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Drinking Patterns of College- and Non-College-Attending Young Adults: Is High-Intensity Drinking Only a College Phenomenon?

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Abstract

Background—Young adults report the heaviest drinking of any age group, and many are at risk for experiencing an alcohol use disorder. Most research investigating young adult drinking has focused on single indicators of use. Using multiple dimensions of consumption, such as federal guidelines for daily/weekly drinking and engagement in drinking at twice the binge threshold ("high-intensity drinking") to characterize drinking behavior could illuminate drinking patterns linked with harms.

Objectives—We used a person-centered approach to examine latent classes of drinkers from a national sample of young adults. Further, we compared classes on college status.

Methods—We used 2012–2013 data from the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC)-III. We included past-year drinkers aged 18–22 years (n = 2213). Latent classes were estimated based on drinking frequency, daily/weekly drinking, frequency of heavy episodic drinking (4+/5+ drinks for women/men), frequency of high-intensity drinking (8+/10+ drinks), and intoxication frequency.

Results—Five latent classes were identified: Occasional, Light Drinkers (30%), Regular Drinkers (6%), Infrequent Drinkers with Occasional Binging (10%), Frequent Drinkers with Occasional Binging (22%), and High-Intensity Drinkers (32%). Although membership in the two riskiest classes were more common among college-attenders, odds of being a High-Intensity Drinker relative to the second riskiest class was not significantly different for college- and non-college-attending young adults.

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Declaration of Interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

Conclusions/Importance—As high-intensity drinking does not appear to be a drinking pattern unique to college-attenders and non-college-attenders are less likely to mature out of heavy drinking patterns, intervention efforts are needed for this at-risk age group.

Keywords

Young adults; latent class analysis; college; non-college; drinking patterns; high-intensity drinking

Young adults between the ages of 18 and 25 report the heaviest drinking rates of any age group in the United States (Johnston, O'Malley, Bachman, Schulenberg, & Miech, 2015). An estimated 35.6% of young adults reported past-month heavy episodic drinking (HED; Substance Abuse and Mental Health Services Administration [SAMHSA], 2014), often defined as 4+/5+ drinks in one sitting for women/men (National Institute on Alcohol Abuse and Alcoholism [NIAAA], 2004). Within an HED occasion, the average young adult consumes 9.5 drinks, far exceeding this threshold (Naimi, Nelson, & Brewer, 2010). HED is associated with numerous negative consequences, including unsafe sexual behaviors, academic/occupational problems, social-interpersonal concerns, and driving under the influence (White & Hingson, 2014). Moreover, young adults are vulnerable to experiencing an alcohol use disorder (AUD), as the prevalence rates for any past-year AUD are highest (26.7%) among those aged 18 to 29 as compared to those over age 30 (Grant et al., 2015a).

A body of research supports that drinking behavior and harms may differ between college-attending and non-college-attending young adults (Carter, Obremski Brandon, & Goldman, 2010; Merrill & Carey, 2016). Most findings suggest that college students drink more than non-college-attending young adults during the college years (e.g., Patrick & Terry-McElrath, 2017; Quinn & Fromme, 2011). For example, a recent study of 19/20 year-olds indicated that as compared to non-college-attending young adults and full-time college students at 2-year institutions, full-time college students at 4-year institutions were significantly more likely to report HED during the past two weeks (Patrick & Terry-McElrath, 2017). Drinking patterns among college students are thought to be influenced by aspects specific to the college environment (e.g., living situation, academic week, decreased responsibilities; Merrill & Carey, 2016). Though some evidence suggests that non-college-attending young adults are lighter drinkers, this sub-population remains a sizable (U.S. Census Bureau, 2014), potentially at-risk population for several reasons. First, though generally lighter drinkers, non-college-attenders are found to be at risk for later harms, such as being less likely to mature out of problematic drinking behavior than their college-attending counterparts (Lanza & Collins, 2006; White, Labouvie, & Papadaratsakis, 2005). Second, some evidence suggests that non-college-attenders are more likely to experience alcohol-related problems, such as getting into fights or going to work/school high/drunk (Quinn & Fromme, 2011). Finally, there are some mixed findings regarding differences in alcohol use between college- and non-college-attenders: though some suggest college students drink more heavily (e.g., Patrick & Terry-McElrath, 2017), others indicate small or no differences in use (e.g., Chen, Dufour, & Yi, 2004; Quinn & Fromme, 2011).

It is important to note that research examining college and non-college drinking behavior has primarily relied on comparisons on single indicators of use (e.g., whether they engage in

HED), precluding contrasts in *patterns* of drinking behavior that may be particularly linked with drinking-related problems. Given the potential for increased alcohol-related harm yet generally lower alcohol consumption, a more in-depth understanding of non-college-attending versus college-attending young adult drinking patterns is warranted. One statistical approach to uncovering complex differences in drinking patterns is latent class analysis (LCA). LCA is a person-centered technique that can be used to identify subgroups based on a variety of shared characteristics (Collins & Lanza, 2010). Such unique classes can then be compared on predictors or outcomes of class membership to detect individual characteristics, such as those receiving post-secondary education, associated with membership in a particular drinking class. Prior research has used LCA or similar techniques to illuminate drinking patterns in national samples of emerging adults over time (Auerbach & Collins, 2006), week-level drinking behavior characteristics among college students (Fairlie, Maggs, & Lanza, 2016), and past 30-day drinking among non-students (Lau-Barraco, Braitman, Stamates, & Linden-Carmichael, 2016). Comparisons in drinking classes between college-attending and non-college-attending young adults have received less attention.

In characterizing drinking patterns between college-attending and non-college-attending young adults, it may be useful to examine a combination of multiple drinking indicators, given evidence that unique information can be gained from each indicator. For example, quantity and frequency of alcohol consumption have been shown to be distinctive predictors of negative consequences from drinking (Breslow, Chen, Graubard, & Mukamal, 2011). The interaction of several drinking indicators has also shown utility in predicting alcohol use outcomes (Gunzerath, Faden, Zakhari, & Warren, 2004) and distinguishing drinking patterns among adults (Linden-Carmichael, Lanza, Dziak, & Bray, 2017a). High-intensity drinking, or drinking two or more times the HED level (8+/10+ drinks in one occasion for women/men), has become a recent, critical focus in examining at-risk young adult drinkers (Patrick, 2016) given recent research suggesting the levels for HED during a drinking occasion may be too low a threshold for characterizing the drinking levels of some individuals. A reported 10.3% of underage young adult drinkers engage in high-intensity drinking (Patrick & Terry-McElrath, 2017). High-intensity drinkers report more frequent HED (Patrick, Terry-McElrath, Kloska, & Schulenberg, 2016a) and are at greater risk for a past-year AUD (Linden-Carmichael, Vasilenko, Lanza, & Maggs, 2017b). The limited research available on high-intensity drinking and college education status suggests full-time college students are more likely to report recent high-intensity drinking than other groups of young adults, including non-college-attenders (Patrick & Terry-McElrath, 2017). However, similar to other indices alcohol use, comparisons have only been made with respect to a single indicator of high-intensity drinking, rather than incorporating high-intensity drinking behavior into a more comprehensive model that describes drinking patterns. Use of multiple drinking level guidelines including HED, high-intensity drinking, and daily/weekly guidelines provided by the National Institute of Alcohol Abuse and Alcoholism and the U.S. Department of Agriculture (NIAAA, 2004; 2009) may be helpful in identifying and comparing patterns of drinking among college- and non-college-attending young adults.

The purpose of the current study was to model latent classes of young adult alcohol users and to compare classes based on college student status. More specifically, using a nationally

representative sample of 18- to 22-year-olds, our first aim was to identify and interpret subgroups of young adults based on several drinking indicators: drinking frequency, daily/weekly drinking quantity, frequency of engagement in HED, frequency of high-intensity drinking, and frequency of alcohol intoxication. Our second aim was to examine the association between class membership and college attendance. We hypothesized that there would be distinct latent classes of young adults based on various drinking characteristics and that these subgroups would differ significantly based on education status, such that college-attenders would be more likely to belong to a group characterized by frequent HED and high-intensity drinking than non-college-attenders.

Method

Participants and Procedure

The data used in the current study were from the National Epidemiologic Survey on Alcohol and Related Conditions-III (NESARC-III), sponsored by the NIAAA (Grant et al., 2014). The target population for NESARC-III was U.S. adults who were at least 18 years old, residing in households or noninstitutionalized group quarters (e.g., dormitories). Adults were randomly selected within this population, and those who were Hispanic, Black, and Asian were oversampled in order to provide more reliable estimates; weights were used to take the sampling procedures into account. Survey weights were consequently incorporated in all study analyses, including weighted percentages. A total of 36,309 adults participated in the NESARC-III survey. The survey protocol was approved by the institutional review boards of the National Institutes of Health and Westat, and all individuals gave informed consent prior to participation. Respondents were compensated $90. Data were collected in 2012–2013.

The current study analyses included only participants who were between the ages of 18 and 22 years (i.e., normative college ages) and who reported any past-year alcohol use; 3,030 participants were aged 18 to 22. Within this sample, 27% reported no alcohol use in the past year. The final analytic sample consisted of 2,213 (49.8% women) young adults. The majority were White, Non-Hispanic (57.7%); others were Hispanic (20.2%), Black, non-Hispanic (14.0%), Asian/Native Hawaiian/Other Pacific Islander, non-Hispanic (6.0%), and American Indian/Alaska Native, non-Hispanic (2.1%). With regard to college education status, participants were categorized as college-attenders if they (1) indicated they were a full-time student in the past 12 months and (2) reported at least some college but less than any graduate education as their highest educational attainment. Approximately 61.4% were categorized as non-college-attenders and 38.6% were categorized as college-attenders.

Measures

Alcohol use indicators—*Drinking frequency* was based on how often participants reported drinking any alcoholic beverage in the last 12 months. Responses were coded as at least monthly or less than monthly. *Exceeding daily or weekly guidelines* was assessed based on whether they consumed no more than 3 (women) or 4 (men) drinks on a single day or no more than 7 (women) or 14 (men) drinks per week in the last 12 months (NIAAA, 2009). *Frequency of heavy episodic drinking* (HED) was measured based how often they reported drinking 4+ (women) or 5+ (men) drinks in a single day (NIAAA, 2004) in the last

12 months with response options coded as not in the past year, less than monthly but past-year HED, and at least monthly HED. *Frequency of high-intensity drinking* was based on the largest number of drinks the participant reported consuming in a single day in the last 12 months and the frequency of heaviest use. Consistent with prior studies, high-intensity drinking was defined as consuming twice the limit of HED, or consuming 8+ (women) or 10+ (men) drinks in a single drinking occasion (Linden-Carmichael et al., 2017b; Patrick, 2016), coded as in not in the past year, less than monthly but past-year high-intensity drinking, and at least monthly high-intensity drinking.

Intoxication—Frequency of intoxication was measured based on how often the participant reported drinking enough to feel intoxicated in the last 12 months. Responses were coded as not in the past year, less than monthly but past-year intoxication, and at least monthly intoxication.

Past-year AUD—The Alcohol Use Disorder and Associated Disabilities Interview Schedule – DSM-5 Version (AUDADIS-5; Grant et al., 2015b), was used to as a measure of past-year AUD. Participants indicated whether they experienced various symptoms for a DSM-5 past-year AUD. Participants were determined to have an AUD if they reported at least two out of the 11 DSM-5 criteria in the past 12 months.

Data Analytic Plan

SAS PROC LCA (Lanza, Dziak, Huang, Wagner, & Collins, 2015) was used to conduct LCA. Latent classes were estimated based on past-year indicators of participants' drinking frequency, whether they exceeded daily/weekly drinking guidelines, frequency of HED, frequency of high-intensity drinking, and frequency of intoxication. Models with one to eight classes were compared to determine the best fitting model based on Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), and interpretability. For both the AIC and BIC, lower values indicate more optimal models. One hundred starting values were used to examine the identification of each model. Models with 7 and 8 classes did not converge.

After selecting the number of drinking classes, we compared drinking classes by college student status in two ways. First, we entered college student status as a grouping variable to describe latent class prevalences within non-college-attenders and within college-attenders. Second, we added college student status as a covariate in models to statistically determine whether latent classes differed based college attendance. Specifically, we conducted a logistic regression to determine whether college-attenders were more likely to be in each latent class relative to the riskiest drinking class. Riskiest drinking class was determined by comparing classes based on past-year AUD through a logistic regression. Both college student status and past-year AUD models were tested with and without sex and age as covariates. Inclusion of these covariates did not substantially modify the latent class structure, thus covariates were excluded for parsimony. So that standard errors could be obtained, non-informative Bayesian priors were applied to avoid estimates on the boundary of the parameter space (i.e., estimates of exactly 0 or 1; Lanza et al., 2015). PROC LCA software is freely available at http://methodology.psu.edu.

Results

Sample Descriptive Statistics

The majority of the overall analytic sample reported drinking at least monthly (68.9%) and exceeding daily or weekly drinking guidelines (68.5%). With regard to frequency of engagement in HED, 36.0% did not report HED in the past year, 23.6% reported HED in the past year but less than monthly, and 40.4% reported at least monthly HED. Most participants did not report high-intensity drinking in the past year (69.5%); 21.5% reported less than monthly high-intensity drinking and 9.0% reported at least monthly high-intensity drinking. In terms of intoxication, the most common response category was past-year but less than monthly intoxication (39.6%); 31.0% did not report past-year intoxication, and 29.4% indicated at least monthly intoxication. Finally, most (60.0%) did not report a past-year AUD.

Latent Class Analysis

Model fit information for a 1- to 6-class solution is presented in Table 1. The AIC, BIC, and adjusted BIC suggested that a model between 4 and 6 classes was optimal. After inspection of the 4-, 5-, and 6-class solutions, a 5-class solution was selected based on interpretability and separation of classes. Table 2 presents the parameter estimates for the 5-class model. Occasional, Light Drinkers represented the second largest class, characterized by less than monthly drinking, few exceeding daily/weekly levels of drinking, no past-year HED and low intoxication. The smallest class was labeled Regular Drinkers; they were comprised those who mostly drank at least monthly and exceeded daily/weekly guidelines, but did not engage HED or high-intensity drinking. Regular Drinkers were mixed in their frequency of intoxication, with most reporting less than monthly intoxication. Infrequent Drinkers with Occasional Binging included young adults who drank infrequently but were likely to report occasional (less than monthly) HED. Within this class, most reported no high-intensity drinking in the past year, while approximately one-quarter indicated occasional high-intensity drinking. Individuals in the Frequent Drinkers with Occasional Binging class drank frequently and most reported occasional or monthly HED and intoxication. Similar to the Infrequent Drinkers with Occasional Binging class, the majority did not report high-intensity drinking, though some reported occasionally drinking at this level. The largest class was labeled High-Intensity Drinkers and included young adults characterized by mostly occasional or monthly engagement in high-intensity drinking as well as frequent drinking, HED, and intoxication.

A logistic regression indicated that past-year AUD was significantly associated with drinking class ($-2 \log L = 479.71$, 4 *df*, $p < .001$). As shown in Table 3, young adults with an AUD had significantly higher odds of belonging to the High-Intensity Drinking class than any other class.

College Student Status

Latent classes were compared based on educational status in two ways. First, college student status was entered as a grouping variable to identify the class prevalences separately for non-college-attenders and college-attenders. As shown in Figure 1, most non-college-attending

young adults belonged to the Occasional, Light Drinkers class. The next most prevalent class was the High-Intensity Drinkers class, followed by the Frequent Drinkers with Occasional Binging class. By contrast, most college-attending young adults belonged to the High-Intensity Drinkers group, followed by the Occasional, Light Drinkers class and the Frequent Drinkers with Occasional Binging class.

Second, we entered college status as a predictor of latent class membership. Results indicated that college student status was significantly associated with drinking class (−2 log L = 24.71, 4 *df*, $p < .001$). We further compared each drinking class to the riskiest drinking class (High-Intensity Drinkers) to determine whether the odds of being in each class differed based on whether the individual was a college-attending or non-college-attending young adult. As shown in Table 3, college-attenders were less likely than non-college-attenders to be in the Occasional, Light Drinkers class, Infrequent Drinkers with Occasional Binging class, and the Regular Drinkers class relative to the High-Intensity Drinkers class. Importantly, the odds of being a High-Intensity Drinker relative to a Frequent Drinker with Occasional Binging (the second riskiest class) was not significantly different for college-attending and non-college-attending young adults.

Discussion

The current study identified five unique latent classes from a national sample of young adults drinkers aged 18 to 22 based on several drinking indicators. These subgroups were: Occasional, Light Drinkers; Regular Drinkers; Infrequent Drinkers with Occasional Binging; Frequent Drinkers with Occasional Binging; and High-Intensity Drinkers. Occasional, Light Drinkers and Infrequent Drinkers with Occasional Binging are both marked by infrequent drinking and no to infrequent high-intensity drinking, but differ primarily in terms of whether they exceeded daily/weekly drinking guidelines and their frequency of HED during the past year. That is, whereas most Occasional, Light Drinkers did not exceed drinking guidelines, all Infrequent Drinkers with Occasional Binging exceeded daily/weekly limits, which is reflected in their more frequent HED and intoxication levels. Regular Drinkers were marked by most reporting monthly drinking. In addition, the majority of Regular Drinkers exceeded daily limits and had a wide-spread of responses intoxication. Frequent Drinkers with Occasional Binging were characterized by drinking at least monthly and occasional HED. Few did not drink beyond the 4+/5+ levels of HED, or engage in high-intensity drinking. The High-Intensity Drinking group represented the riskiest drinking class, with all drinking at least monthly, all reporting exceeding daily/weekly drinking guidelines, and frequent HED. This group is distinguished by their frequency of high-intensity drinking; most reported less than monthly high-intensity drinking but many reported drinking at these levels at least monthly. Unsurprisingly, this group also reports frequent intoxication. Importantly, High-Intensity Drinkers represented the largest class among young adult drinkers. Also given that the High-Intensity Drinking group was at greatest risk of experiencing a past-year AUD relative to other classes, these findings suggest high-intensity drinking is a normative behavior and key public health concern in this age group.

The latent classes were compared based on college education status. College-attenders were more likely to be members of the High-Intensity Drinking class than the less frequent and lower risk classes (i.e., Occasional, Light Drinkers; Regular Drinkers; Infrequent Drinkers with Occasional Binging). Importantly, when comparing the two riskiest drinking classes (i.e., Frequent Drinkers with Occasional Binging and High-Intensity Drinkers), we found that although membership in the Frequent Drinkers with Occasional Binging and High-Intensity Drinkers classes were more common among college-attenders than non-college-attenders, the odds of belonging to either class was not significantly different between college- and non-college-attending young adults. Thus, this extreme behavior pattern of consuming at least 8 (for women) or 10 (for men) drinks in one drinking occasion does *not* appear to be unique to college students. Membership in this potentially risky class appears to be a relevant concern for young adults regardless of education status.

A handful of prior studies have identified latent classes of college student drinkers, such as first-year college students (e.g., Cleveland, Lanza, Ray, Turrisi, & Mallett, 2012) and non-students (Lau-Barraco et al., 2016; Cleveland, Mallett, White, Turrisi, & Favero, 2013). The current study contributed to our knowledge on education status and drinking not only by comparing alcohol use behaviors among those with and without post-secondary education but also by identifying groups of drinkers based on drinking *patterns*. That is, instead of comparing individuals based on one variable (e.g., total consumption, past-month HED), we detected subgroups of drinkers based on several drinking indicators that have been implicated to be potentially risky by NIAAA (e.g., exceeding recommended daily/weekly drinking levels). The discrepancies observed in prior and current research regarding alcohol use behavior among college- and non-college-attending young adults may be the result of differences in selection of drinking indicators. That is, whereas much prior work has compared drinking behavior on only one drinking indicator or on a composite variable (Quinn & Fromme, 2011), this person-centered approach provided additional information on behavioral patterns among individuals. These findings suggest that researchers interested in the larger context of college and non-college alcohol use behavior may benefit from simultaneously examining multiple aspects of drinking in subgroups of individuals.

Problematic drinking patterns appear to be similar for college and non-college individuals during the college years, but some evidence suggests that non-college-attenders may continue or increase their heavy drinking behavior into adulthood (Lanza & Collins, 2006; White et al., 2005). Given this tendency and our finding that those in the High-Intensity Drinking class were at greatest risk for an AUD, prevention and intervention efforts are specifically needed for non-college-attending young adults. Despite the majority (59%) of young adults are not currently enrolled in college (U.S. Census Bureau, 2014), most research investigating alcohol use behaviors among young adults has focused on college students. Although this is important given the high rates of HED, researchers have begun to make secondary prevention tools available to non-student drinkers. Specifically, Lau-Barraco, Braitman, and Stamates (in press) delivered a brief personalized feedback intervention that was adapted to young adult drinkers who have no post-secondary education. Researchers found that those who received the intervention reduced their drinking significantly more at a 1-month follow-up than controls. These findings suggest that well-established intervention

tools such as personalized feedback interventions can be successfully tailored to meet the needs of this sizable group of young adults.

Several limitations should be noted. First, our measures of drinking behavior and symptoms of AUD are based on self-report. Consequently, some participants may under-report their drinking due to social desirability, though some research does indicate that self-report data on substance use are generally valid (Simons, Wills, Emery, & Marks, 2015). Second, there are many different ways to characterize “college” and “non-college” individuals. Many define “college student” as attendance at 4-year universities; some have defined “non-student” as not currently enrolled in college, regardless of past education. To be consistent with prior research, we included only full-time college-attending students as “college students” (Patrick et al., 2016a; Patrick, Yeomans-Maldonado, & Griffin, 2016b). Building from our findings, future research may benefit from parsing out differences in those who have never attended college versus those who have attended 2-year colleges versus those who have attended 4-year universities.

The current study detected five unique classes of young adult drinkers based on multiple drinking indicators. We found that those who engaged in frequent HED and high-intensity drinking were the most prevalent subgroup of drinkers, demonstrating a significant public health concern for young adult drinkers. Moreover, the likelihood of being a member of one of the two riskiest classes was not significantly different for college-attending and non-college-attending young adults. These findings suggest that the High-Intensity Drinkers class was the most common class among young adult drinkers and somewhat more common among college students, indicating the need for harm-reduction interventions, particularly for college students. However, given that high-intensity drinking does not appear to be a drinking pattern unique to college-attenders and that non-college-attenders are generally less likely to mature out of heavy drinking patterns than their college-attending counterparts, more intervention efforts should be devoted to the sizable, at-risk population of non-college-attending young adult drinkers.

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References

Auerbach KJ, Collins LM. A multidimensional developmental model of alcohol use during emerging adulthood. Journal of Studies on Alcohol. 2006; 67:917–925. DOI: 10.15288/jsa.2006.67.917 [PubMed: 17061010]

Breslow RA, Chen CM, Graubard BI, Mukamal KJ. Prospective study of alcohol consumption quantity and frequency and cancer-specific mortality in the US population. American Journal of Epidemiology. 2011; 174:1044–1053. DOI: 10.1093/aje/kwr210 [PubMed: 21965184]

Carter AC, Obremski Brandon K, Goldman MS. The college and noncollege experience: A review of the factors that influence drinking behavior in young adulthood. Journal of Studies on Alcohol and Drugs. 2010; 71:742–750. DOI: 10.15288/jsad.2010.71.742 [PubMed: 20731981]

Chen CM, Dufour MC, Yi H. Alcohol consumption among young adults ages 18–24 in the United States: Results from the 2001–2002 NESARC Survey. Alcohol Research and Health. 2004; 28:269–280.

Cleveland MJ, Lanza ST, Ray AE, Turrisi R, Mallett KA. Transitions in first-year college student drinking behaviors: Does pre-college drinking moderate the effects of parent- and peer-based intervention components? Psychology of Addictive Behaviors. 2012; 26:440–450. DOI: 10.1037/a0026130 [PubMed: 22061340]

Cleveland MJ, Mallett KA, White HR, Turrisi R, Favero S. Patterns of alcohol use and related consequences in non-college-attending emerging adults. Journal of Studies on Alcohol and Drugs. 2013; 74:84–93. DOI: 10.15288/jsad.2013.74.84 [PubMed: 23200153]

Collins LM, Lanza ST. Latent class and latent transition analysis: With applications in the social, behavioral, and health sciences. New York, NY: Wiley; 2010.

Fairlie AM, Maggs JL, Lanza ST. Profiles of college drinkers defined by alcohol behaviors at the week level: Replication across semesters and prospective associations with hazardous drinking and dependence-related symptoms. Journal of Studies on Alcohol and Drugs. 2016; 77:38–50. DOI: 10.15288/jsad.2016.77.38 [PubMed: 26751353]

Grant BF, Chu A, Sigman R, Amsbary M, Kali J, Sugawara Y, Jiao R, Ren W, Goldstein R. Source and accuracy statement: National Epidemiologic Survey on Alcohol and Related Conditions-III (NESARC-III). Rockville, MD: National Institute on Alcohol Abuse and Alcoholism; 2014.

Grant BF, Goldstein RB, Smith SM, Jung J, Zhang H, Chou SP, … Hasin DS. The Alcohol Use Disorder and Associated Disabilities Interview Schedule-5 (AUDADIS-5): Reliability of substance use and psychiatric disorder modules in a general population sample. Drug and Alcohol Dependence. 2015; 148:27–33. DOI: 10.1016/j.drugalcdep.2014.11.026 [PubMed: 25595052]

Grant BF, Goldstein RB, Saha T, Chou SP, Jung J, Zhang H, … Hasin DS. Epidemiology of DSM-5 alcohol use disorder: Results from the National Epidemiologic Survey on Alcohol and Related Conditions III. JAMA Psychiatry. 2015; 72:757–766. DOI: 10.1001/jamapsychiatry.2015.0584 [PubMed: 26039070]

Gunzerath L, Faden V, Zakhari S, Warren K. National Institute on Alcohol Abuse and Alcoholism report on moderate drinking. Alcoholism: Clinical and Experimental Research. 2004; 28:829–847. DOI: 10.1097/01.ALC.0000128382.79375.B6

Johnston LD, O'Malley PM, Bachman JG, Schulenberg JE, Miech RA. Monitoring the Future National Survey Results on Drug Use, 1975–2014: Volume II, College Students and Adults Ages 19–55. Institute for Social Research, The University of Michigan; Ann Arbor, MI: 2015.

Lanza ST, Collins LM. A mixture model of discontinuous development in heavy drinking from ages 18 to 30: The role of college enrollment. Journal of Studies on Alcohol. 2006; 67:552–561. DOI: 10.15288/jsa.2006.67.552 [PubMed: 16736075]

Lanza ST, Dziak JJ, Huang L, Wagner A, Collins LM. PROC LCA & PROC LTA users' guide (Version 1.3.2). University Park: The Methodology Center, Penn State; 2015. Retrieved from http://methodology.psu.edu

Lau-Barraco C, Braitman AL, Stamates AL. A randomized trial of a personalized feedback intervention for nonstudent emerging adult at-risk drinkers. Alcoholism: Clinical and Experimental Research. in press.

Lau-Barraco C, Braitman AL, Stamates AL, Linden-Carmichael AN. A latent profile analysis of drinking patterns among nonstudent emerging adults. Addictive Behaviors. 2016; 62:14–19. DOI: 10.1016/j.addbeh.2016.06.001 [PubMed: 27305099]

Linden-Carmichael AN, Lanza ST, Dziak J, Bray BC. Contemporary alcohol use patterns among a national sample of U.S. adults. Journal of Addictive Diseases. 2017a; doi: 10.1080/10550887.2017.1338816

Linden-Carmichael AN, Vasilenko SA, Lanza ST, Maggs J. High-intensity drinking versus heavy episodic drinking: Prevalence rates and relative odds of alcohol use disorder across adulthood. Alcoholism: Clinical & Experimental Research. 2017b; 41:1754–1759. DOI: 10.1111/acer.13475

Merrill JE, Carey KB. Drinking over the lifespan: Focus on college ages. Alcohol Research: Current Reviews. 2016; 38:103–114. [PubMed: 27159817]

Naimi TS, Nelson DE, Brewer RD. The intensity of binge alcohol consumption among U.S. adults. American Journal of Preventive Medicine. 2010; 38:201–207. DOI: 10.1016/j.amepre.2009.09.039 [PubMed: 20117577]

National Institute on Alcohol Abuse and Alcoholism. NIAAA council approves definition of “binge drinking”. NIAAA Newsletter. 2004. Winter. Retrieved from http://pubs.niaaa.nih.gov/publications/Newsletter/winter2004/Newsletter_Number3.pdf

National Institute on Alcohol Abuse and Alcoholism. Rethinking Drinking (NIH Publication #09-3770), in Series Rethinking Drinking (NIH Publication #09-3770). U.S. Department of Health and Human Services; Rockville, MD: 2009.

Patrick ME. A call for research on high-intensity alcohol use. Alcoholism: Clinical and Experimental Research. 2016; 40:256–259. DOI: 10.1111/acer.12945

Patrick ME, Terry-McElrath YM. High-intensity drinking by underage young adults in the United States. Addiction. 2017; 112:82–93. DOI: 10.1111/add.13556

Patrick ME, Terry-McElrath YM, Kloska DD, Schulenberg JE. High-intensity drinking among young adults in the United States: Prevalence, frequency, and developmental change. Alcoholism: Clinical and Experimental Research. 2016a; 40:1905–1912. DOI: 10.1111/acer.13164

Patrick ME, Yeomans-Maldonado G, Griffin J. Daily reports of positive and negative affect and alcohol and marijuana use among college student and nonstudent young adults. Substance Use & Misuse. 2016b; 51:54–61. DOI: 10.3109/10826084.2015.1074694 [PubMed: 26683453]

Quinn PD, Fromme K. Alcohol use and related problems among college students and their noncollege peers: The competing roles of personality and peer influence. Journal of Studies on Alcohol and Drugs. 2011; 72:622–632. DOI: 10.15288/jsad.2011.72.622 [PubMed: 21683044]

Simons JS, Wills TA, Emery NN, Marks RM. Quantifying alcohol consumption: Self-report, transdermal assessment, and prediction of dependence symptoms. Addictive Behaviors. 2015; 50:205–212. DOI: 10.1016/j.addbeh.2015.06.042 [PubMed: 26160523]

Substance Abuse and Mental Health Services Administration (SAMHSA). Results from the 2013 National Survey on Drug Use and Health: National Findings. Office of Applied Studies; 2014. NSDUH Series H-30, DHHS Publication No. SMA 06-4194

U.S. Census Bureau. Current Population Survey 2014 Annual Social and Economic Supplement. 2014. Retrieved March 25, 2015 from http://www.census.gov/hhes/socdemo/education/data/cps/2014/tables.html

White A, Hingson R. The burden of alcohol use: Excessive alcohol consumption and related consequences among college students. Alcohol Research: Current Reviews. 2014; 35:201–218.

White HR, Labouvie EW, Papadaratsakis V. Changes in substance use during the transition to adulthood: A comparison of college students and their noncollege age peers. Journal of Drug Issues. 2005; 35:281–306. DOI: 10.1177/002204260503500204

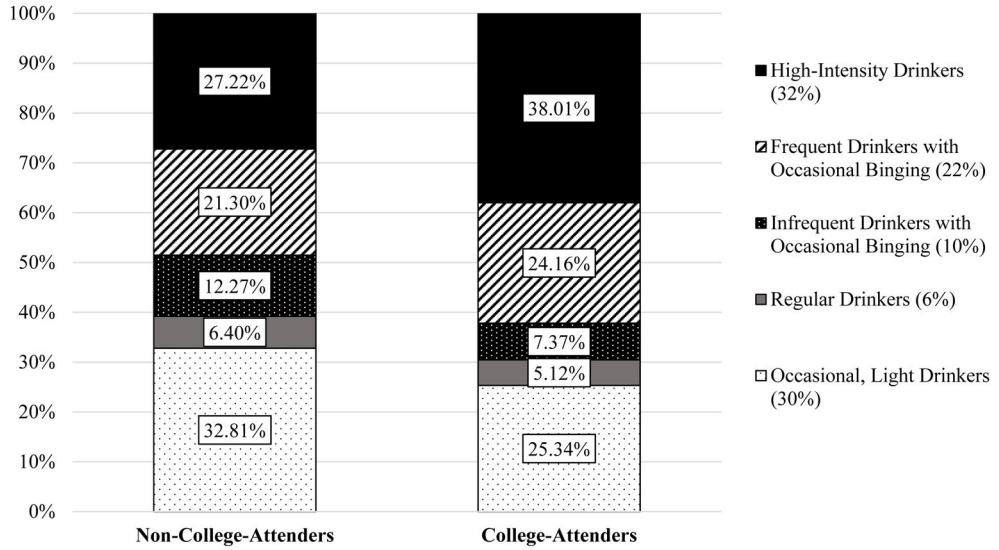

Figure 1.
Proportion of young adults within each class by college education status.

Table 1

Fit Statistics for Latent Class Analysis Models of Young Adult Drinking Behavior

Class	Percent Agreement	AIC	BIC	ABIC	Entropy
1	100%	5923.80	5969.41	5944.00	1.00
2	100%	1471.56	1568.48	1514.47	.97
3	100%	275.81	424.05	341.44	.97
4	67%	171.89	371.45	260.25	.83
5	56%	143.77	394.64	254.84	.86
6	7%	134.08	436.27	267.88	.82

Note. AIC = Akaike Information Criteria, BIC = Bayesian Information Criteria, ABIC = adjusted Bayesian Information Criteria. Percent agreement refers to the proportion of initial starting values that converged on the maximum likelihood solution.

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Table 2

Item-Response Probabilities for Five-Class Model of Young Adult Drinking Behavior

	Class 1: Occasional, Light Drinkers (30%)	Class 2: Regular Drinkers (6%)	Class 3: Infrequent Drinkers with Occasional Binging (10%)	Class 4: Frequent Drinkers with Occasional Binging (22%)	Class 5: High-Intensity Drinkers (32%)
Drinking frequency					
Less than monthly	**.69**	.19	**.91**	.00	.00
Monthly	.31	**.81**	.09	**1.00**	**1.00**
Whether exceeded daily/weekly guidelines					
Did not exceed guidelines in past year	**.95**	**.53**	.00	.00	.00
Exceeded guidelines in past year	.05	.47	**1.00**	**1.00**	**1.00**
Frequency of heavy episodic drinking					
Not in past year	**1.00**	**1.00**	.01	.00	.00
Less than monthly HED	.00	.00	**.99**	**.60**	.00
Monthly HED	.00	.00	.00	.40	**1.00**
Frequency of high-intensity drinking					
Not in past year	**1.00**	**1.00**	**.76**	**.79**	.25
Less than monthly	.00	.00	.24	.21	.46
Monthly	.00	.00	.00	.00	.29
Intoxication					
Not in past year	**.82**	.15	.21	.14	.01
Less than monthly	.18	**.56**	**.79**	**.67**	.25
Monthly	.00	.29	.01	.19	**.74**

Note. Probabilities > .5 in bold to facilitate interpretation of the latent classes. Heavy episodic drinking is defined as 4+ drinks for women and 5+ drinks for men. High-intensity drinking is defined as 8+ drinks for women and 10+ drinks for women.

Table 3

Odds Ratios (with 95% Confidence Intervals) for Alcohol Use Disorder and College Student Status as Predictors of Latent Class Membership Relative to High-Intensity Drinking Class

	Class 1: Occasional, Light Drinkers	Class 2: Regular Drinkers	Class 3: Infrequent Drinkers with Occasional Binging	Class 4: Frequent Drinkers with Occasional Binging	Class 5: High-Intensity Drinkers
Past-year AUD	0.00 [0.00, 0.01]	0.09 [0.05, 0.17]	0.08 [0.05, 0.14]	0.12 [0.07, 0.21]	Reference
College Student	0.55 [0.41, 0.74]	0.57 [0.33, 1.00]	0.43 [0.28, 0.66]	0.81 [0.55, 1.20]	Reference

Note. Sex, age, race and personal income were initially included as covariates. Results with and without inclusion of covariates were consistent; thus these control variables were removed for parsimony. College student status was coded as 0 = non-college-attending young adult and 1 = college-attending young adult.