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Latent Class Analysis of DSM-5 Alcohol Use Disorder Criteria among Heavy-Drinking College Students

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Abstract

The DSM-5 has created significant changes in the definition of alcohol use disorders (AUD). Limited work has considered the impact of these changes in specific populations, such as heavy-drinking college students. Latent class analysis (LCA) is a person-centered approach that divides a population into mutually exclusive and exhaustive latent classes, based on observable indicator variables. The present research was designed to examine whether there were distinct classes of heavy-drinking college students who met DSM-5 criteria for an AUD and whether gender, perceived social norms, use of protective behavioral strategies (PBS), drinking refusal self-efficacy (DRSE), self-perceptions of drinking identity, psychological distress, and membership in a fraternity/sorority would be associated with class membership. Three-hundred and ninety-four college students who met DSM-5 criteria for an AUD were recruited from three different universities. Two distinct classes emerged: Less Severe (86%), the majority of whom endorsed both drinking more than intended and tolerance, as well as met criteria for a mild AUD; and More Severe (14%), the majority of whom endorsed at least half of the DSM-5 AUD criteria and met criteria for a severe AUD. Relative to the Less Severe class, membership in the More Severe class was negatively associated with DRSE and positively associated with self-identification as a drinker. There is a distinct class of heavy-drinking college students with a more severe AUD and for whom intervention content needs to be more focused and tailored. Clinical implications are discussed.

Keywords

DSM-5; alcohol; college students; latent class analysis

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1. Introduction

1.1 College Drinking

College drinking continues to be prevalent and problematic. *Monitoring the Future* (Johnston, O'Malley, Bachman, Schulenberg, & Miech, 2014) indicates that 63% of full-time college students reported drinking in the previous 30 days. Additionally, the report indicates that approximately 13% of full-time college students reported having 10 or more drinks in a row at least once in the last two weeks, and approximately 5% reported 15 or more drinks in a row at least once in the previous two weeks. Heavy drinking among college students has been associated with a number of problems, including morbidity and mortality (Hingson, Zha, & Weitzman, 2009), academic problems (Wechsler, Lee, Kuo, & Lee, 2000), legal problems (Hingson, Heeren, Zakos,Kopstein, & Wechsler, 2002; Wechsler et al., 2002), risky sexual behavior and sexual assault (Goldstein, Barnett, Pedlow, & Murphy, 2007; Hingson et al., 2009), drinking and driving, and unintentional, non-traffic injuries and physical assaults (Hingson et al., 2009).

In addition to experiencing these negative alcohol-related consequences, a significant number of heavy-drinking college students also experience more clinically significant problems. A well-known study by Knight et al. (2002) indicated that approximately 20% of heavy-drinking college students surveyed (N≈6,000) met DSM-IV dependence criteria. Frequent heavy drinkers were 13 times more likely to meet abuse criteria and 19 times more likely to meet dependence criteria. While most college students “mature out” of heavy drinking once they leave college, a considerable number continue to drink heavily and experience more clinically significant problems into adulthood (Schulenberg & Maggs, 2002).

1.2 DSM-5 and Alcohol Use Disorders (AUD)

A number of studies have examined whether subtypes of DSM-IV alcohol abuse and dependence exist and whether these subtypes lie on a continuum (Chung & Martin, 2001; Hasin & Beseler, 2009; Kahler and Strong, 2006; Krueger et al., 2004; Langenbucher et al., 2004; Proudfoot et al., 2006; Saha et al., 2006). Based on these findings, and the findings of the American Psychiatric Association's Substance-Related Disorders Work Group (Hasin et al., 2013), the DSM-5 (American Psychiatric Association, 2013) includes modifications of the DSM-IV TR criteria for AUDs. Final revisions to the DSM-5 include merging abuse and dependence criteria into a single diagnosis of “alcohol use disorder”, removing the legal criterion (i.e., “Have you experienced recurrent alcohol-related legal problems, such as arrests for alcohol-related disorderly conduct?”), adding an item to assess craving, and a requirement of endorsing at least two of the 11 criteria to receive a diagnosis of AUD. Finally, the DSM-5 includes criteria to assess for a mild (endorsing 2–3 items), moderate (endorsing 4–5 items), and severe (endorsing 6 or more items) AUD.

Typically, a diagnosis of a DSM-5 AUD would involve adding up items that the individual endorses. Another possible way of conceptualizing an AUD might be to examine classes of individuals who exhibit certain patterns of AUD criteria. Latent class analysis (LCA) provides an opportunity to examine these classes.

1.3 Latent Class Analysis of College Drinking

Latent class analysis (LCA), like factor analysis, theorizes that there is an underlying or latent variable that is measured by observable, or indicator, variables (Bollen, 1989; Bollen & Curran, 2005). However, unlike factor analysis, LCA assumes a categorical distribution of the latent variable and a categorical or multinomial distribution of the observable variable (Collins & Lanza, 2010). LCA is a *person-centered* approach, which examines the categorical or qualitative differences in behaviors and/or characteristics among groups of people (Ruscio & Ruscio, 2008). Each class has a specific pattern of indicator item endorsement unique to that class, and LCA estimates the probability of being in a particular class based on an individual's indicator item responses.

The use of LCA has become popular in recent years to examine classes of college drinkers and related characteristics. Abar (2012) examined associations between profiles of perceived parental style and drinking behaviors in a sample of first-year college students. Indicators of alcohol use included age of alcohol use initiation, past alcohol use and experienced consequences, engagement in high-risk alcohol using behaviors, attitudes, beliefs, and cognitions about alcohol use, and normative perceptions of friend alcohol use. The author found five profiles of drinkers: Abstainers, Past Drinkers, Light Drinkers, High-Risk Drinkers, and Extreme Risk Drinkers. Another study by Beseler, Taylor, Kraemer, & Leeman (2012) examined whether there were distinct classes of college student drinkers based on pattern s of DSM-IV alcohol use criteria. The authors concluded that a 3-class solution was the best fit. The largest class primarily endorsed tolerance, although no one in this class was alcohol dependent. The middle class mainly endorsed tolerance and drinking more than intended, and one-third of this sample were alcohol dependent. The smallest class endorsed all criteria, and all were alcohol dependent. Alcohol consumption patterns did not differ significantly between the middle and smallest classes.

Chiauzzi, DasMahapatra, & Black (2013) examined classes of alcohol and drug use in a sample of first-year students from 89 universities. Indicators included alcohol consumption, alcohol-related behaviors, and past-year use of illegal drugs and nonmedical use of prescription medications. The authors concluded that there were four classes of college drinking and drug use: 1) Low Risk Drinking/Low Prevalence Drug Use, 2) Lower Intake Drinking/Moderate Prevalence Drug Use, 3) Moderate Risk Drinking/Moderate Prevalence Drug Use, and 4) High Risk Drinking/High Prevalence Drug. O'Connor and Colder (2005) examined classes of college drinkers in a sample of college freshmen. Indicator variables were based on quantity and frequency of alcohol consumption, as well as the experience of alcohol-related problems. The authors concluded that there were five classes of college drinkers, which differed by gender: 1) moderate/high quantity, very high frequency, and very high problems for women and high problems for men; 2) low quantity, low frequency, and low problems; 3) very high quantity, high frequency for women and moderate/high frequency for men, and high problems for women and moderate/high problems for men; 4) moderate/high quantity, high frequency for women and moderate/high frequency for men, and high problems for women and very high problems for men; and 5) moderate/high quantity for women and moderate quantity for men, moderate frequency for women and moderate/high frequency for men, and moderate problems for both men and women.

Finally, a study by Varvil-Weld, Mallett, Turrisi, and Abar (2013) examined pre-college profiles of high-risk drinking among first-year college students and whether they were subsequently associated with experiencing negative alcohol-related experiences once in college. Indicator variables included typical drinking, alcohol-related risky and protective drinking behaviors, alcohol beliefs, descriptive and injunctive norms, and alcohol-related consequences. The authors concluded that there were four pre-college profiles: extreme-consequence drinkers, high-risk drinkers, protective drinkers, and nondrinkers. Relative to the high-risk drinkers, both the protective drinkers and the nondrinkers were significantly less likely to experience negative alcohol-related experiences once in college. Students who were extreme-consequence drinkers were more likely to experience negative alcohol-related experiences once in college.

Taken together, these studies have generally classified drinkers based on quantity and frequency of alcohol use, as well as experience of negative alcohol -related consequences. Only the study by Beseler et al. (2012) identified classes of college drinkers based on DSM criteria. LCA provides a unique opportunity to identify distinct classes of college drinkers based on a variety of observable variables. Identifying unique classes of college drinkers offers the potential advantage of tailoring interventions to different classes of individuals based on these classes (Collins, Murphy, & Bierman, 2004; Lanza, Patrick, & Maggs, 2010). Moreover, certain correlates of college drinking may be associated with membership in these classes (i.e., O'Connor & Colder, 2005).

1.4 Correlates of Problem Drinking among College Students

Correlates of heavy drinking among US college students have also been well-documented in the literature. Specifically, college men are more likely to drink heavily and experience alcohol-related consequences compared to college women (Johnston et al, 2014; Park, 2004; Park & Grant, 2005). Heavy alcohol use and alcohol-related consequences are associated with belonging to a fraternity or sorority (Cashin et al, 1998; Grekin & Sher, 2006; McCabe et al, 2005; Scott-Sheldon et al, 2010; Talbott et al, 2008). Additionally, recent research has found that social norms (i.e. perceptions about how much the typical college student drinks and perceptions about how much the typical college student approves of drinking) have been found to be one of the most consistent predictors of problem drinking (Neighbors, Lee, Lewis, Fossos, & Larimer 2007). Specifically, perceived descriptive norms refer to individuals' perceptions of what is typical drinking behavior and perceived injunctive norms refer to perceptions of others' approval of typical drinking behaviors (Cialdini, Reno, & Kallgren, 1991).

The use of “protective behavioral strategies” (PBS), which are specific cognitive-behavioral strategies intended to moderate drinking and/or consequences of drinking, have been found to reduce alcohol consumption (Martens, Martin, Littlefield, Murphy, & Cimini, 2011) and negative alcohol -related consequences (Martens, Taylor, Damann, Page, Mowry, & Cimini, 2004). Examples of these consequences include changing the manner of drinking (e.g., avoiding shots and drinking games) and limiting the amount of drinking (e.g., pacing drinks, adding more ice, alternating alcoholic and non-alcoholic beverages).

Drinking refusal self-efficacy (DRSE), or the confidence one has to refuse alcohol in a given situation, has also been found to be associated with problem drinking among college students. A number of studies have found that DRSE uniquely predicted alcohol use over and above other constructs, such as alcohol expectancies (Oei & Jardim, 2007; Young, Connor, Ricciardelli, & Saunders, 2006). Psychological distress has also been found to be associated with increased alcohol us e and related problems (Geisner, Larimer, & Neighbors, 2004).

Finally, a growing body of research has begun to examine self-identity as a drinker and its relationship with alcohol use. Drinking identity can be conceptualized as the extent to which a person perceives alcohol consumption to be a defining or central part of his/her identity (Conner, Warren, Close, & Sparks, 1999). Furthermore, and consistent with broader work on self-identity's role in behavior, alcohol identity has been associated with college drinking (Casey and Dollinger, 2007). Self-reported drinking identity has demonstrated significant links with increased alcohol use (Foster, Yeung, & Neighbors, 2014; Reed, Wang, Shillington, Clapp, & Lange, 2007).

1.5 Current Study

College drinking continues to be problematic, and a large number of college students meet criteria for an alcohol use disorder (AUD). LCA provides a way to examine homogenous subtypes of college drinkers based on patterns of AUD criteria endorsement. To date, there are no published studies examining subtypes of college drinkers based on DSM-5 AUD criteria of which we are aware. Additionally, it is unclear whether there are subtypes of college drinkers who meet criteria for an AUD that map onto the DSM-5 definitions of a mild, moderate, or severe disorder. The purpose of this study was to 1) examine whether there were distinct classes of heavy drinking college students based on DSM-5 AUD criteria and 2) determine whether gender, perceived descriptive norms, perceived injunctive norms, use of protective behavioral strategies (PBS), drinking refusal self-efficacy (DRSE), self-identification as a drinkers, psychological distress, and/or membership in a fraternity or sorority is associated with class membership. We hypothesized that those in the more severe classes of DSM-5 AUD would be male, have higher perceived descriptive and injunctive norms, use fewer protective behavioral strategies when drinking, have lower self-efficacy for refusing alcohol, higher self-reported drinking identity, experience more psychological distress, and be members of a fraternity or sorority when compared to those in the less severe classes.

2. Materials and Methods

2.1 Participants

Participants included 394 undergraduates (51.5% female) from a large, public university in the south (n=118), a large, public university in the northwest (n=145), and a small, private university in the west (n=131). Participants were between the ages of 18 and 26, met heavy drinking criteria (defined as drinking at least 4/5 drinks on one occasion for women and men, respectively, in the last month), and met DSM-5 criteria for an AUD (defined by endorsing at least two of the 11 criteria). Participants were baseline respondents of a larger

study examining the effects of a web-based personalized normative feedback intervention to reduce risky drinking. The mean age was 20.5 (*SD*: 1.6) and the racial/ethnic breakdown was 62.9% Caucasian, 16.0% Asian, 21.1% Hispanic, 3.6% Black/African-American, 1.0% Native Hawaiian/Pacific Islander, 0.8% Native American, 7.9% multi-ethnic, and 7.4% "Other".

2.2 Procedures

A list of all registered students during the fall semester of 2012 was obtained by each respective university. Invitations to participate in an online screening survey were sent. In order to be eligible for the larger trial, participants had to be between 18 and 26 years old and meet criteria for heavy drinking, as previously defined.

Of the 9,528 invited students, 2,280 (23.9%) completed the screening assessment and 992 (43.5%) met screening criteria and were invited to participate in the longitudinal study. Of these, 624 (62.9%) completed the baseline assessment and 394 (63.1%) met DSM-5 criteria for an AUD. All three sites received approval from their respective Institutional Review Boards.

2.3 Measures

2.3.1 DSM-5 criteria—Past year AUD criteria was assessed using a self-report measure comprised of 11 yes/ no items corresponding to the DSM-5 criteria (American Psychiatric Association, 2013). Items were taken directly from the DSM-5, with no modifications.

2.3.2 Demographics—Participants' gender was identified by the registrar's list obtained by each respective university. Additionally, participants were asked whether they were currently members of a fraternity or sorority (yes/no).

2.3.3 Perceived norms—Perceived descriptive and injunctive norms were measured by a version of the Drinking Norms Rating Form (DNRF; Baer, Stacy, & Larimer, 1991) that was modified to refer to the typical student at the participant's specific university. Participants were asked to estimate the average number of standard drinks consumed on every day of a normal Monday to Sunday week within the last month by the typical same-sex student at the student's specific university (e.g. "How much alcohol, on average (measured in number of drinks), does a typical male/female [university name] student drink on each [day] of a typical week?"). Participants were also asked to estimate the average number of standard drinks the typical same -sex student approved of consuming on every day of a normal Monday to Sunday week within the last month (e.g. "How much alcohol, on average (measured in number of drinks), does the typical male/female [university name] student approve of drinking on each [day] of a typical week?"). Scores represent the sum of the number of alcoholic beverages over the course of the average week in the past month.

2.3.4 PBS—The Protective Behavioral Strategies Survey (PBSS; Martens et al., 2005) is a 15-item survey that asks respondents to identify different protective behaviors they might have used in the last three months while they were drinking. Sample items include "Using a designated driver", "Having a friend let you know when you have had enough", and

"Alternating alcoholic with non-alcoholic beverages." Respondents rated items on a 5-point Likert scale that ranged from "Never" to "Always", and the scores represent the sum of all 15 items. Cronbach's α for the PBSS was .84.

2.3.5 DRSE—The Drink Refusal Self-Efficacy Questionnaire (DRSEQ; Young & Oei, 1996) is a 19-item scale that assesses self-efficacy related to drinking. Participants were given a list of situations in which people may find themselves drinking alcohol and were asked to rate their ability to resist drinking on a 6-point Likert scale ranging from "I am very sure I could NOT resist drinking" to "I am very sure I could resist drinking", and the scores represent the sum of all 19 items. Cronbach's α for the DRSEQ was .92.

2.3.6 Self-Identification as a Drinker—Adapted from the Smoker Self-Concept Scale (Shadel & Mermelstein, 1996), the Self-Identification as a Drinker scale is a 5-item measure of drinking identity. Participants indicate how much drinking plays a part in their life and personality, as well as others' perceptions of the role of alcohol in their life (e.g., "Drinking is a part of 'who I am'"). Response options range from 0=Strongly Disagree to 6=Strongly Agree. Cronbach's α was .91.

2.3.7 Psychological Distress—The Depression Anxiety Stress Scale-21 (DASS-21; Lovibond & Lovibond, 1995) is a 21-item self-report measure that assesses negative affect. Participants were asked to rate how much a particular statement applied to them over the past week using a 4-point Likert scale ranging from "Did not apply to me at all" to "Applied to me very much, or most of the time." Sample items included "I found it hard to wind down", "I found it hard to work up the initiative to do things", and "I experience trembling (e.g., in the hands)." Scores represent the sum of all 21 items of the DASS-21 and Cronbach's α was .92.

2.4 Data Analysis Plan

Our data analysis plan consisted of 1) examining descriptive statistics and frequencies of all relevant variables, 2) identifying the optimal latent class solution, 3) examining latent class characteristics for the final class solution, and 4) identifying covariates of class membership. All analyses were conducted using IBM SPSS 21 (IBM Corp., Armonk, NY) and MPlus 7.11 (Muthen & Muthen, 2013).

2.4.1 Identifying the optimal latent class solution—Several steps were taken to identify the optimal latent class solution. The first step involved identifying the model with the optimal number of latent classes using the 11 indicators of DSM-5 criteria. We considered models with one to five classes. To assess model fit, we examined the Akaike Information Criterion (AIC), the consistent AIC (CAIC), the Bayesian Information Criterion (BIC), the sample-size adjusted BIC (a-BIC), and average latent class probabilities for most likely latent class membership. Lower AIC, CAIC, BIC, and a-BIC scores indicate better fit. Additionally, the average latent class probabilities for most likely latent class membership by latent class are indicators of latent class separation. Latent class separation refers to the idea that the pattern of item-response probabilities across indicator variables is clearly differentiated among the latent classes (Collins et al., 2010). Good latent class separation is

indicated by a response pattern that has a large probability of occurrence for one latent class (i.e., ≥.8) and has a very small probability of occurrence on all other classes (Geiser, 2013). In other words, good class separation is indicated by a response pattern that is characteristic of that particular class only, and not characteristic of any other latent classes.

2.4.2 Examining latent class characteristics for the final class solution—Once we identified the optimal number of classes using these fit indices, we examined item-response probabilities, which indicate, conditional on latent class membership, the degree to which we can be confident in a response. Item-response probabilities close to 1 indicate a strong relationship between an observed variable and a latent variable. Item-response probabilities help us determine how well a solution can be interpreted and whether the latent classes in the solution show logical and meaningful patterns of item responses.

2.4.3 Covariates of latent class membership—Finally, to examine the effect of the covariates on latent class membership, we included a logit link function in the model. Odds ratios from multinomial regression output indicated the increase in odds of membership in a particular latent class relative to the reference class for a one -unit increase in the covariate. Per the recommendations of Asparouhov and Muthen (2013), Bakk and colleagues (Bakk, Tekle, and Vermunt, 2013), and Feingold and colleagues (Feingold, Tiberio, & Capaldi, 2013), we used the 3-step method to assess the effect of a covariate on the latent class variable. The traditional approach (known as the 1-step approach) combines the latent class model and the latent class regression model into a joint model using the maximum-likelihood estimator (Asparouhov & Muthen, 2013). The disadvantage to using this approach is that the covariate may have some direct influence on any one of the indicator variables. This could lead to a substantial change in the way the latent class is formed, thus altering the latent class solution. As such, we used the “3-step” approach, which does not combine the latent class model and the latent class regression model into a joint model, reducing the possibility for class misspecification (Asparouhov & Muthen, 2013; Vermunt, 2010). During the first step, the latent class model is estimated using only latent class indicator variables. In th e second step, the most likely class variable is created using the latent class posterior distribution obtained during the first step. Finally, during the third step, the most likely class is regressed on the predictor variables, taking into account any misclassifications in the second step. In order to ensure that our class solution was stable and did not change dramatically due to the addition of covariates in the model, we inspected fit indices, class separation, class percentages, and item response probabilities in the new model.

3. Results

3.1 Sample Descriptive statistics and Frequencies

The mean number of drinks per week for the sample was 12.8 (*SD*: 10.3). Table 1 indicates the prevalence of DSM-5 criteria for the whole sample. Almost the entire sample endorsed drinking more than they intended to (91.9%). Additionally, 42.6% of the sample reported spending a great deal of time drinking and 39.6% reported experiencing cravings and a strong desire to drink. Approximately half of the sample reported needing larger amounts of

alcohol to get the same effect as before (54.6%) and experiencing diminished effects over time when consuming the same amount of alcohol (48.7%), both of which are indicators of alcohol tolerance. A small percentage reported experiencing withdrawal symptoms when attempting to quit or reduce drinking (5.1%) and drinking to relieve or avoid withdrawal symptoms (6.1%), both of which are indicators of alcohol withdrawal effects. Of the total sample, 63.7% met criteria for a mild AUD, 24.4% met criteria for a moderate AUD, and 11.9% met criteria for a severe AUD.

3.2 Determination of Number of Classes

The first step in the analysis, which involved comparing models with 1- to 5-class solutions based on fit indices (Table 2), suggested that the 2-class solution was optimal. The 2-class solution also indicated good separation based on the average latent class probabilities for most likely latent class membership by latent class, with probabilities of 0.92 and 0.97.

3.3 Latent Class Characteristics

The final model with the 2-class solution, which included eleven indicators, revealed two distinct and interpretable classes. As seen in Figure 1, there were distinguishable indicator response patterns for both of the latent classes. Class characterizations based on indicator responses are described below.

3.3.1 Class 1(Less Severe; 86%)—This class represented a subgroup of students who reported experiencing relatively few of the DSM-5 criteria for AUD in the past 12 months, as evidenced by a lower probability of endorsing almost all of the indicators. Individuals in this class were likely to endorse drinking more than intended to (92%) and meet criteria for Tolerance (63%). Additionally, approximately 75% of individuals in this class met DSM-5 criteria for a mild AUD and 25% met DSM-5 criteria for a moderate AUD.

3.3.2 Class 2 (More Severe; 14%)—This class represented a subgroup of students who reported experiencing relatively more DSM-5 criteria for AUD in the past 12 months, as evidenced by a higher probability of endorsing over half the criteria. Individuals in this class were more likely to drink more than they intended to (94%), spend a great deal of time drinking (76%), continue drinking despite experiencing recurrent social and interpersonal problems (75%), and experience high alcohol tolerance (74%). Additionally, individuals in this class were more likely to have made multiple efforts to quit or cut down (69%) and neglected their responsibilities as a result of drinking (63%). The majority of those in this class met DSM-5 criteria for a severe AUD (82%) and 18% met criteria for a moderate AUD.

3.4 Covariates of Latent Class Membership

After identifying the two distinct classes, we examined gender, perceived descriptive and injunctive norms, use of PBS, DRSE, self-identification as a drinker, psychological distress, and membership in a fraternity/sorority as covariates of class membership (Table 3). All covariates were entered into the model at one time, which is the most conservative approach. Odds ratios reflect the increase in odds of membership in the More Severe class relative to the Less Severe class for a one-unit increase in a given covariate. Results indicated that

having lower self-efficacy to refuse drinking and greater self-identification as a drinker were uniquely associated with being in the More Severe class, relative to the Less Severe class.

4. Discussion

The purpose of this study was to examine whether there were distinct classes of heavy drinking college students based on DSM-5 AUD criteria and whether membership in those classes was associated with specific covariates. We identified two classes of college drinkers who met criteria for DSM-5 AUD that were distinguished by the types of criteria that they endorsed. The Less Severe class was distinguished by a low probability of endorsing all of the DSM-5 criteria, except drinking more than intending to and tolerance. The More Severe class was distinguished by a high probability of endorsing more than half of the DSM-5 criteria.

A large percentage of those in both classes endorsed drinking alcohol in larger amounts or over a longer period of time than intended. Indeed, most of the whole sample indicated endorsing drinking alcohol in larger amounts or for longer than intended (91.9%). Impaired control, defined as the inability to limit alcohol consumption in a situation where the individual intended to limit their consumption (Heather, Tebbutt, Mattick, & Zamir, 1993), has been found to be associated with alcohol-related problems among college drinkers (Leeman, Patock-Peckham, & Potenza, 2012). Studies have demonstrated stronger relationships between impaired control and alcohol-related problems than between impaired control and alcohol consumption (Nagoshi, 1999; Patock-Peckham & Morgan-Lopez, 2006). A longitudinal study by Leeman, Toll, Taylor & Volpicelli (2009) found that while impaired control prospectively predicted alcohol-related problems, it did not significantly predict frequency of heavy drinking. Given the association between impaired control and alcohol-related problems, we would expect those who meet criteria for DSM-5 AUD to endorse this item.

The DSM-5 differentiates between mild, moderate, and severe AUD criteria based on the number of criteria endorsed. We sought to examine the qualitative differences among subgroups of college drinkers who meet DSM-5 criteria for an AUD. The majority of those in the Less Severe class met criteria for a mild AUD and the majority of those in the More Severe class met criteria for a Severe AUD. These findings indicate the utility of the Severe and Mild AUD categories of the DSM-5, even among a subgroup of drinkers who are at high-risk relative to the general population of drinkers. The majority of those who met criteria for a moderate AUD were in the Less Severe class (90%). This may suggest that, at least among heavy drinking college students between the ages of 18 and 26 who meet criteria for a DSM-5 AUD, the mild and moderate designation in the DSM-5 may be less distinct. While students with a moderate AUD endorsed 2-3 AUD criteria, the majority of whom were in the Less Severe class, their profile of item endorsement was generally less problematic than those in the More Severe class, which included a large proportion of students who endorsed almost all items. This distinction may be most meaningful, as it highlights that there is a more severe class of students who not only endorse 6+ DSM-5 items, but appear to self-identify as drinkers and have lower self-efficacy for refusing alcohol in a given situation.

In examining the profiles of both classes it is interesting that drinking more than intended and tolerance were relatively indistinguishable, whereas there were large discrepancies between the proportion of those reporting having attempted to have cut down, neglected responsibilities, and social/interpersonal problems between the two classes. Therefore, if one wanted to distinguish between more and less severe drinkers in this population, it might make sense to ask questions regarding attempts to cut down, how drinking affects responsibilities, and social or interpersonal problems due to drinking.

The covariate analyses indicated that having lower self-efficacy for refusing drinking and greater self-identification as a drinker was uniquely associated with being in the More Severe class, relative to the Less Severe class. It is not surprising that individuals who have lower self-efficacy for drinking refusal and identified as a drinker were more likely to be in the More Severe class. Self-efficacy is a relatively robust protective factor for disordered drinking and other substance use. Surprisingly, gender, perceived social norms, use of PBS, psychological distress, and membership in a fraternity or sorority were not uniquely associated with class membership. Studies that have found these covariates to be associated with heavier drinking typically include a wider range of drinkers (i.e. abstainers to binge drinkers) (Cashin et al, 1998; Geisner et al., 2004; Johnston et al, 2014; Martens et al., 2011; Neighbors et al., 2007). Relative to the samples in these studies, our sample was much more homogenous, as it included not only heavy-drinking college students, but also college students who met criteria for an AUD. Given this relative homogeneity, these particular factors may not distinguish between two classes of college drinkers who are less severe and more severe. These outcomes speak further to the ability of drinking refusal self-efficacy and self-identification as a drinker for distinguishing between classes.

These results extend previous work considering latent classes of drinking among college students. Our sample was more selective than previous studies in that we were exclusively focusing on students who reported at least one heavy drinking episode in the past month and met DSM-5 criteria for an AUD. Previous work has found between three and five classes using quantity, frequency, consequences of drinking, or DSM-IV criteria as indicators. In considering only drinkers who have had at least one recent heavy drinking episode, there appear to be only two classes. This is not inconsistent with previous work, given that most of the classes not represented here would include light drinkers or nondrinkers. These results do raise questions about the importance of the moderate category in the DSM-5 in this particular population.

One limitation of this study is that while the DSM-5 items, demographics, drinks per week, and self-identification as a drinker were all measured as part of a screening survey, protective behavioral strategies, drinking refusal self-efficacy, and psychological distress were measured at baseline. Thus, there was some time discrepancy between completing the DSM-5 and additional variables. If anything, we would expect results to be stronger if all variables were assessed at one timepoint. An additional limitation is that drinking measures were based on retrospective self-reports. DSM diagnoses are also typically made using interviewer-assisted methods, rather than being based solely on self-report. Attempts were made to minimize potential social desirability bias by assuring participants that all responses were completely anonymous (Babor, Stephens, & Marlatt, 1987). One strength of the study

is that participants were randomly selected to complete the screening survey. Another strength is that we collected data from three US college campuses which differed by size, region, demographics, and SES. As such, we can draw conclusions regarding DSM-5 class membership with more confidence. Future studies should consider the transition across classes of DSM-5 AUD criteria over time. In particular, it would be interesting to see whether the use of personalized normative feedback might impact transitions between specified classes of DSM-5AUD criteria, particularly given that the majority of heavy drinking college students "mature out" of problem drinking once they leave college (Schulenberg & Maggs, 2002). In particular, information which reveals that a given individual in the severe class is drinking more than his or her peers could motivate them to make changes in their drinking, perhaps by causing them to reflect on their drinking-related identity. Alternatively, an individual in the less severe class who has the opportunity to compare his or her drinking with typical others may be motivated to refrain from escalation to the more severe class.

These results have implications for the use of interventions to reduce problem drinking among college students. Those in the More Severe class could receive a greater "dose" of an intervention, which may include: increasing drinking refusal self-efficacy through the use of social skills training; de-identifying as a drinker and re-identifying as other things (i.e., a family member, a friend, a swimmer, etc.); re-focusing on other activities, such as sports or music, given that they are spending a lot of time on drinking-related activities; focusing on activities with friends that do not include drinking, especially given that drinking may be causing persistent social and interpersonal problems; and training to more accurately assess blood alcohol concentration, in order to more reliably determine the effects of alcohol, given their relatively high tolerance.

4.1 Conclusion

In summary, we identified two distinct classes of heavy-drinking college students distinguished by DSM-5 AUD criteria. Lower self-efficacy for refusing drinking and higher self-identification as a drinker was associated with membership in the More Severe class relative to the Less Severe class. Results suggest that intervention strategies may differ depending on class membership. Content for students who are in the More Severe class of heavy drinkers might include specific components designed to increase self-efficacy and/or reduce identification with drinking. This may not be needed for students in the Less Severe class. Moreover, the present results suggest a need to further consider intervention content that is person -centered and personalized based on risk and profile.

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Highlights

- College drinkers with a DSM-5 AUD fall into two distinct classes based on severity
- Lower refusal self-efficacy was associated with being in the more severe class
- Greater identity as a drinker was associated with being in the more severe class
- Interventions need to be more focused and tailored for the more severe class

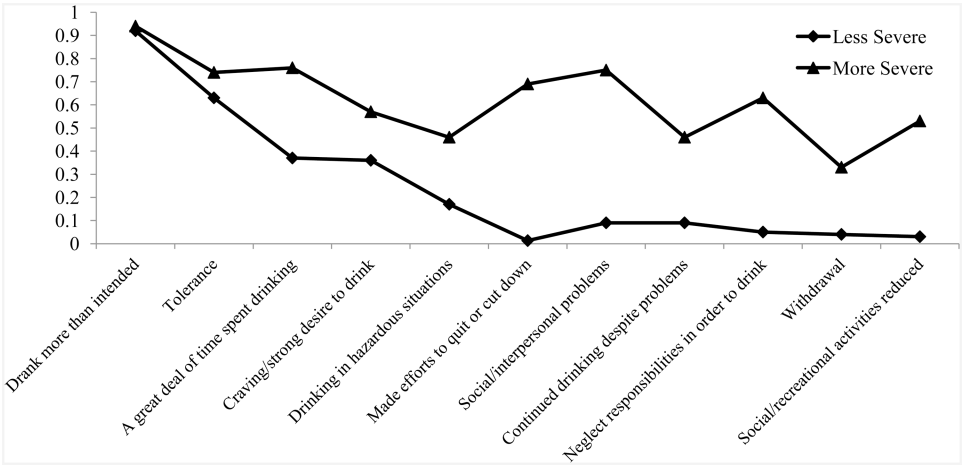

Figure 1. Probabilities of endorsing each indicator variable conditional upon membership in the latent class for the 2-class solution

Table 1

Prevalence of DSM-5 Dependence Criteria (N=394)

	N	%
Drank more than intended	362	91.9
Needing larger amounts[a]	215	54.6
Diminished effects[a]	192	48.7
A great deal of time spent drinking	168	42.6
Craving/strong desire to drink	156	39.6
Drinking in hazardous situations	86	21.8
Made efforts to quit or cut down	84	21.3
Social/interpersonal problems	75	19.0
Continued drinking despite problems	57	14.5
Neglect responsibilities in order to drink	54	13.7
Social/recreational activities reduced	43	10.9
Drank to avoid withdrawal symptoms[b]	24	6.1
Experiencing withdrawal symptoms[b]	20	5.1

[a]Tolerance symptoms

[b]Withdrawal symptoms.

Table 2

Model fit statistics for 1 to 5 latent classes

No. of classes	AIC	CAIC	BIC	a-BIC	Avg. latent class probabilities
1	4164.00	4181.551	4207.74	4172.84	--
2	**3912.64**	**3949.335**	**4004.10**	**3931.12**	**0.92-0.97**
3	3902.29	3958.127	4041.46	3930.40	0.82-0.90
4	3892.03	3967.017	4078.92	3929.79	0.95-0.99
5	3881.13	3975.263	4115.73	3928.53	0.86-0.98

Note. Bolded row indicates the chosen class solution; AIC = Akaike's Information Criterion; CAIC = Consistent Akaike's Information Criterion; BIC = Bayesian Information Criterion; a-BIC = Sample-size Adjusted Bayesian Information Criterion.

Table 3

Odds Ratios for Covariates of Class Membership in the More Severe class relative to the Less Severe class using the 3-Step Method

Covariate	B	S.E. (B)	*OR*	95% CI	
				LL	UL
Gender	0.01	.03	1.01	0.96	1.07
Descriptive norms	0.03	.02	1.03	0.99	1.07
Injunctive norms	0.00	.02	1.00	0.97	1.04
Protective behaviors	0.00	.02	1.00	0.97	1.04
DRSE	-0.03*	.01	0.97	0.95	0.99
Drinker identity	0.09**	.03	1.10	1.04	1.16
Psychological distress	0.10	.10	1.10	0.91	1.33
Frat/sor status	0.20	.43	1.22	0.53	2.85

Note. DRSE=drinking refusal self-efficacy. Frat/sor status=membership in a fraternity/sorority

* $p < .05$.

** $p < .01$.