR = 0.82, 95% CI = 0.62, 1.08, $p > .05$) or prior anxious mood states (OR = 0.80, 95% CI = 0.60, 1.08, $p > .05$). Moreover, happy mood was positively associated with both any alcohol use (OR = 1.36, 95% CI = 1.03, 1.81, $p < .01$) as well as the quantity of later alcohol consumed ($\gamma = 0.04, t = 3.01, p < .01$). Depressed mood was negatively related to subsequent cannabis use (OR = 0.72, 95% CI = 0.58, 0.91, $p < .05$) and happy mood was positively related with later cannabis use (OR = 1.27, 95% CI = 1.06, 1.54, $p < .05$). Results for quantity of cannabis consumed also suggested increased use following happy mood states ($\gamma = 0.03, t = 2.05, p < .05$) and decreased use following depressed mood states ($\gamma = -0.03, t = -2.05, p < .05$). Anxious mood states were not significantly associated with later cannabis use (OR = 0.88, 95% CI = 0.71, 1.11 $p > .05$) or quantity ($\gamma = -0.02, t = 1.18, p > .05$). Analyses that were constrained to the last three observations of the day did not vary substantially from these results. There was no evidence that current alcohol use problems influenced the relationship between mood and later alcohol use.

**Personality as a Risk Factor for Substance Use**

Results of the analyses predicting 30-day substance use and substance use reported during the ambulatory monitoring phase of the study from personality characteristics are presented in Table 2. These analyses are based on the entire sample of 212 individuals who provided data on 30-day substance use and personality characteristics. Relative to non-substance users, means scores on novelty seeking were higher in the alcohol use group, $t(117) = -3.77, p < .01$, further elevated in the cannabis group, $t(126) = -4.94, p < .01$, and highest in the illicit substance group, $t(115) = -6.77, p < .01$. This general pattern was also observed for antisocial personality, with higher mean scores observed among alcohol, $t(117) = -3.08, p < .00$, cannabis, $t(126) = -3.85, p < .01$, and illicit, $t(115) = -4.31, p < .01$, substance users than non-users. Harm avoidance was lower among alcohol users relative to non-users, $t(117) = 2.18, p < .05$, but did not significantly differ for either cannabis, $t(126) = 1.44, p > .05$, or illicit substance use, $t(115) = 1.78, p > .05$. Analysis of variance indicated significant relationships between substance use deviance and novelty seeking, $F(3, 206) = 7.6, p < .01$, as well as antisocial personality, $F(3, 206) = 4.1, p < .01$, adjusting for sex and current substance abuse or dependence. Significant linear contrasts ($p < .01$) revealed that the relationships between substance use deviance and novelty seeking and antisocial personality conformed to a generalized linear pattern as hypothesized. In order to further examine whether the observed linear increases may be attributed to polysubstance use in the cannabis and illicit drug groups (rather than to the social deviance of these substances), the analyses were repeated excluding daily alcohol users from the cannabis group and daily alcohol or cannabis users from the illicit substance group. A linear trend remained significant after excluding polysubstance users for novelty seeking and antisocial personality. Harm avoidance scores were not significantly related to substance use deviance including or excluding polysubstance users.

Analysis of the relationship between personality characteristics and substance use in daily life revealed that novelty seeking was positively associated with any alcohol (OR = 1.10, 95% CI = 1.05, 1.15, $p < .01$) or cannabis use (OR = 1.24, 95% CI = 1.14, 1.35, $p < .01$) in daily life, and also predicted the quantity of alcohol ($\gamma = 0.01, t = 3.19, p < .01$) and cannabis ($\gamma = 0.03, t = 4.09, p < .01$) consumed by participants. Similarly, antisocial personality was positively associated with alcohol use (OR = 1.06, 95% CI = 1.03, 1.09, $p < .01$) and quantity ($\gamma = 0.01, t = 3.31, p < .01$) in daily life, as well as cannabis use (OR = 1.09, 95% CI = 1.03, 1.14, $p < .01$) and quantity ($\gamma = 0.01, t = 2.7, p < .01$). In contrast, harm avoidance was negatively associated with alcohol use (OR = 0.93, 95% CI = 0.89, 0.98, $p < .01$) and alcohol quantity ($\gamma = -0.01, t = -2.47, p < .05$), but was not significantly associated with cannabis use (OR = 0.96, 95% CI = 0.89, 1.03, $p > .05$).

**Table 1**

*Prospective Relationships Between Mood States and Substance Use in Daily Life*

<table>
<thead>
<tr>
<th>Mood State</th>
<th>Any Alcohol Use OR (95% CI)</th>
<th>Any Cannabis Use OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depressed mood</td>
<td>0.82 (0.62, 1.08)</td>
<td>0.72 (0.58, 0.91)*</td>
</tr>
<tr>
<td>Anxious mood</td>
<td>0.80 (0.60, 1.08)</td>
<td>0.88 (0.71, 1.11)</td>
</tr>
<tr>
<td>Happy mood</td>
<td>1.36 (1.03, 1.81)*</td>
<td>1.27 (1.06, 1.54)*</td>
</tr>
</tbody>
</table>

* Moods states are based on assessments made at the assessment period prior to the assessment of substance use. All mood states were group-mean centered, and therefore reflect deviation from an individual’s average level of depressed, anxious, or happy mood. Analyses are based on 4,682 electronic assessments (Level-1 units) provided by 212 individuals (Level-2 units).

*p < .05.*
Moreover, concerning data collected through ambulatory monitoring techniques in order to permit both cross-sectional tests by mood disorder and personality vulnerabilities, as well as prospective and dynamic tests of these models in daily life. The results provide strong evidence for the implication of personality characteristics (novelty seeking, harm avoidance, antisocial personality) moderated any of the significant relationships between mood and substance use in daily life. Novelty seeking was positively associated with the happy mood-quantity of alcohol consumption slope ($\gamma = .003, t = 2.12, p < .05$), indicating that happy mood states were associated with more alcohol consumption among individuals who were high in novelty seeking than individuals who were low in novelty seeking. There was no evidence that novelty seeking, harm avoidance, or antisocial personality moderated any of the other significant mood—substance use relationships in daily life.

### Discussion

This investigation provided a comparison of two commonly cited risk factors for substance use disorders that are rarely tested as models of etiology in young substance users and non-users. Standard clinical assessment strategies were combined with novel ambulatory monitoring techniques in order to permit both cross-sectional tests by mood disorder and personality vulnerabilities, as well as prospective and dynamic tests of these models in daily life. The results provide strong evidence for the implication of personality variables in the use of substances in this sample of young adults, and also indicate that self-medication is unlikely to be a major explanatory factor for substance use in young adult and nonclinical samples.

Although the association of mood and substance use disorders is among the most common form of psychiatric comorbidity (Burns & Teesson, 2002; Grant et al., 2004; Hasin et al., 2005; Kandel et al., 1999; Kessler et al., 1997; Merikangas et al., 1998), no association was found between lifetime mood disorder and alcohol or cannabis use. However, the majority of persons with a lifetime mood disorder experienced major depression only (86%), and recent prospective research has observed weak associations between major depression and the use of most substances when analyses adjust for manic symptoms (Merikangas et al., 2008). Moreover, concerning data collected through ambulatory monitoring, no support was found for the self-medication of negative mood states. Although these findings may appear inconsistent with some previous findings for alcohol use in college student samples (Hussong, Hicks, Levy, & Curran, 2001; Hussong, Galloway, & Feagans, 2005), these studies have suggested that self-medication may be more valid under very specific circumstances. By contrast, the present analyses appear to demonstrate a festive effect, whereby quantity of alcohol and cannabis use increased following periods of elevated positive mood. Although the findings for alcohol use likely reflect the celebratory role of alcohol in many cultures around the world, less evidence exists for the role of positive emotions in cannabis use. While research is needed concerning the social contexts of both alcohol and cannabis use in young adults to shed light on potential enhancement versus coping motives, any given social occasion may motivate substance use through either festive or self-medication mechanisms, depending on the individual.

In contrast to the weak evidence for self-medication, personality variables were strongly associated with recent substance use history as well as substance use in daily life. Temperament and personality characteristics are among the most widely documented factors that are present in the early phases of substance use, and have been shown to account for a large portion of variance in both normal and problematic substance use, as well as polysubstance use (e.g., Caspi et al., 1997; Chakroun, Doron, & Swendsen, 2004; Cloninger, Sigvardsson, & Bohman, 1988; Conway et al., 2003; Franques et al., 2003; Jaffe & Archer, 1987; Teichman et al., 1989; Vukov et al., 1995). The relationships between the social deviance of the substance used and scores on novelty seeking and antisocial personality also conformed to a generalized linear pattern, similar to previous observations in clinical samples (Conway et al., 2002). The analyses that excluded frequent polysubstance users also found support for a “social deviance” interpretation relative to two of the three personality traits examined. Moreover, the general lack of significant interactions between personality and mood-contingent models suggests that each model provides a distinct perspective and that they may legitimately be compared to the other.

The comparison of mood and personality-based models of substance use underscores the limitations of self-medication as an etiological model of substance use in young adults, and suggests that the early identification of individuals at risk for substance use disorders may be more accurately achieved through consideration

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### Table 2

| Personality Variables, 30-Day Substance Use, and Substance Use in Daily Life ($N = 212$) |
|-----------------------------------------------|-----------------------------------------------|-----------------------------------------------|
| Novelty seeking                              | Harm avoidance                                | Antisocial personality                        |
| **30-day substance use**                     |                                               |                                               |
| Alcohol                                      | $t(117) = -3.77^{**}$                         | $t(117) = 2.18^{1}$                          | $t(117) = -3.08^{**}$                        |
| Cannabis                                     | $t(126) = -4.94^{**}$                         | $t(126) = 1.44^{1}$                          | $t(126) = -3.85^{**}$                        |
| Other illicit                                | $t(115) = -6.77^{**}$                         | $t(115) = 1.78^{1}$                          | $t(115) = -4.31^{**}$                        |
| **Substance use in daily life**              |                                               |                                               |
| Any alcohol use                              | $\gamma = 0.11, SE = .21^{**}$               | $\gamma = -0.07, SE = .02^{**}$              | $\gamma = 0.06, SE = .01^{**}$              |
| Any cannabis use                             | $\gamma = 0.21, SE = .04^{**}$               | $\gamma = -0.05, SE = .04$                   | $\gamma = 0.08, SE = .02^{**}$              |

* Each substance is compared to nonconsumption.

$^{1}p < .05$. $^{**}p < .01$. 

$CI = 0.88, 1.04, p > .05$ or quantity ($\gamma = -0.00, t = -0.27, p > .05$).

The pattern of relationships between personality characteristics and substance use in daily life were not affected by the inclusion of a control for current alcohol or cannabis abuse or dependence. 

### Mood and personality as predictors of substance use in daily life.

In a final set of analyses, we considered whether personality characteristics (novelty seeking, harm avoidance, antisocial personality) moderated any of the significant relationships between mood and substance use in daily life. Novelty seeking was positively associated with the happy mood-quantity of alcohol consumption slope ($\gamma = .003, t = 2.12, p < .05$), indicating that happy mood states were associated with more alcohol consumption among individuals who were high in novelty seeking than individuals who were low in novelty seeking. There was no evidence that novelty seeking, harm avoidance, or antisocial personality moderated any of the other significant mood—substance use relationships in daily life.
of personality factors than mood state characteristics. However, as ambulatory monitoring methods have revealed support for the self-medication in clinical or mature substance using samples (e.g., Swendsen et al., 2000), it is possible that self-medication mechanisms may gradually increase in intensity and explanatory power over the course of substance use. As such, it may be more applicable as an explanation of substance use disorder chronicity and relapse than as a model of etiology.

In drawing conclusions from the current study, a number of methodological constraints warrant consideration. First, although the time sampling and lagged analysis strategy were based on a previous ambulatory monitoring investigation that found support for self-medication in a mature sample of adults (Swendsen et al., 2000), it is possible that capturing fluctuations in mood and substance use in young adults requires different sampling frames and frequencies. In this vein, the current study involved only a single week of ambulatory monitoring. Future research that utilizes wider assessment windows or that implements periodic follow-up assessment weeks would provide important information on the evolution of young adult substance use over time. Second, as relatively few individuals in the sample used illicit drugs during the week of ambulatory monitoring, the validity of self-medication in daily life could not be tested relative to substances other than alcohol and cannabis. Third, although relationships between mood states and substance use in daily life may differ for individuals with a current mood or anxiety disorder and those without, the current study did not test this possibility. Fourth, the current study did not include data on lifetime substance use or family history of substance use or dependence, both of which are important for establishing the direction of the relationship between mood and substance use. Finally, while computerized assessment techniques minimized retrospective recall, the reliance on self-reports of substance use by participants themselves remains a potential source of bias. The application of novel methods to compare two models of substance use nonetheless provides information that is currently lacking in the assessment of etiological models of substance use disorders. Future research in this domain may benefit from comparisons among alternative models as well as from the continued use of ambulatory methods of data collection.

References


