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Self-regulation and alcohol use involvement: A latent class analysis

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Abstract

Although alcohol use can be problematic, research suggests considerable heterogeneity in problems across various drinking classes; particularly among the heaviest drinking groups. Differences in self-regulation may differentiate drinking classes. The current study evaluated differences in emotional and behavioral self-regulation across four empirically derived drinking classes. Participants ($n = 1895$ college students) completed online measures of demographics, alcohol involvement, and self-regulation. Using latent class analysis (LCA), four drinking classes were empirically derived. Moderate drinkers were the largest class (38.1%) followed by light drinkers (37.4%), heavy drinkers (17.8%), and problem drinkers (6.8%). Each class was predicted by self-regulation indicators in the LCA. With the exception of urgency, behavioral self-regulation distinguished primarily between light drinkers and the other three classes. Emotional self-regulation and urgency were not associated with use, but did distinguish among the most problematic class. Specifically, emotional instability and urgency were higher in the problem use class than all other classes. Overall, the findings suggest important differences in behavioral and emotional self-regulation across drinking classes that differentially contribute to use and consequences. Further, the results highlight the importance of examining homogenous subpopulations of drinkers that may differ on indices other than consumption.

Keywords

Latent class analysis; Self-regulation

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Contributors

NJK developed the primary hypotheses; wrote the majority of the introduction and discussion.

RDD provided the data; assisted in the development of the hypotheses; conducted the analyses; wrote the majority of the methods and results.

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EMS assisted in the literature review; assisted with data collection; assisted in the writing of the methods and results.

Conflict of interest

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1. Introduction

College students are at an increased risk for both alcohol use and alcohol related problems (Connell, Gilreath, & Hansen, 2009; Wechsler, Lee, Kuo, & Lee, 2000). Students who drink are more likely to miss class, fall behind in school, and study less, and have lower GPAs (Wechsler & Nelson, 2008). Furthermore, they are more likely to engage in risky sexual behavior and anti-social acts (Wechsler & Nelson, 2008). Though drinking can be problematic, there is also evidence that alcohol use may be a normal part of young adult development (Schulenberg, Maggs, & Hurrelmann, 1997). Adolescence and young adulthood are considered stages in human growth when experimentation, risk taking, and independence are normative (Shedler & Block, 1990). In fact, alcohol use among young adults may even have some benefits. Research shows that light or moderate drinkers have a better quality of social relationships and less subjective distress than even abstainers (Schulenberg et al., 2000). Thus, alcohol use may be adaptive, but it is important to understand when drinking transitions from adaptive to problematic.

2. Drinking classes

Research suggests that alcohol-related consequences differ across groups of varying alcohol use involvement. Understanding factors that may differentiate problematic from non-problematic alcohol use is an important area of research. Heavy drinkers are likely to start drinking at an earlier age and experience significantly more negative consequences associated with drinking (Abar, 2012). Connell et al. (2009) found that heavy drinkers were more likely to engage in risky sexual behavior and drug use compared to alcohol experimenters. Heavy drinkers have also reported higher scores on aggression measures as compared to low and moderate drinkers (Beseler, Taylor, Kraemer, & Leeman, 2012). In the same sample, heavy drinkers also reported a lower life satisfaction than low and moderate drinkers. Interestingly, Beseler et al. (2012) found that moderate and heavy drinkers did not consume significantly different amounts of alcohol, though significant individual differences existed between groups.

Several studies have used latent class analysis (LCA) to derive drinking classes (Auerbach & Collins, 2006; Beseler et al., 2012; Connell et al., 2009). Beseler et al. (2012) demonstrated three drinking classes among college students: light, moderate, and heavy. In this sample, moderate and heavy users did not differ significantly in consumption per week, binge drinking episodes, or drinks per day; however, heavy users endorsed more Alcohol Use Disorder (AUD) criteria and experienced more alcohol-related problems. Auerbach and Collins (2006) identified five classes: no use, occasional low use, occasional high use, frequent high use, and frequent high use with heavy episodic drinking. Across several LCA studies, research consistently differentiates several homogenous drinking groups within heterogeneous populations, including multiple heavy drinking classes which are often distinguished by alcohol related problems.

Some research has utilized the Alcohol Use Disorders Identification Test (AUDIT; Saunders, Aasland, Babor, & de la Fuente, 1993) to empirically derive drinking classes

using LCA (Rist, Glöckner-Rist, & Demmela, 2009; Smith & Shevlin, 2008). Rist et al. (2009) identified four drinking classes from the six negative alcohol-related outcomes assessed on the AUDIT: unaffected (by negative effects of alcohol), harm, dependence, and harm plus dependence. It is unclear how much these groups differ in use because it is not reported. However, the authors do note that, based on the factor structure and latent classes, assessing ‘use only’ fails to capture the fact that some drinking classes are comprised of adverse outcomes above and beyond use. Smith and Shevlin (2008) used LCA with the full AUDIT and found a six class solution: heavy consumption with multiple negative consequences, heavy consumption with injury and suggestion to cut down, heavy consumption with memory loss, moderate consumption, mild consumption with injury and suggestion to cut down, and a baseline/very mild consumption. Consistent with previous research, the heaviest use classes were differentiated by levels/types of alcohol related problems. Thus, there appears to be considerable heterogeneity among heavy users. Understanding factors that may differentiate heavy drinkers with problems versus heavy drinkers without problems may be important for intervention efforts.

In summary, research consistently finds multiple drinking classes. Moreover, there appears to be differences in alcohol related consequences between individuals belonging to drinking classes that report similar levels of alcohol consumption, with the most heterogeneity observed in the heaviest drinking groups. Finally, individual factors may differentiate both between use classes as well as problematic functioning within similar drinking classes. Given that drinking classes appear to differ in personality, temperament, and/or cognitive abilities, examining differences across groups from a multi-dimensional self-regulation framework may provide insight into the nature of drinking classes and help to identify those at greatest risk for alcohol-related problems.

3. Self-regulation

Vohs et al. (2008) define self-regulation as “The self exerting control to override a prepotent response, with the assumption that replacing one response with another is done to attain a goal and conform to standards” (p. 884). Self-regulation can be divided into many subtypes (Boekaerts, Pintrich, & Zeidner, 2000). Both behavioral and emotional self-regulation have been effectively used as predictors of behavior (Carver & Scheier, 1998; Khantzian & Galanter, 1990). These forms of self-regulation have been found to be related to substance use and substance related problems (see Wills, Walker, Mendoza, & Ainette, 2006).

Emotional self-regulation involves complex processes that we use to influence which emotions we have, when we have them, and how we experience and express them (Gross, 1998). There is considerable research linking poor emotional self-regulation to alcohol consumption and related problems (Sher, Grekin, & Gross, 2007). Negative emotion regulation is related to multiple indices of problematic use (Catanzaro & Laurent, 2004; Cooney et al., 2009; Giancola, 2004; Simons, Carey, & Wills, 2009). Emotional self-regulation has several components, some of which are the degree and magnitude of emotional instability and individual differences in one's ability to tolerate and cope with negative emotions. These specific sub-components of emotional self-regulation have been

related to problematic alcohol use (Buckner, Keough, & Schmidt, 2007; Simons & Carey, 2006).

Emotional instability is an important component of emotion regulation (Oliver & Simons, 2004). Several studies (e.g., Simons & Carey, 2006; Simons et al., 2009) have shown an inverse association between emotional instability and alcohol use; although, others have shown a positive association between instability and use (Gottfredson & Hussong, 2013). Despite this contradiction, emotional instability appears to convey significant risk for alcohol related problems (Simons & Carey, 2006), including the development of dependence symptoms (Simons et al., 2009).

Distress tolerance is important to emotional self-regulation, as high distress tolerance helps to lessen the impact of negative mood states (Simons & Gaher, 2005). Distress tolerance appears to buffer against problematic drinking. Buckner et al. (2007) found that people with higher distress tolerance were less likely to use alcohol and experienced fewer alcohol-related problems. Grüsser, Mörsen, and Flor (2006) found problem drinkers experienced more stress-distress and used more negative coping strategies than occasional drinkers. Other studies have found that the relation between distress tolerance and alcohol problems is mediated by coping (Howell, Leyro, Hogan, Buckner, & Zvolensky, 2010; Vujanovic, Marshall-Berenz, & Zvolensky, 2011; Zvolensky et al., 2009). These findings suggest that drinking is used as a way to cope with high levels of distress. Thus, distress tolerance has a complex yet consistent relationship with alcohol-related problems.

Behavioral self-regulation consists of a number of factors often referred to as impulsivity, (dis)inhibition, self-control, and/or constraint (see Carver, 2005). Research and theory suggests that these factors combine to comprise two separate, but related, systems. There are several different theories of how these two processes function (e.g., id vs. ego, rational vs. experiential, hot vs. cool, reflective vs. impulsive, etc.). Although these theories have important conceptual differences, they share a common theoretical framework (Carver, 2005). The first system, often referred to as the “hot” or “impulsive” system is quick to act and heavily influenced by emotional states. The second system, often called the “cool” or “effortful” system, is slower, flexible, and strategic. Each of these systems have been differentially related to alcohol use and alcohol-related problems (Dvorak, Simons, & Wray, 2011; Wills, Sandy, & Yaeger, 2002).

Research suggests that the effortful system is associated with adaptive outcomes. For example, this system is associated with reduced alcohol use and problems (Dvorak et al., 2011), more positive life events (Wills et al., 2006), fewer external problems (Eisenberg et al., 2004), and increased resiliency (Eisenberg et al., 2004). Furthermore, the effortful system appears to diminish the effects of the impulsive system on maladaptive outcomes (Dvorak & Simons, 2009; Dvorak et al., 2011; Wills, Ainette, Stoolmiller, Gibbons, & Shinar, 2008). In contrast, the impulsive system is often associated with maladaptive outcomes including increased alcohol use and problem severity (Dvorak et al., 2011).

Interestingly, these two systems appear to differ across drinking classes (Beseler et al., 2012; Goudriaan, Grekin, & Sher, 2007). Beseler et al. (2012) observed significant differences in

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attentional, non-planning, and motor impulsivity when comparing light, moderate, and heavy drinkers. Research suggests that these facets of impulsivity map onto the higher order factors of Premeditation (i.e., “cool” processing) and Urgency (i.e., “hot” processing) (Whiteside & Lynam, 2001). Goudriaan et al. (2007) found significant differences in the performance on the Iowa Gambling Task across drinking classes. They demonstrated that light binge drinkers had better task performance than moderate and heavy binge drinkers, whereas, moderate and heavy drinkers did not differ in task performance. Dvorak et al. (2011) examined how these systems related to alcohol use and problem severity. Although they did not examine “classes” per se, they did utilize a statistical model (i.e., zero-inflated count model) which allowed for the examination of abstainers and individuals who never experience alcohol related problems, relative to drinkers and those who do experience problems. They found that good self-control (i.e., the effortful system) was inversely associated with the frequency of problems among people who experienced alcohol related consequences, but did not differentiate those who never experienced problems. However, individuals with higher rates of good self-control were more likely to be abstainers. In contrast, the impulsive system did not differentiate abstainers, but did predict alcohol use among those who drank. Further, the impulsive system was robustly associated with increased problems.

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Finally, research suggests that the impulsive system may be comprised of two separate modes that influence impulsive action via divergent mechanisms (Dawe, Gullo, & Loxton, 2004; Gullo & Dawe, 2008). The first is influenced by emotional states and is often called “rash action,” “urgency,” and/or “(dis)inhibition.” The urgency facet is comprised of impulsive behavioral tendencies while experiencing strong emotional states. The next mode, referred to here as “sensation seeking,” tends to be a product of reward drive, and is composed of appetitive processes such as “sensation seeking,” “reward sensitivity,” and/or “craving” (Gullo & Dawe, 2008). Research suggests that these two modes of impulsivity have distinct neural substrates and differentially influence (and are influenced by) substance use (see Dawe et al., 2004; Gullo & Dawe, 2008). Consequently, examining them independently is important in the context of behavioral self-regulation.

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Thus, behavioral self-regulation appears to be comprised of two systems, an effortful system and an impulsive system. The impulsive system is further divided into two separate functional modes: urgency and reward drive. The recent development of the five factor model of impulsivity (see Cyders et al., 2007) presents an opportunity to examine these three facets of behavioral self-regulation (i.e., self-control, urgency, and reward drive). This model allows for the assessment of reward drive via the sensation seeking scale, two forms of urgency (positive and negative), and two facets of self-control (premeditation and perseverance). Although research frequently examines these five impulsivity components independently, there is evidence that this may result in suppression effects and spurious findings due to the high correlations among some of these variables, which may explain inconsistent findings (see Magid & Colder, 2007). Furthermore, factor analysis supports the three-factor higher-order structure presented here (Cyders & Smith, 2007).

4. Hypotheses

The present study has several primary hypotheses. First, based on earlier research using LCA with the AUDIT, it was hypothesized that we would find multiple alcohol involvement classes, with the heaviest drinking classes being further divided based on alcohol related consequences. Of primary interest was the possibility that facets of behavioral and emotional self-regulation may differentiate between the classes. It was hypothesized that behavioral self-regulation facets would differentiate between the drinking classes with sensation seeking increasing, and self-control decreasing, with level of drinking involvement. Further, it was hypothesized that urgency would differentiate the most problematic drinkers from those with lower levels of problems. Aspects of emotional self-regulation were hypothesized to primarily differentiate the heaviest use classes.

5. Methods

5.1. Participants

Participants ($n = 1895$) were recruited as part of a larger ecological momentary assessment study examining “Emotion, Personality, and Risky Behaviors.” They ranged in age from 18 to 33 ($M = 21.07$, $SD = 2.44$). Participants were 91.1% Caucasian, 4.3% Asian, 1.4% African American, and 3.2% other. Females comprised 60.8% ($n = 1152$) of the sample.

5.2. Measures

Alcohol Use Disorders Identification Test (AUDIT; $\alpha = .86$; Saunders et al., 1993) is a 10-item measure designed to identify individuals at risk for alcohol use disorders. The time reference of the AUDIT is the past year, although some items have no specified time period. It contains scales measuring consumption (3 items; $\alpha = .82$) and consequences (7 items; $\alpha = .82$), which can be summed to yield a total AUDIT score. Previous research supports the validity and reliability of the AUDIT with college student samples (DeMartini & Carey, 2012).

Affect Lability Scale-Short Form (ALS-SF; Oliver & Simons, 2004) is an 18-item short form of the Affect Lability Scales. All items were measured on a 4-point Likert scale ranging from *very un-descriptive* to *very descriptive*. The measure consists of three subscales (Anxiety/Depression: 5 items, $\alpha = .90$; Depression/Elation: 8 items, $\alpha = .90$; Anger: 5 items, $\alpha = .91$). In the current study, the emotional instability indicator was the standardized mean of the three lower order subscales ($\alpha = .86$). The ALS-SF has shown good internal consistency and validity with 30-day test–retest reliability ranging from $r = .56$ to $.86$ across subscales (Oliver & Simons, 2004).

Distress Tolerance Scale (DTS; Simons & Gaher, 2005) is a 15-item measure used to assess tolerance of negative emotional experiences. Items are rated on a 5-point Likert scale ranging from *strongly agree* to *strongly disagree*. The DTS is comprised of four subscales (Tolerance: 3 items, $\alpha = .80$; Appraisal: 5 items, $\alpha = .85$; Absorption: 3 items, $\alpha = .86$; Regulation: 3 items, $\alpha = .80$). In the current analysis, distress tolerance was the standardized mean of the four subscales ($\alpha = .98$). The DTS has shown adequate internal consistency and

validity with a 6 month test–retest reliability for the higher order scale of $r = .61$ (Simons & Gaher, 2005).

UPPS-P Impulsive Behavior Scale is a 59-item measure assessing a 5-factor model of impulsivity. This scale incorporates the original 45-item four factor UPPS model (Whiteside & Lynam, 2001) with a 14-item measure of positive urgency (Cyders & Smith, 2007; Cyders et al., 2007). Participants respond to statements on a 4-point Likert scale ranging from *strongly agree* to *strongly disagree*. The five factors include negative urgency (12 items, $\alpha = .90$), positive urgency (14 items, $\alpha = .95$), premeditation (11 items, $\alpha = .86$), perseverance (10 items, $\alpha = .86$), and sensation seeking (12 items, $\alpha = .85$). The UPPS-P has shown adequate reliability as well as convergent, discriminant, and predictive validity (Cyders, Flory, Rainer, & Smith, 2009; Cyders & Smith, 2007; Cyders et al., 2007).

Research shows that the five-factor model loads on three higher order constructs: conscientiousness (i.e., self-control), urgency, and sensation seeking (Cyders & Smith, 2007). In the current study, three higher-order facets were formed to serve as measures of behavioral self-regulation. Positive and negative urgency were combined to form a mean standardized “urgency” indicator ($\alpha = .86$); perseverance and premeditation were combined to form a mean standardized “self-control” indicator ($\alpha = .72$). The sensation seeking scale was the final indicator.

5.3. Procedure

Participants were recruited via a campus-wide listserv, at a moderate sized Midwest University, and through the University research subject pool. Approximately 10,000 students were offered the opportunity to participate. Participants enrolled in the university research pool received course credit for participation which could be allocated to a course of their choosing. The low response rate (~20%) was likely due to the fact that most participants received neither course credit nor compensation. The study was part of a screen for an ecological momentary assessment study on “Emotion, Personality, and Risky Behaviors.” They completed an online survey assessing basic demographics, aspects of behavioral and emotional functioning, and alcohol involvement. The university IRB approved this study and all participants were treated in accordance with APA ethical guidelines (Sales & Folkman, 2000).

6. Results

6.1. Descriptive, univariate, and bivariate statistics

Table 1 displays the descriptive statistics and bivariate correlations for all study variables. The majority of respondents (82.3%) reported some alcohol consumption. Men and women were not equally distributed across classes with men over represented in the higher drinking classes, $\chi^2(3) = 85.63, p < .001$. Correlations were generally consistent with previous research.

6.2. Latent class analysis

Drinking classes were empirically derived from the AUDIT items using LCA in *Mplus 7.0* (Muthén & Muthén, 2011). We iteratively examined 2, 3, 4, and 5 class models, see Table 2.

Entropy, Bayesian Information Criteria (BIC), and Vuong–Lo–Mendell–Rubin Likelihood Ratio tests (LRT; Lo, Mendell, & Rubin, 2001) were used to compare classes. The LRT and BIC suggested that 2 classes were a better fit than 1, 3 classes were a better fit than 2, and 4 classes were a better fit than 3; though there was a slight drop in Entropy in all cases. A 5 class model was not supported (higher BIC, lower Entropy, and non-significant LRT); thus, the 4 class model was retained. Within the 4 class model, average latent class probabilities for most likely latent class membership across classes were 96.3% (light drinkers), 93.7% (moderate drinkers), 92.1% (heavy drinkers) and 97.1% (problem drinkers). Moderate drinkers were the largest class (38.1%) followed by light drinkers (37.4%), heavy drinkers (17.8%), and problem drinkers (6.8%). Fig. 1 displays the latent class profiles across AUDIT items. Consistent with previous research, we derived multiple classes with the two heaviest drinking classes being primarily differentiated by alcohol-related consequences.

All drinking classes were predicted by the self-regulation indicators in the primary LCA (see Table 3). The findings were generally consistent with hypotheses. Relative to light drinkers, all other drinking classes exhibited higher sensation seeking and lower self-control. When compared to the moderate drinking group, heavy drinkers did not differ on any of the emotion-regulation indicators, but did endorse lower self-control and higher sensation seeking. In contrast, problem drinkers endorsed higher urgency and higher emotional instability than all other drinking classes. The only unexpected finding was that moderate drinkers evidenced greater sensation seeking than heavy drinkers in the multivariate model; though, this is likely due to collinearity with other predictors in the multivariate model as the univariate analysis was consistent with our hypothesis.

7. Discussion

The purpose of the present study was to identify latent drinking classes in a college student sample, and to examine differences in emotional and behavioral self-regulation among these classes. Using LCA, we identified four drinking classes based on students' responses on the AUDIT. In addition, we predicted each class using indicators of emotional and behavioral self-regulation to examine differences in these constructs across empirically derived drinking groups.

Despite the fact that the number of latent drinking classes found in the literature varies from study to study (e.g., three classes, Beseler et al., 2012; five classes, Auerbach & Collins, 2006; six classes, Rist et al., 2009; Smith & Shevlin, 2008), we replicated a pattern of findings consistently shown in the literature. On the lower end of the alcohol use involvement spectrum (i.e., light vs. moderate drinkers), groups were distinguished primarily based on their frequency and quantity of alcohol consumption, whereas on the higher end of the alcohol use involvement spectrum (i.e., heavy drinkers vs. problem drinkers), groups were identified primarily based on their experience of alcohol-related problems. Specifically, problem drinkers did not differ from heavy drinkers in terms of two of the alcohol consumption items and were actually lower on one item; however, they endorsed higher levels of all alcohol-related problem items. For every problem drinker, there were 2.64 times more heavy drinkers in the sample that seemed to drink similar amounts but did not experience similar consequences. Thus, it is important to identify characteristics that

may distinguish between heavy drinkers without significant alcohol-related problems and heavy drinkers with significant alcohol-related problems.

We found significant differences among all four drinking classes across the self-regulation indicators. Although the univariate models revealed more heterogeneity across groups, the multivariate analysis showed results consistent with hypotheses. Differences in behavioral self-regulation distinguished primarily between consumption levels. Specifically, the three drinking classes reporting the most alcohol use had higher levels of sensation seeking and lower self-control (premeditation/perseverance) compared to the group consuming the least amount of alcohol. Further, there was an increasing trend for behavioral self-regulation indicators as alcohol involvement increased, which was primarily evident in the univariate models. Differences in emotional self-regulation distinguished between problem drinkers and all other groups. Specifically, problem drinkers reported higher levels of emotional instability and urgency as compared to all other groups. As previously mentioned, urgency may be considered a mixed indicator of emotional and behavioral self-regulation as it reflects the tendency to act impulsively when experiencing an extreme mood (i.e., elevated positive or negative affect); alternatively, the interaction of emotional and behavioral self-regulation may contribute to urgency. Future research is warranted to clarify the role of urgency in self-regulation models.

Despite the fact that problem drinkers have similar levels of sensation seeking and self-control as do the moderate and heavy use groups, they demonstrated more emotional dysregulation than each of the other drinking groups. Sensation seeking not differing significantly between drinking classes conflicts with Adams, Kaiser, Lynam, Charnigo, and Milich (2012) who found that sensation seeking was related to alcohol related problems, but it is consistent with the LCA of Beseler et al. (2012) who found that moderate and heavy drinking groups did not differ significantly on sensation seeking. Still, these findings provide some support for a class of related, yet distinct, models of alcohol use/addiction. These theoretical frameworks include the self-medication hypothesis (Khantzian & Galanter, 1990), tension reduction hypothesis (Conger, 1956), stressor-vulnerability model (Cooper, Russell, & George, 1988; Cooper, Russell, Skinner, Frone, & Mudar, 1992), stress-response dampening theory (Sher & Levenson, 1982), and negative reinforcement model of addiction (Baker, Piper, McCarthy, Majeskie, & Fiore, 2004). Although these frameworks differ in their scope and their proposed mechanisms, they all suggest an important relation between affective regulation and the development and continuance of problematic substance use. Although the present study did not test any particular affect regulation model over another, it used a novel technique to examine the importance of the association between emotional dysregulation and problematic alcohol use.

The present study highlights the promise of using LCA in population based alcohol research. The current findings should not be taken to assume that the classes represent distinct diagnostic sub-categories. Instead, the empirically derived classes represent relatively homogenous subpopulations of drinkers who differ from each other, not only in terms of their levels of alcohol consumption, but also their experience of alcohol-related problems. As shown in the present study, identification of a problem drinking class is not only useful in determining what alcohol use involvement characterizes problem drinkers, but also what

other psychological characteristics are relevant in describing this form of use. Of course, the case can be (and has been) made for simply using continuous models to examine these relationships. However, the current analysis provides an additional perspective with which to examine these phenomena. It provides important information about drinking subpopulations beyond what is gleaned from continuous models. Therefore, this approach may help to clarify distinct classes in which various theories of addiction are operating. Finally, the current study provides evidence that heavy drinking may not be related to mood for all drinkers, and a case can be made that alcohol related problems are a result of emotion regulation difficulties.

There is significant variability in the literature in terms of the number of drinking classes detected using LCA ranging from three classes (Beseler et al., 2012) to six classes (Rist et al., 2009; Smith & Shevlin, 2008). It is important to determine if such variability in the number of classes reflect (1) measurement differences and/or (2) population differences. Given that all of these studies differ from each other, it is difficult to ascertain what could account for these discrepant findings. In terms of measurement differences, Auerbach and Collins (2006) used four alcohol use items to classify drinkers, whereas Rist et al. (2009) used 6 items from the AUDIT assessing alcohol-related consequences, excluding alcohol use and physiological dependence. Beseler et al. (2012) used a self-report measure of AUD criteria, and found that the LCA fit better when excluding the alcohol use item (i.e., binge drinking). Smith and Shevlin (2008) administered the full AUDIT to classify drinkers which contains both alcohol use as well as alcohol-related consequence items. In terms of population differences, these studies used samples ranging across healthy adults, inpatients, adolescents, and college students. Even though the number of latent classes detected differed across studies, they all demonstrated the usefulness of LCA to identify relatively homogenous groups of individuals who differ in terms of the severity of alcohol-related impairment. Also, when both alcohol consumption as well as alcohol consequence (i.e., AUD symptoms) indicators have been employed to detect latent drinking classes, we find that these indicators distinguish between groups at the lower-end and higher-end of the alcohol use involvement continuum, respectively.

8. Treatment implications

Affect regulation theories propose that mood regulation and consumption are intertwined, resulting in problematic drinking and/or addiction (Baker et al., 2004; Conger, 1956; Khantzian & Galanter, 1990). However, this relationship may not exist for all heavy drinkers. For these drinkers, a harm reduction approach may be more beneficial as they are less likely to experience problems and may not want to quit drinking, but their drinking may still be excessive. In contrast, many problematic drinkers who are likely to report driving drunk or experiencing blackouts appear to be experiencing emotional problems such as emotional instability. Focusing on ways to cope with emotional instability might be a useful tool to effectively reduce alcohol related problems.

9. Limitations

The non-experimental design prevents us from determining causality and the cross-sectional design prevents establishing temporal precedence. For example, one could argue that poor emotional functioning is a consequence of problematic alcohol consumption rather than an antecedent. Longitudinal extensions of the present study would allow future researchers to determine if changes in class membership over time predict, or are predicted by, self-regulation deficits. An additional limitation is the homogenous college student sample. Similarly, there may be unmeasured characteristics specific to this sample, given the low response rate. Thus, it is not clear that the latent classes derived from this sample would generalize to the broader population. As discussed above, given the number of LCA studies in this field to date, one cannot determine whether differences across studies reflect measurement differences, and/or population differences. More LCA research is needed to better establish the number of latent classes one might expect in particular populations.

10. Conclusion

Although frequency and quantity of alcohol consumption differed among the light, moderate, and heavier use groups; alcohol-related consequences distinguished between the heavy and problem use groups, which differed very little in frequency/quantity of alcohol consumption. Our findings suggest the importance of identifying psychological characteristics that differ between problem and non-problem drinkers. The heavy and problem drinking classes displayed differential emotional dysregulation, with problem drinkers experiencing the highest levels of emotional instability and urgency. Overall, the findings suggest important differences in behavioral and emotional self-regulation across drinking classes that differentially contribute to use and consequences. The results highlight the importance of examining self-regulation in a multidimensional framework in order to best delineate differences across alcohol involvement groups.

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HIGHLIGHTS

- Empirically derived four drinking classes using the AUDIT
- Behavioral self-regulation primarily differentiated use classes
- Emotional self-regulation differentiated problem classes

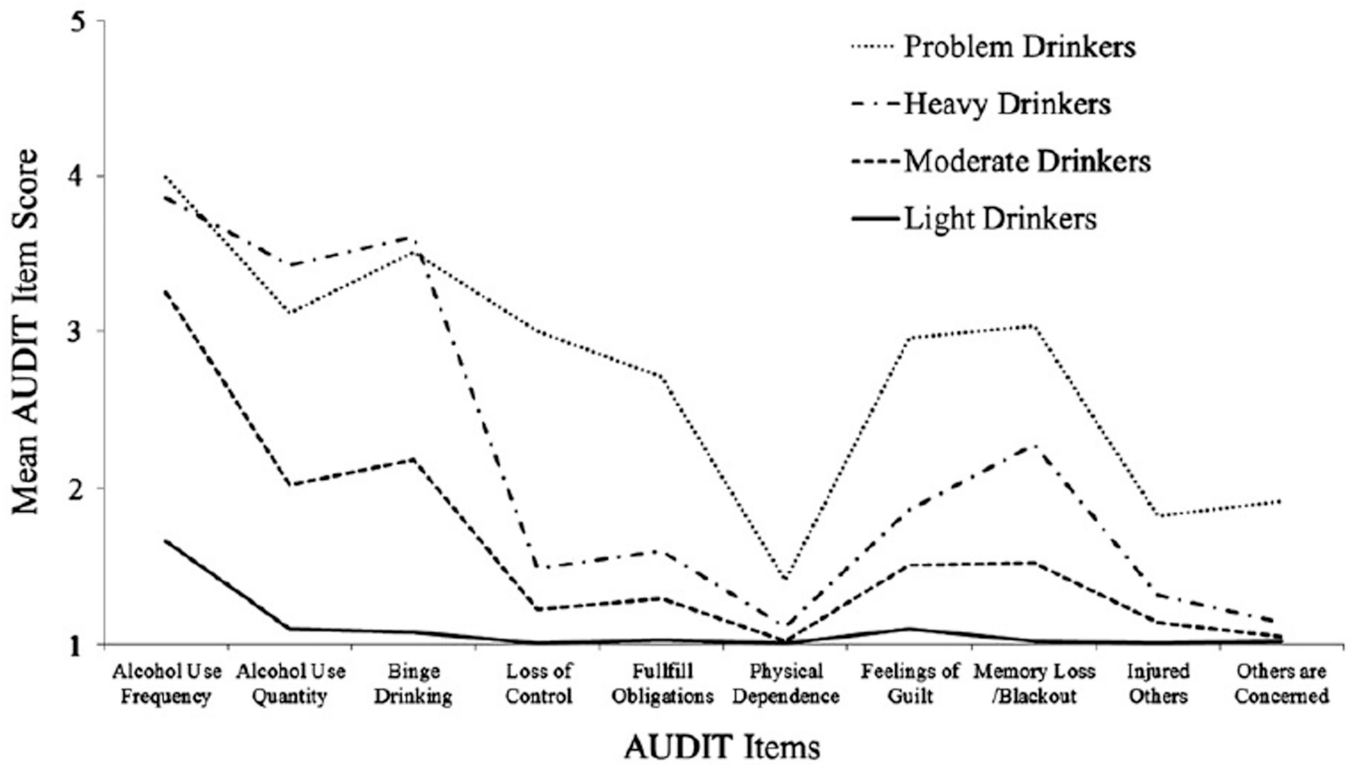


Fig. 1.
Mean AUDIT item scores for each latent class.

Table 1

Descriptive statistics and bivariate correlations among all study variables.

Analysis variables	1	2	3	4	5	6	7	Range	Mean	SD	Skew
1. AUDIT	.86							10 to 36	16.07	5.20	0.84
2. Urgency	.25	.84						-1.58 to 3.08	0.00	0.93	0.59
3. Self-control	-.18	-.49	.72					-3.72 to 1.77	0.00	0.88	-0.64
4. Sensation seeking	.21	.16	.01	.86				12 to 48	33.98	7.31	-0.33
5. Distress tolerance	-.11	-.46	.18	.03	.98			-2.19 to 1.63	0.00	0.87	-0.29
6. Emotional instability	.09	.36	-.16	.01	-.38	.86		-1.03 to 2.70	0.00	0.88	0.75
7. Gender	.17	.08	-.04	.20	.07	-.07	-	0 to 1	0.39	0.49	0.44
8. Age	.12	-.04	.04	-.04	.06	-.05	.06	18 to 34	20.48	2.39	1.58

Note. Significant correlations ($p < .05$) are bolded for emphasis. Cronbach's alphas for multi-indicators are listed on the diagonal. Gender was dummy-coded (0 = Women, 1 = Men).

Table 2

Fit indices of latent class models using AUDIT items.

Drinking classes	Free model parameters	Model log-likelihood	Likelihood Ratio Test	<i>p</i>	BIC	Entropy
2 Classes	39	-17592.58	5571.91	<.0001	35479.49	.911
3 Classes	56	-19345.52	2494.12	<.0001	33113.66	.907
4 Classes	73	-14454.21	1156.96	.0020	32085.00	.901
5 Classes	90	-15725.24	83.59	.5018	32129.71	.865

Note. Likelihood Ratio Test is Vuong–Lo–Mendell–Rubin Likelihood Ratio Test for $k - 1$ class model vs. k class model. BIC = Bayesian Information Criteria.

Multinomial logit coefficients comparing higher order self-regulation indicators across drinking classes.

Table 3

Model predictors	Class comparisons					
	Light vs. moderate	Light vs. heavy	Light vs. problem	Moderate vs. heavy	Moderate vs. problem	Heavy vs. problem
Distress tolerance	1.05	0.98	1.21	1.08	1.24	1.15
Emotional instability	1.01	1.19 [†]	0.76 [*]	0.85 [†]	0.64 [*]	0.75 [*]
Urgency	0.94	0.87	0.49 [*]	1.09	0.57 [*]	0.52 [*]
Self-control	1.14 [†]	1.51 [*]	1.30 [†]	0.76 [*]	0.86	1.14
Sensation seeking	0.96 [*]	0.92 [*]	0.94 [*]	1.05 [*]	1.02	0.97

Note. Bottom group is the reference group. Coefficients are Relative Risk Ratios.

* $p < .05$.

[†] $p < .10$.