Published in final edited form as:

Addict Behav. 2018 December ; 87: 276–282. doi:10.1016/j.addbeh.2018.06.002.

Using latent transition analysis to compare effects of residency status on alcohol-related consequences during the first two years of college

Michael J. Cleveland^{a,*}, Kimberly A. Mallett^b, Rob Turrissi^{b,c}, Nichole M. Sell^c, Racheal Reavy^b, Bradley Trager^c

^aDepartment of Human Development, Washington State University, Pullman, WA 99164, USA

^bBennett Pierce Prevention Research Center, Pennsylvania State University, University Park, PA 16802, USA

^cDepartment of Biobehavioral Health, Pennsylvania State University, University Park 16802, USA

Abstract

The current study examined two research aims: (1) Identify latent statuses of college students who share common patterns of single or repeated experiences with distinct types of negative alcohol-related consequences during the first two years of college; and (2) Examine how changes in students' living arrangements were associated with transitions in the consequence statuses. Using a sample of college student drinkers ($N = 1706$), four latent statuses were identified that distinguished among distinct combinations of single and repeated experiences across the multiple consequence subtypes: *No Consequences*, *Physical Non-Repeaters*, *Multiple Consequences*, and *Multiple Consequences Repeaters*. Students who remained in on-campus living spaces were most likely to belong to lower-risk statuses at T1, and remain in those statuses at T2. We found that moving into Greek housing had strongest effects among students who started in the *No Consequences* status, while students who moved to off-campus housing were most likely to remain in the *Multiple Consequences* status. Given that students who moved out of on-campus residences were more likely to transition into high-risk statuses, interventions that target students who intend to move to off-campus or fraternity housing should be implemented during the first year of college.

Keywords

Alcohol-related consequences; College students; Latent transition analysis; Residency status; Greek status; Off-campus

*Corresponding author at: Department of Human Development, Washington State University, Johnson Tower, Room 516, Pullman, WA 99164, USA. michael.cleveland@wsu.edu (M.J. Cleveland).

Declaration of interest
None.

1. Introduction

Rates of risky alcohol behaviors by college students continue to exceed rates of their non-college attending peers (Johnston, O'Malley, Bachman, Schulenberg, & Miech, 2016). Such use is associated with a range of negative alcohol-related consequences, including health problems and sexual assault (Hingson et al., 2009). Continued effort to understand the factors that contribute to college students' alcohol use and related problems thus remains a public health priority. This study examines associations between changes in residential status and alcohol-related consequences during the first two years of college. Most previous examinations of residential status have focused on the transition from high school to college, and demonstrate this first-year transition (typically from their family home to on-campus living spaces) is associated with increased rates of heavy drinking (Harford, Wechsler, & Muthén, 2002; White et al., 2006). Selection effects have also been noted, such that high school students who regularly consume alcohol tend to select living arrangements in college that facilitate alcohol use, such as a suite-style vs. standard dormitory room (Fromme et al., 2008; Willoughby & Carroll, 2009).

Less understood is how socialization and selection effects influence alcohol use after the first year of college, when many students move to other types of living spaces, such as Greek or off-campus houses. Studies confirm affiliation with a Greek organization is an important risk factor for high-risk alcohol use (Borsari, Hustad, & Capone, 2009; Larimer, Anderson, Baer, & Marlatt, 2000; Page & O'Hegarty, 2006) and that residence in Greek housing may be a risk factor, over and above affiliation (Park et al., 2009; Wechsler et al., 2009). In contrast, few studies have examined the effects of moving from on-campus to off-campus living spaces. Fewer still have directly compared the effects of these two alternatives. Recently, Simons-Morton and colleagues (2016) observed increases in alcohol use among first-year students who moved into on-campus housing but not among those who moved to off-campus living spaces. However, the study combined students who moved into residence halls with students who moved into Greek houses and was unable to determine if the observed differences were due to living in on-campus spaces or living in Greek housing. It is also unclear if these differences were sustained after the first year of college.

We used latent transition analysis (LTA) to address these questions. Prior research has used similar methods to identify patterns of college student drinking behaviors (Beseler, Taylor, Kraemer, & Leeman, 2012; Cleveland et al., 2013; O'Connor & Colder, 2005); however, few have applied these methods to students' alcohol-related consequences. Using the cross-sectional variant of LTA (latent class analysis, LCA), Rinker et al. (2016) identified four latent classes of first-year students based on negative alcohol-related consequences (*No Problems, Academic Problems, Injured Self, and Severe Problems*). These authors reported that students who intended to join a Greek organization were more likely to belong to each of the three problem classes, relative to the *No Problems* class.

We extend previous research by examining a wider range of consequences, including physical consequences (e.g., nausea) that are relatively common among college students as well as less commonly experienced consequences (e.g., tolerance-related consequences). We also build on previous research that confirms students' variability with respect to frequency,

repetition, and diversity of experienced alcohol-related consequences across the first two years of college (Mallett et al., 2011). The first aim used LTA to identify subgroups of students who share common patterns of experiences with multiple types of negative alcohol-related consequences during the fall of the first year (T1) and the fall of the second year (T2) of college. The second aim examined how changes in students' living arrangements were associated with transitions in the consequence subgroups.

2. Materials and Methods

2.1. Recruitment Procedures

As part of a larger study, 4,000 first-semester students were randomly selected from the university registrar's database at a large, public northeastern university. The current study utilized data from the baseline survey during fall semester of participants' freshman year (T1) and a follow-up survey in the fall of the sophomore year (T2). At T1, 67.3% ($N = 2690$) of invited participants elected to participate. Because the goal of the larger study was to assess traditional aged college students' alcohol consequences, only participants between ages 18–19 and who reported consuming at least one drink prior to baseline were invited to complete the follow-up assessment. Of those who completed the T1 assessment, 75.2% ($n = 2024$) met these participation criteria. Retention from T1 to T2 was 87.4% ($N = 1768$). No differences were observed between those who completed both assessments and those who completed only the first assessment. Students received \$25 for completing the T1 survey, \$30 for completing the T2 survey, and a \$5 bonus for each survey they completed within 5 days of receiving the email invitation. Study procedures were approved by the university's Institutional Review Board.

Policies at the university required, with few exceptions, first-year students to live in on-campus residence halls. We thus excluded 32 students who reported other living arrangements at T1. Of the remaining 1992 students, 1742 (87.45%) reported their living arrangement at T2. Very few reported either "living with parents" ($N = 28, 1.61\%$) or "other" ($N = 8, 0.46\%$) at T2 and were excluded from the analyses. Thus, the analysis sample consisted of 1706 students who all reported on-campus living arrangements at T1, and at T2 belonged to one of three groups: (1) remained in on-campus residence halls ($N = 672, 39.39\%$); (2) moved to a fraternity or sorority house ($N = 157, 9.20\%$); or (3) moved to an off-campus apartment or house ($N = 877, 51.41\%$). The mean age at T1 was 18.18 ($SD = 0.39$) years, and the majority identified as female (57.2%), Caucasian (87.4%), and heterosexual (98.0%). At T1, participants reported an average of 10.60 ($SD = 8.41$) drinks per week.

2.2. Measures

Alcohol-related consequences were assessed using subscales derived from the Young Adult Alcohol Consequences Questionnaire (YAACQ; Read et al., 2006) and the Young Adult Alcohol Problems Screening Test (YAAPST; Hurlbut & Sher, 1992; Larimer et al., 1999). Participants indicated how many times they had experienced each consequence during the current semester on an 8-point scale from "1 time" (1) to "40 or more times" (8), with an option for "never" (0). Items were grouped within seven distinct subscales, using the

following criteria: (1) the content of each item was conceptually consistent with the subscale category, (2) the item was endorsed by at least 5% of the sample, and (3) the item did not weaken the internal consistency of the subscale (i.e., $\alpha > .70$; items significantly correlated; see Mallett et al., 2015). The *physiological* consequences subscale ($\alpha = .72$) included four items such as vomiting or having a hangover. *Social consequences* ($\alpha = .80$) were measured with three items including “I have become rude, obnoxious, or insulting.” Three items assessed *sexual* consequences ($\alpha = .73$), for example, being pressured to have sex with someone because of being too drunk to prevent it. The *academic* subscale ($r = .79$) included two items (missing/skipping a class, or having academic work suffer due to drinking). *Tolerance* consequences included two items, “I needed larger amounts of alcohol to feel any effect” and “I found it difficult to limit how much I drank” ($r = 0.46$). Single items were used to capture *legal* (“I have received a citation because of drinking or other drunken behavior”) and *impulse control* (“When drinking, I have done impulsive things that I later regretted”) consequences.

Typical drinking was assessed using the Daily Drinking Questionnaire (DDQ; Collins et al., 1985), which asked participants to indicate how many drinks they consumed on each day of a typical week. Responses were summed to indicate the number of drinks one typically consumed each week. *Heavy drinking* was assessed using a single item from the Quantity, Frequency, Peak scale (QFP; Dimeff, 1999). Participants indicated how many times, in the past 30 days, they had been drunk or very high from alcohol. Response options were as follows: 0 = Never, 1 = 1–2 times, 2 = 3–4 times, 3 = 5–6 times, 4 = 7–8 times, 5 = 9+ times.

2.3. Analytic Strategy

We used LTA to identify common patterns of experiencing consequences, and transitions of these patterns between T1 and T2. All consequence items exhibited skewed distributions. Thus, the subscales were recoded to differentiate students who (1) did not experience any consequences within each subscale; (2) experienced at least one particular consequence within that subscale but only one time (i.e., not repeated); and (3) experienced repeated consequences (2 or more times) for at least one particular consequence within that subscale. These trichotomous variables were used as indicators of the LTA model. We used relative measures of fit (AIC and BIC), parsimony, and model interpretability to determine the optimal number of statuses (Collins & Lanza, 2010). Analyses were conducted using PROC LTA (Lanza et al., 2011). This procedure uses full information maximum likelihood (FIML), which can accommodate missing data among the LTA indicator items.

The resulting LTA model included three sets of parameters. The *item-response probabilities* represented the probability of responding to each level of the indicator item, conditional on status membership. The *prevalence rates* represented the proportion of the sample in each status at each measurement occasion, while *transition probabilities* described how statuses change over time. Measurement invariance across the two waves was assessed by comparing a model with item-response probabilities freely estimated to a model with the probabilities constrained to be equal at both times. The difference in log-likelihood values between these two nested models is a likelihood ratio test (LRT) statistic and is distributed as a chi-square.

To confirm the validity of the statuses, rates of typical and heavy alcohol use were compared across the statuses using a model-based approach (Lanza et al., 2011). This approach estimates the association between a latent variable and an observed outcome taking into account the uncertainty of each individual's status membership. These analyses were conducted by adding each drinking behavior as a covariate to a cross-sectional LCA model estimated with T1 indicators only. Marginal distributions of typical and heavy drinking at T1 were then estimated.

The second phase examined whether the T1 status prevalence rates differed across the three living arrangement groups. In these analyses, we compared the fit of a model with the T1 prevalence rates freely estimated across the three living arrangement groups to a model that constrained all status proportions to be equal. Significant differences were followed by comparison of models with the prevalence of each status constrained to be equal and freely estimated. Similar multiple group comparisons were used to examine whether transition probabilities differed among the three living arrangement groups. The LRT was used to compare the fit of a model with a specific transition probability constrained to be equal across the three groups to a model that allowed the parameter to be freely estimated. Effect sizes in terms of an odds ratio were calculated from these probabilities. Probabilities were converted into odds and then divided to produce an odds ratio to compare two specific living arrangement groups (Roberts & Ward, 2011).

3. Results

3.1. Identifying and examining the latent consequence subgroups and transitions

We determined that four statuses provided the optimal fit. As seen in Table 1, model improvement diminished with additional five- and six-status solutions, relative to more parsimonious solutions. Moreover, inspection of the more complex models revealed the additional statuses were not clearly distinguished and each comprised a very small number of students (less than 2% of the sample). Although the LRT for measurement invariance test was significant ($G^2 = 151.68$, $df = 56$, $p < 0.05$), the AIC and BIC for the constrained model were smaller than values for the freely estimated model. These comparisons suggested the more parsimonious (constrained) model provided a better fit to the data. Inspection of the response probabilities in the freely estimated model also indicated the interpretation of the four statuses was identical at both waves. We thus imposed measurement invariance in subsequent analyses.

Table 2 presents the four-status solution. Members of the *No Consequences* status were most likely to report they did not experience any of the consequences. Members of the *Physical Consequences Non-Repeater* status were most likely to experience only physical consequences and only one time, without repeating. Students in the *Multiple Consequences* status were likely to report at least one incident of all consequence subscales (except legal), with repeated instances (2+ times) of tolerance and impulse control consequences. Students in the *Multiple Consequences Repeater* status were likely to report repeated experiences of all of the consequences. Subsequent analyses indicated status membership at T1 was significantly associated with measures of typical and heavy drinking at T1 (both $LRT > 373$, $ps < 0.001$). Students in the *No Consequences* status reported the lowest rates of drinking

while students in the *Multiple Consequences Repeater* status reported the highest rates (see Table 3).

The bottom of Table 2 displays the prevalence rates of the four statuses. *The Physical Non-Repeater* status was the most prevalent at T1 (41%), followed by the *No Consequences* status (35%). Both of these remained the most prevalent at T2. About one-fifth of the sample at both assessments belonged to the *Multiple Consequences* status. Relatively few students (about 5%) belonged to the *Multiple Consequences Repeater* status at either assessment. Transition probabilities revealed that although overall prevalence rates among the four statuses remained fairly consistent, individual students were not likely to remain in the same status (see Table 4). Stability was lowest among the *Multiple Consequences Repeaters*, with fewer than half of those members at T1 (49%) remaining in that same status at T2. The most common type of transition was to the next highest or lowest status in terms of risk. For example, students in the *No Consequences* status were most likely to transition into the *Physical Non-Repeater* status at T2 (31% did so) while students in the *Physical Non-Repeater* status were almost equally likely to transition to either the *No Consequences* (18%) or the *Multiple Consequences* status (19%).

3.2. Comparing latent status membership and transitions across living arrangement groups

The omnibus test comparing T1 prevalence rates across the living arrangement groups was significant (LRT = 174.54, $df = 6$, $p < 0.001$).¹ As seen in Figure 1, students who remained in on-campus spaces were more likely to belong to the *No Consequences* status at T1, compared to students who moved to fraternity ($p < 0.001$) or off-campus ($p < 0.001$) housing. In contrast, students who remained in on-campus spaces were the least likely to belong to the *Physical Non-Repeater* status at T1 (compare to fraternity: $p < 0.01$; compare to off-campus: $p < 0.01$). Pairwise comparisons also indicated students who moved to fraternity housing were less likely to belong to the *Multiple Consequences* status at T1, compared to students in off-campus arrangements ($p < 0.01$) and were more likely to belong to the *Multiple Consequences Repeater* status at T1, compared to students in on-campus ($p < 0.001$) or off-campus ($p < 0.001$) spaces.

Table 5 displays the transition probabilities between the T1 and T2 assessments, separately for each living arrangement group. Among the students who belonged to the *No Consequences* (LRT = 4.20, $p < 0.05$) and the *Physical Non-Repeater* (LRT = 3.20, $p = 0.07$) statuses at T1, those who moved to fraternity housing were more likely to transition to *Multiple Consequences Repeater* status at T2, compared to students who remained on-campus (ORs = 9.79 and 2.69, respectively). Among the students in the *Physical Non-Repeater* status at T1, those who remained on-campus were more likely to transition to the *No Consequences* status, compared to students who moved to fraternity (LRT = 5.40, $p < 0.05$; OR = 2.60) or off-campus (LRT = 2.88, $p = 0.09$; OR = 3.15) housing. The stability among the students in the *Multiple Consequences* status was highest for students who

¹Similar comparisons were conducted to examine whether T1 prevalence rates were different across female and male students. This test was not significant (LRT = 6.66, $df = 3$, $p < 0.08$). Additional analyses indicated the transition probabilities did not significantly differ across the gender groups (LRT = 8.3, $df = 12$, $p < 0.76$).

moved off-campus, compared to students who either remained on-campus (LRT = 3.86, $p < 0.05$; OR = 2.47) or moved to fraternity housing (LRT = 3.24, $p = 0.07$; OR = 4.53). On the other hand, students who remained on-campus in the *Multiple Consequences Repeater* status at T1 were more likely to transition to *Multiple Consequences* status than students who moved off-campus (LRT = 2.80, $p = 0.09$; OR = 3.84).

4. Discussion

We identified four statuses of college student drinkers that characterized distinct combinations of negative consequences, including whether the student experienced no consequences, multiple (but not repeated) instances of consequences, and repeated instances of multiple consequences. At baseline, students in the *No Consequences* status reported the lowest rates of typical and heavy drinking. Although recruitment criteria included previous drinking, it is likely that this status included drinkers as well as current non-drinkers. The highest rates of drinking were found in the *Multiple Consequences Repeaters* status. Somewhat surprising were findings that revealed higher rates of typical drinking among the baseline *Physical Consequences Non-Repeater* status compared to *Multiple Consequences* status.

All of the students in our analytic sample resided in on-campus living spaces at T1, a requirement of students attending the chosen institution. This restriction allowed us to examine the effects of two types of transitions that occurred during the following year – moving to a fraternity house or moving to an off-campus apartment or house. Importantly, differences among the living arrangement groups were already evident at the beginning of the study, prior to changes in residency. These differential patterns support the notion that students self-select into certain types of living arrangements that are congruent with their current or previous drinking behaviors (Baer, Kivlahan, & Marlatt, 1995). Our findings extend previous research by demonstrating this selection process is an important factor not only during the transition from high school to college (Capone, Wood, Borsari, & Laird, 2007; Park, Sher, & Krull, 2008; Park et al., 2009; Simons-Morton et al., 2016) but also during another important milestone in many students' college careers – deciding whether or not to remain in on-campus living spaces.

Examination of transitions suggested students who moved out of on-campus living spaces, regardless of whether to Greek or off-campus housing, were more similar to each other than they were to students who remained in on-campus living spaces. Two exceptions to this pattern are worth noting. First, among the students who at T1 belonged to the *No Consequences* status, those who moved into Greek housing were most likely to transition into the *Multiple Consequences Repeaters* status at T2. This suggests that moving into Greek housing has strongest effects among lowest risk first-year students. It was also noteworthy that students who moved to off-campus living spaces were the most likely to remain in the *Multiple Consequences* status at both assessments. Given that students who moved to Greek housing were least likely to belong to this status at T1, this suggests there is less “middle ground” between experiencing no (or relatively few) consequences and experiencing repeated instances of multiple types of consequences among students in Greek housing. In other words, the accumulation of consequences may be accelerated for these

high-risk students, occurring over the course of a single semester rather than across multiple semesters (Martinez et al., 2014).

Most troubling is the finding that some students were not only likely to report experiencing the entire range of consequences, but to report repeated instances of nearly all types of consequences. This distinguishes the students in the *Multiple Consequences Repeaters* status from a similar high-risk group of student drinkers, identified by Mallett et al. (2011), who also experienced a variety of consequences repeatedly, though not necessarily across multiple subscales. Multiple studies show that for many college students, experiencing alcohol-related consequences is not viewed as a negative phenomenon (Mallett et al., 2008; Park & Grant, 2005) and does not reduce future drinking behaviors (Martinez et al., 2014). This presents a challenge to intervention efforts to reduce the harm associated with alcohol-related consequences. Our findings suggest these efforts could be enhanced by identifying students who intend to move to off-campus or Greek housing after the first year of college.

There is also preliminary evidence that an environmental wellness program that incentivizes health-promoting behaviors (e.g., daily exercise, healthy diet, and mindfulness practice) is well-received by college students (Hudziak & Tiemeier, 2017). In this approach, students are required to sign a code of conduct that prohibits alcohol and other substance use only within the residence hall, and are also required to take a neuroscience course in order to gain understanding of the relationship between brain development and young adult risk behaviors, such as high-risk alcohol use. This type of integrative program that supplements substance-free living spaces with personal incentives for healthy behaviors represents an innovative approach that may be an effective way to motivate students to remain in less risky, on-campus residence halls.

Several limitations of this study warrant attention. First, our sample was drawn from students at one university and was limited by a lack of ethnic diversity. Future studies that examine these questions with other university students is needed to generalize these findings. An important extension in future studies should also include how individual (e.g., perceptions of peer norms) and contextual (alcohol availability) factors are differentially associated with transitions. We also note that our LTA model was based on categorical indicators of consequence experiences. Alternative models of latent statuses could be estimated based on continuous measures, which require a different approach (e.g., latent profile analysis).

In conclusion, our findings demonstrate students in different types of living arrangements follow different paths of experiencing distinct types of consequences as they begin their college experience. These differences were already evident at the beginning of the study, when all students in our sample resided in on-campus living spaces, where supervision and strict no-alcohol rules were in place. Students who moved out of residence halls, whether to off-campus or Greek housing, were most likely to belong to higher-risk statuses, characterized by multiple and/or repeated consequences. Prevention efforts delivered in the freshman year may help reduce the likelihood of this escalation.

Acknowledgment

The present research study was supported by NIAAAR01AA021117 awarded to Dr. Kimberly Mallett. The NIAAA had no involvement in any aspect of the study design, data collection, analysis, or interpretation of results.

References

- Baer JS, Kivlahan DR, & Marlatt GA (1995). High-risk drinking across the transition from high school to college. *Alcoholism: Clinical and Experimental Research*, 19, 54–61.
- Beseler CL, Taylor LA, Kraemer DT, & Leeman RF (2012). A Latent Class Analysis of DSM-IV Alcohol Use Disorder Criteria and Binge Drinking in Undergraduates. *Alcoholism: Clinical and Experimental Research*, 36(1), 153–161.
- Borsari B, Hustad JT, & Capone C (2009). Alcohol use in the Greek system, 1999–2009: A decade of progress. *Current Drug Abuse Reviews*, 2(3), 216. [PubMed: 20443768]
- Capone C, Wood MD, Borsari B, & Laird RD (2007). Fraternity and sorority involvement, social influences, and alcohol use among college students: A prospective examination. *Psychology of Addictive Behaviors*, 21(3), 316. [PubMed: 17874882]
- Cleveland MJ, Hultgren B, Varvil-Weld L, Mallett KA, Turrissi R, & Abar CC (2013). moderation of a parent-based intervention on transitions in drinking: Examining the role of normative perceptions and attitudes among high-and low-risk first-year college students. *Alcoholism: Clinical and Experimental Research*, 37(9), 1587–1594.
- Collins LM, & Lanza ST (2010). Latent class and latent transition analysis: With applications in the social, behavioral, and health sciences. Vol. 718 John Wiley & Sons Retrieved from http://books.google.com/books?hl=en&lr=&id=3xJaoIqhZhEC&oi=fnd&pg=PR7&dq=latent+class+analysis+lanza+collins&ots=9Uk5EoH53S&sig=LtKRDj2E_Qnm8sbRNH-H6tas_4I.
- Collins RL, Parks GA, & Marlatt GA (1985). Social determinants of alcohol consumption: the effects of social interaction and model status on the self-administration of alcohol. *Journal of Consulting and Clinical Psychology*, 53(2), 189. [PubMed: 3998247]
- Dimeff LA (1999). Brief alcohol screening and intervention for college students (BASICS): A harm reduction approach. Guilford Press Retrieved from [http://books.google.com/books?hl=en&lr=&id=61eRtNQcGUAC&oi=fnd&pg=PA1&dq=Brief+alcohol+screening+and+intervention+for+college+students+\(BASICS\):+A+harm+reduction+approach&ots=GGLR5e989V&sig=8xsr3QdvpYzTJg_Sus02MOVRSb8](http://books.google.com/books?hl=en&lr=&id=61eRtNQcGUAC&oi=fnd&pg=PA1&dq=Brief+alcohol+screening+and+intervention+for+college+students+(BASICS):+A+harm+reduction+approach&ots=GGLR5e989V&sig=8xsr3QdvpYzTJg_Sus02MOVRSb8).
- Fromme K, Corbin WR, & Kruse MI (2008). Behavioral risks during the transition from high school to college. *Developmental Psychology*, 44(5), 1497. [PubMed: 18793080]
- Harford TC, Wechsler H, & Muthén BO (2002). The impact of current residence and high school drinking on alcohol problems among college students. *Journal of Studies on Alcohol*, 63(3), 271–279. [PubMed: 12086127]
- Hingson RW, Zha W, & Weitzman ER (2009). Magnitude of and trends in alcohol-related mortality and morbidity among US college students ages 18–24, 1998–2005. *Journal of Studies on Alcohol and Drugs*, 16, 12.
- Hudziak JJ, & Tiemeier GL (2017). Neuroscience-inspired, behavioral change program for university students. *Child and Adolescent Psychiatric Clinics*, 26(2), 381–394.
- Hurlbut SC, & Sher KJ (1992). Assessing alcohol problems in college students. *Journal of American College Health*, 41(2), 49–58. [PubMed: 1460173]
- Johnston LD, O'Malley PM, Bachman JG, Schulenberg JE, & Miech RA (2016). Monitoring the Future national survey results on drug use, 1975–2015: Volume II, college students and adults ages 19–55.
- Lanza ST, Dziak JJ, Huang L, Xu S, & Collins LM (2011). PROC LCA & PROC LTA users' guide (Version 1.2. 7). University Park: The Methodology Center, Penn State.
- Larimer ME, Anderson BK, Baer JS, & Marlatt GA (2000). An individual in context: Predictors of alcohol use and drinking problems among Greek and residence hall students. *Journal of Substance Abuse*, 11(1), 53–68. [PubMed: 10756514]

- Larimer ME, Lydum AR, Anderson BK, & Turner AP (1999). Male and female recipients of unwanted sexual contact in a college student sample: Prevalence rates, alcohol use, and depression symptoms. *Sex Roles*, 40(3–4), 295–308.
- Mallett KA, Bachrach RL, & Turrisi R (2008). Are all negative consequences truly negative? Assessing variations among college students' perceptions of alcohol related consequences. *Addictive Behaviors*, 33(10), 1375–1381. [PubMed: 18639384]
- Mallett KA, Marzell M, Varvil-Weld L, Turrisi R, Guttman K, & Abar C (2011). One-time or repeat offenders? An examination of the patterns of alcohol-related consequences experienced by college students across the freshman year. *Addictive Behaviors*, 36(5), 508–511. [PubMed: 21276662]
- Mallett KA, Turrisi R, Cleveland MJ, Scaglione NM, Reavy R, Sell NM, & Varvil-Weld L (2015). A dual-process examination of alcohol-related consequences among first-year college students. *Journal of Studies on Alcohol and Drugs*, 76(6), 862–871. [PubMed: 26562594]
- Martinez JA, Sher KJ, & Wood PK (2014). Drinking consequences and subsequent drinking in college students over 4 years. *Psychology of Addictive Behaviors*, 28(4), 1240. [PubMed: 25528051]
- O'Connor RM, & Colder CR (2005). Predicting alcohol patterns in first-year college students through motivational systems and reasons for drinking. *Psychology of Addictive Behaviors*, 19(1), 10. [PubMed: 15783273]
- Page RM, & O'Hegarty M (2006). Type of student residence as a factor in college students' alcohol consumption and social normative perceptions regarding alcohol use. *Journal of Child & Adolescent Substance Abuse*, 15(3), 15–31.
- Park A, Sher KJ, & Krull JL (2008). Risky drinking in college changes as fraternity/sorority affiliation changes: A person-environment perspective. *Psychology of Addictive Behaviors*, 22(2), 219. [PubMed: 18540719]
- Park A, Sher KJ, & Krull JL (2009). Selection and socialization of risky drinking during the college transition: The importance of microenvironments associated with specific living units. *Psychology of Addictive Behaviors*, 23(3), 404. [PubMed: 19769425]
- Park CL, & Grant C (2005). Determinants of positive and negative consequences of alcohol consumption in college students: Alcohol use, gender, and psychological characteristics. *Addictive Behaviors*, 30(4), 755–765. [PubMed: 15833579]
- Read JP, Kahler CW, Strong DR, & Colder CR (2006). Development and preliminary validation of the young adult alcohol consequences questionnaire. *Journal of Studies on Alcohol*, 67(1), 169–177. [PubMed: 16536141]
- Rinker DV, Diamond PM, Walters ST, Wyatt TM, & DeJong W (2016). Distinct classes of negative alcohol-related consequences in a national sample of incoming first-year college students: a latent class analysis. *Alcohol and Alcoholism*, 51(5), 602–608. [PubMed: 27325885]
- Roberts TJ, & Ward SE (2011). Using latent transition analysis in nursing research to explore change over time. *Nursing Research*, 60(1), 73. [PubMed: 21127448]
- Simons-Morton B, Haynie D, Liu D, Chaurasia A, Li K, & Hingson R (2016). The effect of residence, school status, work status, and social influence on the prevalence of alcohol use among emerging adults. *Journal of Studies on Alcohol and Drugs*, 77(1), 121–132. [PubMed: 26751362]
- Wechsler H, Kuh G, & Davenport AE (2009). Fraternities, sororities and binge drinking: Results from a national study of American colleges. *NASPA Journal*, 46(3), 395–416.
- White HR, McMorris BJ, Catalano RF, Fleming CB, Haggerty KP, & Abbott RD (2006). Increases in alcohol and marijuana use during the transition out of high school into emerging adulthood: The effects of leaving home, going to college, and high school protective factors. *Journal of Studies on Alcohol*, 67(6), 810–822. [PubMed: 17060997]
- Willoughby BJ, & Carroll JS (2009). The impact of living in co-ed resident halls on risk-taking among college students. *Journal of American College Health*, 58(3), 241–246. [PubMed: 19959438]

HIGHLIGHTS

- Four statuses were identified that distinguished students' alcohol-related consequences. • Most students transitioned into a different status by the fall of their second year.
- Moving out of on-campus housing was associated with transitioning to higher risk status.
- Moving into Greek housing had strongest effects.

Fig. 1.

Baseline latent status prevalence rates, separately by living arrangement group at T2.

Table 1

Model fit statistics for LTA models with 2 to 6 latent statuses.

Number of Statuses	–Loglikelihood	AIC	BIC
2	16687.79	11182.57	11351.22
3	16294.68	10434.30	10706.40
4	16174.21	10235.37	10621.75
5	16092.71	10118.35	10629.89
6	16039.94	10027.98	10675.57

Note: AIC = Akaike's information criteria; BIC = Bayesian information criteria; aBIC = adjusted Bayesian information criteria. The optimal four-status solution is highlighted in ***bold italics***.

Table 2

Parameter estimates and prevalence rates for the selected 4-status LTA model.

Indicator and Response Options				
	NO CONSEQ	PHYSICAL NON-REPEAT	MULTIPLE CONSEQ	MULTI-CONSEQ REPEATER
Physical Consequences				
NONE	0.56	0.07	0.01	0.00
ONCE	0.36	0.67	0.59	0.17
2+ TIMES	0.08	0.26	0.40	0.83
Social Consequences				
NONE	0.94	0.67	0.26	0.00
ONCE	0.05	0.25	0.47	0.17
2+ TIMES	0.01	0.08	0.28	0.83
Academic Consequences				
NONE	0.98	0.69	0.35	0.08
ONCE	0.02	0.23	0.36	0.07
2+ TIMES	0.00	0.09	0.29	0.85
Sexual Consequences				
NONE	0.99	0.86	0.36	0.18
ONCE	0.01	0.12	0.46	0.15
2+ TIMES	0.00	0.02	0.19	0.67
Tolerance Consequences				
NONE	0.95	0.54	0.16	0.05
ONCE	0.04	0.19	0.25	0.02
2+ TIMES	0.02	0.27	0.59	0.92
Legal Consequences				
NONE	0.99	0.96	0.93	0.70
ONCE	0.01	0.04	0.05	0.05
2+ TIMES	0.00	0.00	0.01	0.25
Impulse Control Consequences				
NONE	0.96	0.62	0.05	0.04
ONCE	0.03	0.25	0.22	0.00

	NO CONSEQ	PHYSICAL NON-REPEAT	MULTIPLE CONSEQ	MULTI-CONSEQ REPEATER
2+ TIMES	0.01	0.14	0.73	0.96
Prevalence Rates				
Time 1	0.35	0.41	0.20	0.04
Time 2	0.31	0.41	0.23	0.05

Note: NO CONSEQ = No Consequences; PHYSICAL NON-REPEAT = Physical Consequences Non-Repeaters; MULTIPLE CONSEQ = Multiple Consequences; MULTI-CONSEQ REPEATERS = Multiple Consequences Repeaters. Status defining probabilities are highlighted in bold and outlined.

Table 3

Comparison of Typical and Heavy Drinking Behavior across the T1 Latent Statuses. Note: Values in table refer to model-based mean estimates of the drinking behavior, conditional upon T1 latent status membership.

Time 1 latent status	Typical drinking	Heavy drinking
No Consequences	5.35	0.69
Physical Non-Repeater	9.69	2.28
Multiple Consequences	7.87	2.51
Multiple Consequences Repeater	10.53	3.84

Table 4

Transition Probabilities from Baseline status (rows) to Follow-Up status (columns).

	Latent status at time 2			
	No conseq	Physical Non-repeat	Multiple Conseq	Multi-conseq Repeater
Latent Status at Time 1				
No Consequences	<i>0.64</i>	0.31	0.04	0.00
Physical Non-Repeater	0.18	<i>0.60</i>	0.19	0.03
Multiple Consequences	0.02	0.23	<i>0.64</i>	0.10
Multiple Consequences Repeater	0.09	0.09	0.33	<i>0.49</i>

Note: NO CONSEQ = No Consequences; PHYSICAL NON-REPEAT = Physical Consequences Non-Repeaters; MULTIPLE CONSEQ = Multiple Consequences; MULTI-CONSEQ REPEATERS = Multiple Consequences Repeaters. Stability coefficients are highlighted in *bold italics*.

Table 5

Transition Probabilities from Baseline status (rows) to Follow-Up status (columns), separately by Living Arrangement group.

	Latent Status at Time 2			
	NO CONSEQ	PHYSICAL NON-REPEAT	MULTIPLE CONSEQ	MULTI-CONSEQ REPEATER
<i>Living Arrangement Group</i>				
Latent Status at Time 1				
<i>On Campus</i>				
No Consequences	0.67	0.22	0.10	0.01
Physical Non-Repeater	0.28	0.57	0.05	0.09
Multiple Consequences	0.12	0.32	0.44	0.13
Multi-Consequence Repeater	0.02	0.00	0.44	<i>0.55</i>
<i>Fraternity</i>				
No Consequences	<i>0.56</i>	0.24	0.11	0.09
Physical Non-Repeater	0.13	<i>0.45</i>	0.20	0.21
Multiple Consequences	0.11	0.42	0.30	0.16
Multi-Consequence Repeater	0.06	0.07	0.18	<i>0.68</i>
<i>Off Campus</i>				
No Consequences	<i>0.72</i>	0.18	0.08	0.02
Physical Non-Repeater	0.11	<i>0.60</i>	0.11	0.19
Multiple Consequences	0.11	0.18	0.66	0.05
Multi-Consequence Repeater	0.05	0.06	0.17	0.72

Note: NO CONSEQ = No Consequences; PHYSICAL NON-REPEAT = Physical Consequences Non-Repeaters; MULTIPLE CONSEQ = Multiple Consequences; MULTI-CONSEQ REPEATERS = Multiple Consequences Repeaters. Bolded text within solid borders indicate significant overall differences among the three Living Arrangement groups.