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Alcohol Craving in Patients Diagnosed with a Severe Mental Illness and Alcohol Use Disorder: Bi-Directional Relationships between Approach and Avoidance Inclinations and Drinking

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Abstract

Objective—The current study was undertaken to better understand the craving-drinking relationship among individuals dually diagnosed with a severe mental illness (SMI) and an alcohol use disorder (AUD). Using an ambivalence conceptualization of craving (Breiner et al., 1999), we investigated the bi-directional relationships between desires and behavioral intentions to use (approach inclinations) and not use (avoidance inclinations) alcohol and drinking outcomes in patients diagnosed with a SMI-AUD.

Method—Patients ($N = 278$) seeking outpatient dual diagnosis treatment from a community mental health center were followed longitudinally over the course of 6 months. Assessments at baseline, 2-month, 4-month, and 6-month intervals included approach and avoidance inclinations, alcohol urges, readiness to change, and drinking outcomes.

Results—Time-lagged multilevel growth curve modeling found that avoidance inclinations moderated the effect of approach inclinations on subsequent drinking outcomes differentially over time. Specifically, avoidance inclinations attenuated the effect of approach on subsequent heavier drinking levels, and high avoidance/low approach demonstrated significant decreases on levels of drinking over time. Results also indicated that number of drinks consumed and heavy drinking days predicted subsequent approach inclinations differentially over time, such that lower levels of drinking predicted decreases in approach inclinations. Decreases in drinking also predicted higher subsequent avoidance inclinations, which were maintained over time.

Conclusions—These findings highlight the complexity of subjective craving responses and the importance of measuring both approach and avoidance inclinations. Among those diagnosed with SMI-AUDs, treatment strategies that increase avoidance inclinations may increase abstinence rates in this difficult-to-treat population.

Alcohol is the most widely used and abused substance in the United States with an estimated 18.7 million people diagnosed with an alcohol use disorder (AUD; SAMSHA, 2010). Severely mentally ill (SMI; i.e., schizophrenia spectrum, bipolar disorder) individuals are three times more likely to be diagnosed with an AUD as compared with individuals in the general population (Regier et al., 1990). Individuals diagnosed with both an AUD and a SMI experience greater negative consequences as compared to those with only an SMI including more severe psychiatric symptoms (e.g., Carey et al., 1991), more frequent psychiatric re-hospitalizations (e.g., Swofford et al., 1996), less stable living situations (e.g., Osher et al,

1994), and greater rates of violent behavior (e.g., Cuffel et al., 1994). Furthermore, among individuals diagnosed with SMI-AUDs, alcohol relapse rates are high with estimates exceeding 80% at 12-months post-treatment (e.g., Xie et al., 2010).

Studies examining alcohol use and relapse among SMI-AUD individuals have primarily focused on the contextual or environmental factors related to use. For example, increased symptoms of mental illness, lack of supervised housing, social pressures to use within high drug use neighborhoods, interpersonal stressors, social isolation, and lack of meaningful activities are all associated with relapse following a period of abstinence (see Drake et al., 2005, for review). Although this work has drawn attention to the need to better understand relapse in this socially vulnerable population, few studies have examined the influence of psychological factors on relapse to alcohol use among SMI individuals. With the growing recognition that risk factors for alcohol use and relapse among SMI populations may be more similar than different to those found in non-SMI populations (e.g., Bradizza et al., 2009; Drake et al., 2005; Bradizza & Stasiewicz, 2003), greater understanding of the psychological factors influencing use is warranted. One area that has received significant attention among non-SMI substance abusers, but has yet to be examined in dually diagnosed populations, is craving.

Craving has been described as the most studied and most misunderstood concept within addiction research (Lowman et al., 2000). It plays a prominent role in theoretical models regarding the development, maintenance, and reinstatement of AUDs (e.g., Marlatt & Witkiewitz, 2005; Tiffany & Conklin, 2000), and is assumed to be predictive of drinking and relapse. As such, craving is often targeted in both psychosocial and pharmacological treatments (e.g., Miranda et al., 2008; Stasiewicz et al., 2007) and is being considered for inclusion as a symptom of substance use disorders in the DSM-V (APA, 2012). Indeed, significant relationships have been found between craving and relapse during and following inpatient and outpatient treatment for AUDs (e.g., Flannery et al., 2003; Gordon et al., 2006); however, the literature has failed to yield consistent associations between craving and drinking (Drummond et al., 2000; Tiffany, 1990). Part of the difficulty in studying alcohol craving lies in the lack of consistent definitions (Rosenberg, 2009; Sayette et al., 2000; Tiffany et al., 2000). For example, craving has been operationalized within several theoretical frameworks, including conditioned-reinforcement (e.g., Koob, 2000), incentive sensitization (e.g., Robinson & Berridge, 2000), cognitive social learning theory (e.g., Niaura, 2000), and cognitive processing models (e.g., Tiffany, 1990). Further, many craving assessments are confounded by other factors known to contribute to drinking (e.g., expectancies, self-efficacy, mood; Kavanagh et al., 2012). More importantly, many of these approaches to assessing craving fail to capture the “ambivalence” or competing desires to drink and not drink often present in those diagnosed with AUDs (e.g., Smith-Hoerter et al., 2004; Sayette et al., 2000; Breiner et al., 1999; Tiffany, 1990), or account for craving as a function of recovery (Breiner et al., 1999; Stritzke et al., 2007). Thus, prediction of the craving-drinking relationship could be improved by applying a model of craving that assesses both the inclinations to approach and to avoid alcohol use.

To address these concerns, Breiner, Stritzke, and Lang (1999) introduced an ambivalence conceptualization of craving (Ambivalence Model of Craving; AMC) that called for independent assessment of both approach and avoidance inclinations to use psychoactive substances. More precisely, the AMC views craving as a complex experience requiring consideration of both desires and behavioral intentions to use (approach inclinations) and not use (avoidance inclinations) alcohol or drugs (Breiner et al., 1999; McEvoy et al., 2004; Stritzke et al., 2004). Both are presumed to develop as a function of the positive and negative consequences of use (Breiner et al., 1999) and are proposed to be orthogonal to one another, resulting in four hypothetical quadrants (see Figure 1): approach (high approach,

low avoidance), avoidance (low approach, high avoidance), ambivalence (high approach, high avoidance), and indifference (low approach, low avoidance). Consistent with neurobiological theories, although these dimensions may be activated reciprocally (e.g., high on one dimension, low on the other), approach and avoidance inclinations are independent and can be activated simultaneously to elicit different motivational states (Barkby et al., 2012; Cacioppo et al., 1999).

Measurement of both approach and avoidance inclinations as separate dimensions within the craving experience have several clinical and methodological advantages (see Stritzke et al., 2007). For example, the AMC provides a framework for the evaluation of craving (approach) and competing desires (avoidance) as a function of both substance use patterns and recovery status of those seeking and/or receiving treatment (see Figure 2). Further, it has been argued that measuring “craving” exclusively in terms of approach without consideration of a separate, yet concurrent, avoidance inclination may misrepresent a motivational disposition that is actually a combination of both, thereby significantly diminishing the utility of the information obtained (Breiner et al., 1999). Indeed, studies examining avoidance inclinations using both cue reactivity paradigms and self-report measures have provided considerable support for its incremental validity in predicting alcohol-related variables in both non-clinical and clinical samples (Schlauch et al., 2012; Schlauch, Breiner et al., 2013; Curtin et al., 2005; Klein et al., 2007; McEvoy et al., 2004; Stritzke et al., 2004; Stritzke et al., 2007). For example, avoidance inclinations are related to taking steps to make a change (Klein et al., 2007; Schlauch et al., 2012; Schlauch, Breiner et al., 2013), treatment retention (e.g., Schlauch et al., 2012), and recovery and relapse status (e.g., Stritzke et al., 2007). In addition, these dimensions appear to change during the course of recovery, with significant decreases in approach inclinations associated with decreases in drinking, while avoidance inclinations remain relatively high (Schlauch et al., 2012).

To date, there has been limited investigation of alcohol craving in SMI-AUD populations. When assessed, alcohol craving is often reported as a secondary outcome in pharmacological treatment studies for alcohol use disorders, focuses exclusively on approach inclinations, and is rarely linked to drinking outcomes (e.g., Petrakis et al., 2004; Batki et al., 2007). Interestingly, of the factors found to be associated with drinking in SMI-AUD populations (e.g., high risk situations, interpersonal stressors), craving may function as a mediating variable in that relationship. Further, despite the dearth of literature linking craving to drinking outcomes in SMI-AUD populations, treatment recommendations continue to incorporate modules for coping with craving and avoiding high-risk situations (e.g., Bellack & DiClemente, 1999; Horsfall et al., 2009), suggesting that a better understanding of the craving-drinking relationship among SMI-AUD individuals has the potential to inform interventions for this vulnerable population.

Current Study

The current study sought to improve our understanding of the psychological factors involved in alcohol relapse by examining craving and competing desires to not use alcohol. Specifically, the study had two main aims: 1) evaluate the role of craving in individuals dually diagnosed with a SMI and AUD, and 2) provide additional support for the Ambivalence Model of Craving in this understudied population, particularly the examination of the temporal relationship between approach and avoidance inclinations and drinking behaviors. We conducted secondary analyses on data from a longitudinal study designed to examine factors associated with drinking following treatment initiation in a SMI-AUD population (see Bradizza et al., 2009, for details). Specifically, we examined the bi-directional relationships between approach and avoidance inclinations and drinking outcomes. Based on previous literature examining approach and avoidance inclinations in

non-SMI populations (e.g., Schlauch et al., 2012; Klein et al., 2007; Stritzke et al., 2007; Stritzke et al., 2004), we predicted that:

1. Approach and avoidance inclinations would predict future drinking, such that avoidance inclinations would moderate the effect of approach inclinations on total number of drinks, number of drinking days, and number of heavy drinking days. Such a relationship was expected to vary over time such that greater decreases in drinking behaviors were expected for those with higher avoidance inclinations and low approach inclinations.
2. Drinking behaviors would predict future approach inclinations, such that lower levels of drinking (total drinks, drinking days, heavy drinking days) would predict decreasing approach inclinations over time.
3. Drinking behavior would predict future avoidance inclinations, such that lower levels of drinking would predict higher levels of avoidance inclinations; however, such a relationship was not expected to change over time.

Method

Participants

Participants were 278 men and women seeking outpatient dual diagnosis treatment from a community mental health center in Buffalo, New York. The community mental health center provides integrated mental health and substance abuse services, including both group and individual sessions, and psychiatric services including psychiatric pharmacotherapy. Topics covered during sessions include the nature of dual diagnosis, substance abuse education, changing negative thinking, overcoming denial of substance use problems, relapse prevention, social services and housing, and an introduction to 12-step groups. Prior to program admission, all patients are assessed and medically and psychiatrically stabilized to facilitate participation in treatment services (i.e., no longer in acute withdrawal or actively delusional). Although there are no specific guidelines regarding the length of treatment, the average length of treatment when these data were collected was 15.1 weeks.

Of the 278 participants, 46% were men and 54% were women with a mean age and education of 39.4 (SD=9.35) and 11.6 (SD=1.86) years, respectively. Participants were primarily African American (65%; 27% White, 4% Latino, 3% Native American, 1% other), mostly single (97%), unemployed (98%), and low income (85% reporting annual income < \$10,000). At baseline assessment, 41% lived in supervised settings (e.g., group home, halfway house) and 59% in unsupervised settings (e.g., apartment, private home). On average, participants reported having been treated 8.19 (SD=13.42, Mdn=4.00) prior times for psychiatric problems (e.g., inpatient, residential, or outpatient) and 14.04 (SD=14.06, Mdn=10.00) prior times for problems associated with substance abuse (e.g., detox, inpatient, group home, or outpatient).

Prior to study entry all participants were screened by the study staff. Specifically, eligibility criteria included a) living at the same address for at least 6 months or could provide contact information for two individuals (locators) who could be used to contact the participant during the study (i.e., stability criterion), b) scored at least a 23 on the Mini-Mental State Exam (MMSE; Folstein et al., 1975), and c) met DSM-IV criteria for a current (past 12 months) AUD and a current (past 30 days) schizophrenia-spectrum or bipolar disorder (Diagnostic Interview Schedule for DSM-IV; Robins et al., 1995). Most participants met criteria for current alcohol dependence (97%), while 3% met criteria for current alcohol abuse. In addition, high rates of current drug use disorders were observed, with 76% meeting criteria for abuse or dependence on cocaine, 46% marijuana, 23% opiates, 16% sedatives or

hypnotics, and 9% amphetamines. Overall, 86% of participants met criteria for at least one drug abuse or dependence diagnosis. Regarding comorbid mental disorders, 12% of participants met DSM-IV criteria for schizophrenia, 56% for bipolar disorder, and 32% for schizoaffective disorder.

Procedure

Individuals were recruited during the first 2 weeks following admission to the community mental health center to participate in a naturalistic, longitudinal study examining predictors of substance use. All participants provided written informed consent and were assured of the confidentiality of their responses. Figure 2 depicts participant recruitment using guidelines outlined by the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) criteria for reporting participant recruitment (Von Elm et al., 2008).

Participants were contacted at monthly intervals for 6 months following the baseline assessment. Specifically, in-person interviews were conducted at baseline and the 2-, 4-, and 6-month follow-ups. The 1-, 3-, and 5-month interviews were conducted by phone. The 6-month follow-up rate was 81% ($n = 221$). During each in-person interview, participants provided breath samples to ensure a blood alcohol level (BAL) of zero; interviews with positive BALs were rescheduled. Due to limited reading ability, interviewers read all questions to participants and recorded responses. Participants received retail gift cards as compensation for their time.

Measures

Demographic and background information—At the diagnostic session, demographic information, current status (e.g., marital, employment, residential), and treatment history (e.g., psychiatric and substance abuse) were obtained.

Substance use and psychiatric diagnoses—The Diagnostic Interview Schedule for DSM-IV (DIS-IV; Robins et al., 1995) is a structured interview used to obtain current and lifetime DSM-IV Axis I diagnoses. For the current study, the following sections of the DIS-IV were administered: alcohol use, drug use, depression, mania, and schizophrenia.

Alcohol Urge Questionnaire—(AUQ; Bohn et al., 1995). The AUQ is a unidimensional measure of alcohol craving (8-item) assessing desire to use alcohol, positive effects from using, and ability to avoid using if alcohol were present. Participants rated their agreement with each statement on a 7-point Likert scale (1=strongly disagree to 7=strongly agree). The AUQ has demonstrated good psychometric properties in both treatment seeking and non-treatment seeking alcohol dependent samples (Bohn et al., 1995; Drummond & Phillips, 2002). In the current study, Cronbach's alphas indicated good internal consistency at each of the four time points (baseline $\alpha = .89$; 2-month follow-up $\alpha = .91$; 4-month follow-up $\alpha = .92$; 6-month follow-up $\alpha = .91$).

Approach and Avoidance Alcohol Questionnaire—(AAAQ; McEvoy et al., 2004). The AAAQ is a 20-item self-report measure assessing two primary dimensions: approach and avoidance inclinations. Participants rated their agreement during the past week with each item on a 9-point Likert scale (0=not at all to 8=very strongly). Originally developed among non-dependent drinkers as a three-factor measure with two approach subscales differing on intensity (i.e., inclined/indulgent and obsessed/compelled), recent evidence in a clinical sample suggests that the items for these two factors simply represent an approach dimension (Klein et al., 2007).

Drinker Inventory of Consequences—(DrInC; Miller et al., 1995). The DrInC is a 50-item self-report measure designed to assess adverse consequences of alcohol use. Items are rated on a 4-point Likert scale (0=never to 3=daily or almost daily) and form five subscales: Physical (8 items), Interpersonal (10 items), Intrapersonal (8 items), Impulse Control (12 items), and Social Responsibility (7 items). The DrInC has demonstrated good psychometric properties in alcohol dependent samples (Miller et al., 1995; Forechimes et al., 2007). In the current study, Cronbach's alphas indicated good internal consistency at the baseline assessment for all subscales (Physical subscale $\alpha = .78$; Interpersonal subscale $\alpha = .88$; Intrapersonal subscale $\alpha = .88$; Impulse Control subscale $\alpha = .76$; Social Responsibility subscale $\alpha = .83$).

Stages of Change Readiness and Treatment Eagerness Scale—(SOCRATES; Miller & Tonigan, 1996). The SOCRATES is a 19-item self-report measure designed to assess awareness of problem drinking and motivation to change. Items are rated on a 5-point Likert scale (1=strongly disagree to 5=strongly agree) and form three subscales: problem recognition (7 items), ambivalence (4 items), and taking steps to make a change (8 items). The SOCRATES has demonstrated good psychometric properties in SMI-AUD samples (Carey et al., 2008). In the current study, Cronbach's alphas indicated good internal consistency at all four time points for the Problem Recognition subscale (baseline $\alpha = .85$; 2-month follow-up $\alpha = .84$; 4-month follow-up $\alpha = .88$; 6-month follow-up $\alpha = .87$) and the Taking Steps subscale (baseline $\alpha = .88$; 2-month follow-up $\alpha = .89$; 4-month follow-up $\alpha = .90$; 6-month follow-up $\alpha = .88$). In contrast, Cronbach's alphas indicated acceptable internal consistency for the Ambivalence subscale at all three follow-ups (2-month follow-up $\alpha = .68$; 4-month follow-up $\alpha = .70$; 6-month follow-up $\alpha = .68$), but fell slightly below acceptable at baseline ($\alpha = .58$). However, the performance of the Ambivalence subscale is consistent with a previous SMI-AUD study (Carey et al., 2008), as well as other alcohol dependent samples (Miller & Tonigan, 1996).

Timeline Follow-Back—(TLFB; Sobell & Sobell, 1992). Alcohol use was assessed at baseline (2 month period prior) and all follow-up interviews using the TLFB. The TLFB is a calendar-based retrospective recall interview of daily alcohol use, and has been found to be a reliable and valid measure of alcohol use among psychiatric outpatients (Carey et al., 2004). The TLFB was used to estimate the number of drinking days, standard drinks consumed, and heavy drinking days (4 drinks in a day for women, 5 for men) over the prior 1-month period at each of the monthly follow-up interviews (in-person and phone). For the current study, variables covering 2-month blocks (baseline, 2-, 4-, and 6-month follow-ups) were analyzed.

Data Analytic Strategy

Prior to conducting main analyses, the psychometric properties of the main measure of interest (i.e., AAAQ) were examined. Specifically, inter-item reliability and factor structure of the AAAQ were examined using MPLUS 7.0 (Muthen & Muthen, 2012). Initial examination of the item distributions suggested minor skewness, therefore parameters were estimated using maximum likelihood with robust standard errors (MLM option in MPLUS 7.0). Further, incremental validity analyses examining the unique relationship between avoidance inclinations and theoretically related constructs (e.g., negative drinking consequences) were conducted.

To examine our main hypotheses, multilevel time-lagged growth curve models were estimated using Hierarchical Linear Modeling (HLM 7.0; Raudenbush et al., 2011). Models were estimated in two directions to test the bidirectional associations between alcohol involvement and approach and avoidance inclinations. First, to examine hypothesis 1,

reports of alcohol outcomes were predicted from temporally prior reports of approach and avoidance inclinations, simultaneously, controlling for prior reports of the outcome and prior stages of change and treatment readiness variables (see Table 3). Second, to examine hypothesis 2, models were estimated in the reverse direction such that reports of approach or avoidance inclinations were predicted from temporally prior reports of alcohol use, controlling for prior reports of the outcome and current opposite dimension (e.g., current avoidance when predicting current approach).

For all main analyses, control variables were selected and implemented so that 1) the estimated outcomes do not reflect within-person variance attributable to related, yet distinct, constructs (i.e., stages of change and treatment readiness) and 2) related controls were temporally matched to constructs of interest (i.e., *prior* reports of SOCRATES matched with *prior* reports of AAAQ when predicting alcohol outcomes). Average between-person differences in gender were controlled in all models. Additionally, in all models, main and moderating effects of time (centered at baseline and reflecting increases in outcomes for every two months in real time) were included to test for effects of differential growth in outcomes over time. All *prior* control variables were entered into the models centered on the person's own mean to control for within-person variations of related constructs. All main predictor variables were entered grand mean centered due to our interest in examining between group differences on approach and avoidance inclinations when predicting drinking outcomes, or between group differences on level of drinking when predicting approach or avoidance.

The same iterative procedure was used in the testing of all models. First, all main and interaction effects for each model were estimated simultaneously. Non-significant interaction terms were then trimmed from models to increase model stability and to appropriately interpret lower order terms, and the models were re-estimated (Raudenbush & Bryk, 2002). Finally, because all alcohol outcomes (e.g., number of drinks, number of drinking days, number of heavy drinking days) were treated as count variables, models were estimated in HLM with the Poisson estimation option (with overdispersion), and therefore are non-linear. In contrast, approach and avoidance outcomes were treated as continuous, and therefore these models were linear. See Table 1 for means and standard deviations.

Results

Factor Structure and Reliability of the AAAQ

Prior to conducting the main analyses, a confirmatory factor analysis was conducted on the AAAQ (at baseline) based on the two-factor solution reported by Klein et al. 2007. Results indicated a good fitting model (i.e., $\chi^2(169) = 417.6$, $p < .001$; CFI=.90; RSMEA=.073, 90% CI .064-.082) with factor loadings $> .60$ for all items except item 2 (i.e., "I cut down the amount I drank," factor loading .36). Because item 2 may be confounded with drinking outcomes, the analysis was re-run without the item. Modification indices also suggested correlating two residuals, which likely resulted from similar behavioral intentions aimed at "distraction" (i.e., "I occupied myself so I would not drink" and "I did things to take my mind off alcohol"). Results indicated a slightly improved fit (i.e., $\chi^2(150) = 356.9$, $p < .001$; CFI=.92; RSMEA=.071, 90% CI .061-.080), with factor loadings for all items $> .60$.

Although results from the CFA indicated a good fitting model (i.e., CFI .90, RSMEA .08), fit indices fell slightly short of an excellent fit (i.e., CFI .95, RSMEA .05). Therefore, an exploratory factor analysis was conducted on all 20 items (MLM estimation with varimax rotation). Results suggested a 2-factor solution (i.e., eigenvalues > 1 ; approach factor 7.74, avoidance factor 3.24) with factor loadings $> .55$ for all items, except item 2 ("I cut down the amount I drank", factor loading .37). Further exploration of inter-item

correlations revealed correlations $>.30$ for all items within their respected subscales except item 2 (inter-item correlations ranging from .16 to .27), suggesting the item was performing poorly. Taken together, results are consistent with a two-factor structure found in clinical samples (Klein et al., 2007): approach inclinations (10 items, $\alpha = .92$) and avoidance inclinations (9 items, $\alpha = .87$).

Approach and Avoidance Incremental Validity Analyses

To examine the unique relationships between approach and avoidance inclinations and alcohol urges (i.e., AUQ, a traditional alcohol craving measure), readiness to change variables (i.e., SOCRATES), and consequences of drinking (i.e., DrInC), regression analyses were conducted for each measure with approach and avoidance entered simultaneously as predictors (see Table 2 for summary of results). Examination of the semi-partial correlations at all four time points indicated that approach was uniquely and positively related to problem recognition, ambivalence about changing, and alcohol urges, and negatively related to taking steps to make a change. Avoidance was also uniquely and positively related to problem recognition and taking steps to make a change, and negatively associated with alcohol urges above and beyond approach inclinations. Finally, at baseline, avoidance was significantly and uniquely related to four of the five subscales of the DrInC, whereas approach was associated with the impulse control subscale only. These findings are consistent with the AMC and provide support for the incremental validity of avoidance inclinations.

Approach and Avoidance Inclinations Predicting Future Alcohol Involvement

To examine our first hypothesis, that avoidance inclinations would moderate the effect of approach inclinations on future drinking behavior, three separate multilevel models were conducted for each of the drinking variables. Results from models in which alcohol involvement outcomes were predicted from prior reports of approach and avoidance inclinations are shown in Table 3 and Figure 3. All models showed a general pattern of decreasing alcohol involvement over time (i.e., *Time* variable significant across all growth curve models as shown in Table 3 top panel). However, results also showed that these patterns of change depended on levels of both approach and avoidance inclinations. As shown in Figure 3 (see also *Prior Approach X Avoidance X Time* interactions in Table 3), approach and avoidance inclinations interacted to differentially predict alcohol involvement trajectories across all three outcomes similarly. Specifically, follow-up analyses indicated that low approach and high avoidance predicted significant decreases in number of heavy drinking days ($b = -.20, p = .003$) and a marginal decrease in total drinks consumed ($b = -.14, p = .071$) over the course of six months, but not number of drinking days ($b = -.06, p = .241$). Further, among those reporting high avoidance, having concurrently high approach inclinations significantly predicted greater total number of drinks consumed ($b = .48, p < .001$), drinking days ($b = .38, p < .001$), and heavy drinking days ($b = .43, p < .001$) at the six month follow-up. In contrast, trajectories of alcohol outcomes among those high in approach ratings did not significantly change over time with one exception; those reporting high approach and low avoidance had significantly greater numbers of drinking days over time ($b = .06, p = .034$). Further, high approach and high avoidance significantly predicted lower number of drinks consumed ($b = -.13, p < .001$) and heavy drinking days ($b = -.11, p = .010$) at the six-month follow-up when compared to those high approach and low avoidance. No differences were found for total number of drinking days ($b = -.07, p = .135$), suggesting that avoidance inclinations may be important for moderating the intensity of drinking (i.e., quantity, heavy drinking days), rather than simple frequency of use. Together, as expected, avoidance inclinations attenuate the effect of approach inclinations on alcohol involvement for individuals with severe mental illness, and that such effects cannot be attributed to

within-person variations on measures of motivation to change, or their individual average patterns of alcohol use.

Alcohol Involvement Predicting Future Approach and Avoidance Inclinations

To examine our second hypothesis, that prior drinking would predict future approach and avoidance inclinations, several multilevel models were conducted with approach inclinations and avoidance inclinations as outcome variables (see Table 4 for summary of results). Simple growth models indicated that approach inclinations significantly decreased over the course of six months, whereas avoidance inclinations did not (see *Time* variables under growth curve models in Table 4). As expected, greater prior alcohol involvement positively predicted current approach inclinations differentially over time for two of the three drinking outcomes (see Models 1 and 3, *Prior Drinking X Time* interactions, Table 4). As shown in Figure 4, time moderated the effects of prior number of drinks consumed and number of drinking days to predict later approach inclinations. Specifically, lower levels of alcohol involvement predicted greater decreases in approach inclinations when compared to higher levels of alcohol involvement. However, while no differences were noted at baseline, significant differences emerged at the six-month follow-up. Specifically, those reporting a lower number of drinks consumed and fewer heavy drinking days predicted significantly lower ratings on approach inclinations when compared to those reporting higher number of drinks consumed ($b = .003, p = .004$) and heavy drinking days ($b = .036, p < .001$). Total number of drinking days also positively predicted approach inclinations, which remained constant over time. Finally, number of drinks consumed, drinking days, and heavy drinking days all negatively predicted avoidance inclinations (see drinking variables in Models 1–3 of Table 4), which remained constant over time.

Discussion

This study sought to examine the relationship between alcohol craving and drinking in individuals diagnosed with a SMI-AUD. Specifically, we aimed to contribute to the understanding of the role of psychological risk factors for relapse to drinking among the dually diagnosed. Additionally, this study examined the incremental and predictive validity of assessing avoidance inclinations within the craving-drinking relationship in this understudied and difficult-to-treat population.

Consistent with previous literature in non-SMI alcohol dependent populations (e.g., Klein et al., 2007), factor analyses indicated a two factor solution for the AAAQ: approach inclinations and avoidance inclinations. Consistent with the AMC, approach inclinations were positively associated with traditional craving measures, whereas avoidance inclinations were uniquely and negatively related. Further, avoidance inclinations were also uniquely and positively associated with drinking-related negative consequences at baseline, whereas few relationships were found with approach inclinations (the only exception was problems related to impulse control). Finally, and consistent with prior studies (e.g., Schlauch et al., 2012; Klein et al., 2007), avoidance inclinations were uniquely associated with the problem recognition and taking steps to make a change subscales of the SOCRATES at all four time points, and approach inclinations were uniquely and positively related to problem recognition, ambivalence, and taking steps to make a change. Together, these findings suggest that the AAAQ is a valid and reliable measure among those dually diagnosed with a SMI and AUD and highlights the importance of both dimensions within subjective craving experiences.

More importantly, and as predicted, significant interactions were found between prior reports of approach and avoidance inclinations predicting current drinking outcomes. Specifically, approach and avoidance interacted to differentially predict alcohol involvement

over the course of six months following treatment initiation. Among those reporting high avoidance and low approach inclinations, total number of drinks consumed and number of heavy drinking days decreased over the course of six months following treatment initiation. Further, high avoidance and low approach predicted lower alcohol involvement as measured by number of drinking days, and number of heavy drinking days at the six month follow-up when compared to those with high in approach and high in avoidance ratings. In contrast, previously high approach ratings did not alter the trajectories for most alcohol outcomes with one exception, high approach and low avoidance predicted increases in total number of drinking days over the course of six months. Rather, those high in approach inclinations and low in avoidance inclinations reported the highest levels of alcohol involvement across all time points. Further, avoidance inclinations moderated the effect of approach inclinations on drinking, such that high approach and high avoidance significantly predicted lower levels of drinks consumed and heavy drinking days at six months when compared to high approach and low avoidance. Interestingly, no differences were found on number of drinking days, suggesting that avoidance inclinations may be important for moderating the intensity of drinking rather than its frequency.

The results also support our second and third hypotheses of prior drinking behavior predicting current approach and avoidance inclinations, suggesting bi-directional relationships between approach and avoidance inclinations and drinking behaviors. Specifically, prior number of drinks and heavy drinking days differentially predicted changes in approach inclinations over time, such that higher number of drinks consumed and number of heavy drinking days were related to higher approach inclinations, whereas lower number of drinks consumed and number of heavy drinking days predicted greater decreases in approach over time. Further, and as expected, prior number of drinks, drinking days, and heavy drinking days all negatively predicted current avoidance inclinations, such that lower levels of drinking predicted higher avoidance inclinations, which remained constant over time. These findings are suggestive of a pattern in which changes in approach inclinations occur following significant decreases in drinking, and that the intensity of approach inclinations may be driven by the intensity of alcohol use (i.e., total number of drinks consumed and number of heavy drinking days).

Taken together, these results indicate that there is a bidirectional influence between approach and avoidance inclinations and alcohol involvement in individuals with a severe mental illness, and support a growing literature calling for the study of psychological constructs in predicting drinking behaviors within SMI-AUD populations. Furthermore, results from the current study are consistent with the notion that factors affecting this socially vulnerable population are similar to those in non-SMI populations (e.g., Bradizza et al., 2009; Drake et al., 2005; Bradizza & Stasiewicz, 2003). With craving being considered for inclusion as a symptom of substance use disorders in the DSM-V (APA, 2012), modules targeting subjective craving experiences will continue to figure prominently in many treatment approaches, including those for individuals diagnosed with an SMI and AUD. Results from this study suggest that the concurrent assessment of avoidance inclinations may improve the prediction of the craving-drinking relationship. However, it is important to note that, although the current design allowed for the examination of the temporal relationships between approach/avoidance inclinations and drinking, it did not allow us to examine the daily or momentary associations between subjective craving experiences and drinking. That is, craving processes likely fluctuate both between and within days, particularly approach inclinations, and such daily processes may be more predictive of use, rather than the 2-month intervals evaluated in the current study. For example, Stritzke et al. (2007) monitored a small sample of inpatient alcohol-dependent patients following 50 days of treatment using interactive voice response (IVR) and found patterns suggesting that moderate levels of avoidance inclinations, which remained relatively constant, may allow

patients to overcome the challenges of gradual and/or acute rises in approach inclinations within days following treatment. Such a pattern may also hold true during the course of treatment among SMI-AUD individuals. Nevertheless, significant bi-directional relationships between approach and avoidance inclinations and drinking behaviors were found, calling attention to the greater need to understand the multidimensional nature of subjective craving experiences.

Although approach inclinations decreased significantly over the 6-month, post-treatment-initiation period as a function of intensity of drinking (i.e., drinks per drinking day), avoidance inclinations demonstrated relatively little change over the 6-month period, despite significant changes in drinking behaviors. Such findings are consistent with previous studies in non-SMI alcohol dependent samples seeking treatment (e.g., Schlauch et al., 2012), which found strong associations between changes in approach inclinations with changes in drinking behavior, and little change observed in avoidance inclinations during the course of treatment. Although the AMC predicts that increased avoidance inclinations would precede decreases in drinking, it is possible that within our sample of dually diagnosed patients, most of the change in avoidance inclinations occurred prior to treatment entry. Indeed, avoidance inclinations were relatively high at baseline and predictive of taking steps to make a change. Perhaps pre-treatment changes in drinking behaviors noted in clinical trials for non-SMI populations (e.g., Stasiewicz et al., in press; Epstein et al., 2005) are the result of increased avoidance inclinations prior to entering treatment. Interestingly, variables hypothesized to predict avoidance inclinations (e.g., alcohol-related distress and negative life events associated with alcohol use) have also been associated with treatment initiation and pretreatment changes (e.g., Orford et al., 2006) among non-SMI populations. Alternatively, it may be due to a combination of the processes associated with both approach and avoidance inclinations such that initial changes in avoidance inclinations result in initial changes in drinking which, in turn, initiates a reduction in approach inclinations. Treatment then leads to a continued reduction in approach inclinations, which leads to additional and sustained changes in drinking. Indeed, results from the current study appear to support this latter explanation such that avoidance inclinations may attenuate the effects of approach on drinking, thereby resulting in lower levels of drinking, which subsequently result in decreases in approach inclinations. However, because this was a naturalistic study designed to examine factors related to post-treatment-initiation drinking, exploration of the time periods prior to treatment initiation were not possible. Nevertheless, our results continue to highlight the importance of these processes in changes in drinking behaviors and indicate that the role of craving patterns (i.e., Approach, Ambivalence, and Avoidance quadrants) in predicting recovery status deserves more attention. Thus, future research should continue to explore the relationships between approach and avoidance inclinations and drinking behaviors, both during the pretreatment period and during the course of recovery.

The findings offer several directions for future clinical research on craving processes among those dually diagnosed, as well as AUDs more broadly. First, results highlight the importance of concurrently assessing avoidance inclinations within subjective craving experiences, given that avoidance may be an important predictor of drinking. A study examining the daily influences of both approach and avoidance inclinations on subsequent drinking behavior could improve predictions of what is likely a dynamic process. Indeed, it has been hypothesized that avoidance inclinations may sustain successful change by forestalling lapses resulting from the extreme ups and downs in approach inclinations that are often experienced during the course of recovery (Stritzke et al., 2007). Second, although approach inclinations significantly declined during the course of six months following treatment initiation, avoidance inclinations remained relatively high and demonstrated little change. This finding is consistent with literature in non-SMI populations (e.g., Schlauch et al., 2012) and suggests that increases in avoidance inclinations may be an important

precipitant to treatment initiation and future changes in drinking behavior. Greater understanding of when avoidance inclinations shift and their subsequent influence on changes in drinking and treatment seeking behaviors may help elucidate processes by which people successfully overcome problematic alcohol use. Of particular interest are changes during pretreatment intervals, as they may predict decreases in drinking often observed prior to the first treatment session (e.g., Stasiewicz et al., in press; Epstein et al., 2005). Finally, future research identifying techniques that enhance or maintain avoidance inclinations may improve treatment outcomes by allowing individuals to successfully cope with acute rises in approach inclinations over the course of treatment. For example, recent work suggests that higher positive affect is associated with greater avoidance inclinations and lower approach inclinations in response to alcohol cues among inpatient substance abusers (Schlauch, Gwynn-Shapiro, et al., 2013), as well as lower craving ratings and stress reactivity among alcohol-dependent outpatients (McHugh et al., 2013). Identifying techniques that strengthen avoidance inclinations early in treatment may serve to improve drinking outcomes. Such techniques include behavioral activation, motivational interviewing, or providing reinforcement of changes already made may be of particular interest.

Overall, the current results offer insights that enhance our understanding of the psychological factors related to drinking behavior among those dually diagnosed with a SMI-AUD, and enhance our understanding of craving processes more broadly. However, this study has limitations. First, although its research design permitted the examination of craving and drinking over time, including their reciprocal influences, approach and avoidance inclinations likely fluctuate daily and follow a dynamic process over time. Thus, longitudinal designs with multiple assessments, ideally with daily ratings, should be utilized to more systematically examine the relationships between approach inclinations, avoidance inclinations, and drinking behavior. Second, the generalizability of our findings to other SMI samples may be somewhat limited. Specifically, we excluded individuals with compromised cognitive functioning and those who were more transient, and thus our findings may not apply to more severe SMI populations. Similarly, given the challenges associated with lower cognitive functioning among SMI populations, generalizability of this study's findings to non-SMI populations is also limited. However, the consistency in results across SMI and non-SMI populations, as well as the growing literature identifying similar psychological influences on drinking in the groups, suggests that approach and avoidance inclinations may function similarly in alcohol dependent populations, regardless of co-morbid diagnoses. Nevertheless, future research would benefit from the inclusion of a broader sample of those diagnosed SMI-AUD, as well as non-SMI samples when examining the validity and utility of the Ambivalence Model of Craving.

In summary, findings from this study support a growing literature highlighting the importance of psychological factors in predicting drinking behaviors in individuals diagnosed with an SMI-AUD, as well as adding to our understanding of the multi-dimensional nature of subjective craving experiences. Such an advance in understanding can enhance our knowledge of factors influencing help-seeking behaviors and changes in drinking early in treatment, and can inform the development of treatment interventions focused on strengthening recovery processes.

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a. Adapted from Breiner et al., 1999

b. Adapted from Stritzke et al., 2007

Figure 1.
Ambivalence Model of Craving.

Figure 2.
Participant flow diagram

Figure 3. Prior Approach X Avoidance X Time Interactions for total number of drinks consumed (top panel), drinking days (middle panel), and heavy drinking days (bottom panel).

Figure 4. Prior number of drinks consumed X time (top panel) and prior number of heavy drinking days X time (bottom panel) interactions predicting current approach inclinations.

Table 1

Means (standard deviations) for time varying predictors and outcomes.

	Baseline	2 Month	4 Month	6 Month
SOCRATES				
Problem Recognition	29.9 (5.4)	27.6 (6.4)	27.9 (7.0)	27.6 (6.8)
Ambivalence	14.0 (3.7)	13.4 (4.3)	12.7 (4.4)	12.7 (4.2)
Taking Steps	35.4 (5.0)	34.9 (5.1)	33.8 (6.4)	34.3 (5.9)
AUQ	19.5 (12.1)	17.2 (11.7)	17.7 (12.2)	17.8 (11.6)
AAAQ				
Approach Inclinations	3.4 (2.5)	2.7 (2.5)	2.7 (2.4)	2.7 (2.3)
Avoidance Inclinations	5.4 (2.2)	5.5 (2.1)	5.3 (2.2)	5.3 (2.2)
Drinking Outcomes				
Total # Drinks	127.4 (214.3)	57.1 (159.7)	48.2 (132.4)	59.5 (151.7)
Total # Drinking Days	12.8 (16.5)	6.3 (13.2)	6.2 (12.8)	7.1 (14.12)
Total # Heavy Drinking Days	9.1 (13.4)	4.0 (10.1)	4.1 (10.4)	4.3 (11.1)
DrInC				
Physical	15.6 (5.0)	--	--	--
Interpersonal	20.8 (7.3)	--	--	--
Intrapersonal	19.5 (5.4)	--	--	--
Impulse Control	17.2 (6.5)	--	--	--
Social Responsibility	14.3 (5.1)	--	--	--

Note. AUQ = Alcohol Urge Questionnaire. SOCRATES = Stages of Change Readiness and Treatment Eagerness Scale; DrInC = Drinker Inventory of Consequences.

Table 2

Incremental validity analyses examining the relationship between approach and avoidance inclinations and stages of change readiness and treatment eagerness, alcohol urges, and consequences of drinking (semi-partial correlations).

	Baseline		2 Months		4 Months		6 Months	
	Approach	Avoidance	Approach	Avoidance	Approach	Avoidance	Approach	Avoidance
SOCRATES								
Problem Recognition	.19**	.36***	.24***	.33***	.28***	.39***	.23***	.37***
Ambivalence	.31***	.10	.26***	.11	.33***	.11	.34***	.12
Taking steps	-.24***	.39***	-.18**	.51***	-.24***	.37***	-.13*	.48***
AUQ - Alcohol Urges	.58***	-.18***	.59***	-.16**	.61***	-.11*	.57***	-.15***
DrInC								
Physical	.03	.25***	--	--	--	--	--	--
Interpersonal	.04	.10	--	--	--	--	--	--
Intrapersonal	.02	.30***	--	--	--	--	--	--
Impulse Control	.15*	.12*	--	--	--	--	--	--
Social Responsibility	.06	.16**	--	--	--	--	--	--

Note. AUQ = Alcohol Urge Questionnaire. SOCRATES = Stages of Change Readiness and Treatment Eagerness Scale; DrInC = Drinker Inventory of Consequences. For each outcome, approach and avoidance inclinations were entered simultaneously as predictors.

* p<.05,

**

p<.01

p<.001

Table 3
Base Growth Models and Prior Approach and Avoidance Inclinations Predicting Current Alcohol Outcomes

	# Drinks				# Drinking Days				# Heavy Drinking Days			
	<i>b</i>	<i>SE</i>	<i>ERR</i>	<i>P</i>	<i>b</i>	<i>SE</i>	<i>ERR</i>	<i>p</i>	<i>b</i>	<i>SE</i>	<i>ERR</i>	<i>P</i>
Growth Curve Models												
Intercept	4.71	.092	110.99	<.001	2.41	.071	11.17	<.001	2.06	.079	7.87	<.001
Time	-.151	.032	.860	<.001	-.108	.020	.898	<.001	-.139	.030	.870	<.001
AP X AV Models												
Intercept	3.28	.278	26.61	<.001	1.21	.189	3.36	<.001	.878	.225	2.41	<.001
Time	.012	.049	1.01	.805	.041	.038	1.04	.290	-.020	.046	.980	.654
Prior Drinking	-.000	.000	1.00	.402	-.011	.007	.989	.121	-.007	.009	.993	.448
Gender	.317	.261	1.37	.226	.395	.186	1.48	.034	.442	.234	1.56	.060
Prior SocPR	-.076	.033	.927	.020	-.014	.021	.987	.515	-.057	.022	.944	.008
Prior SocAMB	.026	.034	1.03	.448	.012	.026	1.01	.628	.047	.030	1.05	.111
Prior SocTS	.036	.030	1.04	.223	-.008	.017	.992	.621	.014	.018	1.14	.419
Prior AP	.243	.107	1.28	.023	.232	.062	1.26	<.001	.185	.082	1.20	.024
Prior AV	-.075	.082	.928	.358	-.030	.076	.971	.696	.003	.082	1.00	.975
Prior AP X AV	-.039	.035	.962	.269	-.015	.021	.986	.497	-.046	.030	.955	.103
Prior AP X Time	.022	.021	1.02	.288	.010	.012	1.01	.431	.026	.015	1.03	.091
Prior AV X Time	-.027	.017	.973	.109	-.021	.015	.979	.158	-.036	.016	.964	.025
Prior AP X AV X Time	.016	.008	1.02	.039	.011	.005	1.01	.040	.017	.006	1.02	.009

Note. SocTS = Socrates Taking Steps subscale; SocPR = Socrates Problem Recognition subscale; SocAMB = Socrates Ambivalence subscale; AP=Approach Inclinations. ERR= Event Rate Ratio, effect sizes estimates for models using Poisson distributions, which are interpreted as the percentage change in the dependent variable associated with an increase of 1 unit in the independent variable, holding all other variables constant.

Table 4

Prior Drinking Behavior Predicting Current Approach and Avoidance Inclinations

	Approach Inclinations				Avoidance Inclinations			
	<i>b</i>	<i>SE</i>	<i>ES</i>	<i>p</i>	<i>b</i>	<i>SE</i>	<i>ES</i>	<i>p</i>
<u>Growth Curve Models</u>								
Intercept	3.29	.140	2.80	<.001	5.48	.126	5.39	<.001
Time	-.188	.022	-.34	<.001	-.036	.027	-.11	.179
<u>Model 1 (Total # Drinks)</u>								
Intercept	2.91	.210	1.86	<.001	5.65	.191	3.96	<.001
Time	-.043	.038	-.33	.255	-.107	.042	-.17	<.001
Prior AP (or AV)	-.245	.050		<.001	-.163	.072	-.15	.025
Gender	.049	.264	.02	.853	-.500	.221	-.30	.024
Current AV (or AP)	-.306	.050	-.42	<.001	-.320	.042	-.52	<.001
Prior Drinks	.000	.001	.03	.709	-.001	.0005	-.15	.026
Prior Drinks X Time	.0004	.0002	.16	.015	---	---	---	---
<u>Model 2 (# of Drinking Days)</u>								
Intercept	2.87	.201	1.92	<.001	5.70	.188	4.07	<.001
Time	-.034	.037	-.06	.358	-.117	.041	-.19	.005
Prior AP (or AV)	-.263	.051	-.35	<.001	-.160	.073	-.15	.028
Gender	.006	.260	.00	.980	-.470	.216	-.29	.031
Current AV (or AP)	-.291	.050	-.39	<.001	-.303	.042	-.48	<.001
Prior Drinking Days	.032	.006	.37	<.001	-.020	.006	-.21	.002
Prior Drinking Days X Time	---	---	---	---	---	---	---	---
<u>Model 3 (# of Heavy Drinking Days)</u>								
Intercept	2.93	.211	1.86	<.001	5.67	.189	4.02	<.001
Time	-.049	.038	-.087	.197	-.11	.041	-.18	.008
Prior AP (or AV)	-.0140	.051	-.33	<.001	-.158	.072	-.15	.030
Gender	.036	.265	.02	.891	-.493	.219	-.30	.026
Current AV (or AP)	-.306	.050	-.42	<.001	-.317	.041	-.51	<.001
Prior Heavy Drinking	.006	.010	.04	.538	-.018	.007	-.17	.011
Prior Heavy Drinking X Time	.005	.002	.14	.045	---	---	---	---

Note. AP = Approach Inclinations; AV = Avoidance Inclinations; ES = Effect Size, which are estimated Cohen's *d* based on the t-ratio and estimated degrees of freedom obtained from the HLM output. Dashes indicate the term was dropped due to non-significance. Variable names in parentheses represent variables entered for avoidance outcome analyses.