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Patterns of Drinking-related Protective and Risk Behaviors in College Student Drinkers

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Abstract

Drinking-related protective (e.g., pacing consumption) and risk (e.g., participating in drinking games) behaviors influence both the amount of alcohol consumed and the consequences experienced by college students. Previous studies of these behaviors have typically examined use and predictors of these constructs separately. In the current study, latent profile analysis (LPA) was used to identify latent subgroups of drinkers with distinct patterns of use of both drinking-related protective and risk behaviors in a sample of college students. A random sample of first year student drinkers (N = 229, 59.4% female) at a large, public university in the Northeastern United States completed a web-based assessment of drinking-related protective and risk behaviors, alcohol use, and related consequences. Three patterns of use were identified, including: 1) students who used protective behaviors frequently and seldom engaged in risk behaviors (10%), 2) students who used risk behaviors more frequently and used protective behaviors less often (30%), and 3) students who used both risk and protective behaviors at similar frequencies (60%). Significant differences in the distribution of profiles was observed when considering gender, age of onset of alcohol use, and recent drinking outcomes including weekend alcohol use, heavy-episodic drinking, and alcohol-related problems. Prevention and intervention programs may benefit from a focus on not only increasing protective actions, but on also reducing risk behaviors beyond that of quantity and frequency of alcohol use alone.

Keywords

College students; Alcohol use; Protective behaviors; Risk behaviors

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Contributors

Authors Ray and Turrisi were responsible for study conceptualization and design. Author Stapleton conducted statistical analyses. Authors Ray and Stapleton wrote the initial draft of the manuscript. Authors Turrisi and Philion provided feedback and edits on all paper sections. All authors contributed to and have approved the final manuscript.

Conflict of Interest

All authors declare that they have no conflicts of interest.

1. Introduction

Heavy drinking continues to be a concern on U.S. college campuses (Hingson, Zha, & Weitzman, 2009). Numerous studies have documented the association between alcohol use and consequences such as vomiting, blacking out, academic difficulties, unprotected and regretted sex, unintentional injury, assaults, and death (Hingson et al., 2009; Hingson, Heeren, Winter & Wechsler, 2005; Mundt, Zakletskaia, & Fleming, 2009; Thombs et al., 2009). Research has focused on identifying various etiological variables that are predictive of alcohol use in order to utilize such variables for the design of evidence-based prevention and intervention efforts (Larimer & Cronce, 2007). Accordingly, the current research focuses on drinking-related protective and risk behaviors. These behaviors capture a stylistic aspect of alcohol use and, although associated with typical assessments of alcohol use including drinking quantity and frequency, are conceptually distinct from how much or how often one drinks. More specifically, these behaviors reflect strategies to regulate one's drinking experience by either limiting (e.g., pacing one's drinks) or increasing (e.g., playing drinking games) drinking and/or related harm. The importance of protective behaviors has been demonstrated by the inclusion of components reflecting this construct in several common college student interventions including BASICS and other personalized feedback efforts (Dimeff, Baer, Kivlahan, & Marlatt, 1999; Larimer et al., 2007). However, many of the studies of drinking-related protective and risk behaviors have examined these variables in isolation and little is known about how both constructs operate collectively within college student drinkers. The aim of the current study was to examine the use of multiple drinking-related protective and risk behaviors in order to identify subgroups of first-year college student drinkers based on their use of both types of drinking behaviors.

Protective drinking behaviors include actions such as setting limits on the number of drinks one consumes, pacing drinks to one or fewer per hour, and making sure to walk home with a friend after a drinking occasion (Martens et al., 2004; Ray, Turrisi, Abar, & Peters, 2009; Sugarman & Carey, 2007). Research indicates a negative relationship between these behaviors and drinking outcomes, such that as students increase their use of protective drinking behaviors they report lower levels of alcohol consumption and consequences (Benton et al., 2004; Delva et al., 2004; Haines, Barker, & Rice, 2006; Lewis, Rees, Logan, Kaysen, & Kilmer, 2010; Martens et al., 2004; Ray et al., 2009). Further, the relationship between protective behaviors and alcohol-related consequences remains after controlling for alcohol use (Martens et al., 2004; Lewis et al., 2010; Ray et al., 2009), which suggests that one's style of drinking is influential above and beyond quantity of alcohol use alone. Accordingly, protective behaviors are sometimes included as a component of harm reduction interventions targeted towards college student populations and have been examined as mediators of such efforts (Barnett, Murphy, Colby, & Monti, 2007; Larimer et al., 2007; Martens, Cimini, et al., 2007). Recent studies have focused on predictors of protective behaviors, including mood (LaBrie, Kenney, Lac, Garcia, & Ferraiolo, 2009; Martens et al., 2008), personality (Martens et al., 2009), drinking motives (Martens, Ferrier, & Cimini, 2007), attitudinal and normative constructs (Benton, Downey, Glider, & Benton, 2008; Ray et al., 2009), age of onset of alcohol use (Palmer, Corbin, & Cronce, 2010), family history of alcohol use (Walters, Roudsari, Vader, & Harris, 2007), and gender (Nguyen, Walters, Wyatt, & DeJong, 2011; Walters et al., 2007).

Researchers have also identified drinking-related risk behaviors that influence alcohol consumption and related consequences (Borsari, 2004; Borsari et al., 2007; LaBrie & Pedersen, 2008; Pedersen & LaBrie, 2006, 2007; Nagoshi, Wood, Cote, & Abbit, 1994; Zamboanga, Calvert, O'Riordan, & McCollum, 2007). In particular, the literature has focused on participation in drinking games and pregaming (also known as prepartying) in

which students have shots or other drinks prior to going to a social event (e.g., Borsari et al., 2007). Not surprisingly, a positive relationship between such actions and drinking outcomes has been observed, such that students who engage in these behaviors tend to report more alcohol use, are more likely to report heavy-episodic drinking, and experience more consequences (Pedersen & LaBrie, 2006, 2007). In a recent study by Borsari et al. (2007), 62% of students reported participating in pregaming, drinking games, or both on evenings when they received violations for alcohol intoxication. With regards to gender as a correlate of risk behaviors, recent research indicates male and female college students engage in drinking games at similar rates but women are more likely to report experiencing consequences as a result (Pedersen & LaBrie, 2006). Studies have also examined specific motives to engage in drinking games (Borsari, 2004; Johnson & Sheets, 2004), and findings suggest students who are motivated by competition, conformity, sex, and novelty are more likely to participate in these behaviors. Finally, normative misperceptions of both pregaming and drinking game participation are predictive of these actions (Pedersen & LaBrie, 2008). Notably, drinking-related risk behaviors are often not a significant focus of many college alcohol interventions despite their link to increased consumption and related consequences (Borsari, 2004; Borsari et al., 2007).

The aforementioned research has shed light on the important influence of protective and risk behaviors on drinking outcomes, as well as variables that influence their use. Yet these studies have primarily examined the use of protective and risk behavior constructs separately. Although such studies are helpful in understanding how these behaviors operate independently, they can potentially mask important information about whether students engage in both drinking-related risk and protective behaviors, and how the use of both types of behaviors is associated with drinking outcomes. An analysis that takes into consideration multiple categories of both of these behavioral constructs can provide important insights into the etiology of high-risk drinking behaviors in college students and, in turn, inform existing prevention and intervention efforts.

Further, protective and risk behaviors have typically been studied using variable-centered approaches in which averaged relationships between either protective or risk variables and both predictors and outcomes of these actions were examined. Although such analyses are critical in understanding the use of these behaviors, individual level behaviors are often obscured. In other words, it is likely that individuals' typical drinking patterns are not well described by averaging the use of these behaviors across an entire sample. The current analysis seeks to provide a better understanding of how certain types of individuals tend to use protective and risk behaviors. These findings may aid in the development of prevention and intervention content that more accurately reflects the actual behaviors of participants.

Thus, the primary focus of the current study was to examine patterns of both drinking-related protective and risk behaviors in a sample of first-year college students using latent profile analysis (LPA). LPA is a model-driven analytic approach that allows for the detection of distinct subgroups of individuals based on shared behavioral profiles or patterns of behaviors (Muthén, 2004). LPA provides information about: (1) the number of distinct subgroups, or profiles, of individuals in the sample, based on distinct patterns of protective and risk behaviors, (2) the percentage of individuals in the sample who are well described by each profile, and (3) the mean use of protective and risk behaviors within each profile.

In order to validate the findings from the LPA, a secondary focus of the study was to compare the observed profiles on several demographic and background variables as well as alcohol-related outcomes. We expected to find that established demographic and background risk factors (e.g., male gender, positive family history of alcoholism, early age of onset, low GPA) would be associated with profiles that are defined by lower levels of

drinking-related protective behaviors. Given literature that suggests drinking-related protective behaviors are associated with decreased alcohol use and related harm, we expected that profiles delineated by more frequent use of multiple protective behaviors would be associated with lower levels of drinking and fewer reported consequences compared to other profiles. Similarly, in accordance with literature on drinking-related risk behaviors, we expected that profiles delineated by more frequent use of risk behaviors would be associated with higher levels of drinking and more consequences compared to other profiles.

2. Method

2.1. Sample

Participants were 229 first-year college students screened as drinkers at a large, Northeastern United States university. The mean age of the sample was 18.61 years ($SD = 0.49$) with more than half of participants identifying as female (59.4%). Racial background was as follows: 91.7% of the sample identified as Caucasian, 4.4% as Asian, 1.7% as Multiracial, 0.9% as African American, and 0.9% identified as "Other." Five participants (2.2%) identified as Hispanic or Latino/a. Demographic characteristics of the sample were similar to the general student population of first-year students at the university, suggestive of a representative sample. All participants provided informed consent and the procedures were approved by the university's Institutional Review Board.

2.2. Participant recruitment and procedure

A random sample of 600 first-year college students was invited, via email, to participate in a web-based assessment. Participants received up to three email reminders to complete the survey during the week following the email invitation and were compensated $10 upon completion. Three hundred and three students provided consent and completed the survey yielding a 50.5% response rate. This response rate is similar to other studies in the college student alcohol literature using web-based surveys with similar incentives (Larimer et al., 2007; Turrisi et al., 2009). Respondents were screened on drinking tendencies to include only those who identified as current drinkers. Four items were used to determine drinker status including heavy-episodic drinking, peak drinking, weekend drinking, and drunkenness. If a student reported alcohol use on any of these variables, he or she was considered to be a drinker. Based on these criteria, 229 students (75.5%) were included in analyses.

2.3. Measures

2.3.1. Drinking-related protective behaviors—Participants were presented with a list of 16 protective behaviors and were asked to indicate how often they engaged in each behavior when drinking (Ray et al., 2009; Ray, Turrisi, Abar, Abar, & Peters, 2007). Response options were *Never* (0), *Rarely* (1), *Sometimes* (2), *Usually* (3), and *Always* (4). Four categories were assessed including pacing, setting limits, diluting, and social awareness behaviors. The mean of all items within their respective category was calculated to create an overall score for each construct. The pacing variable ($\alpha = .77$) consisted of pacing one's drinks to one or fewer per hour, drinking slowly rather than gulping or chugging, avoiding keeping up or out-drinking others, and avoiding alternating between shots and other drinks (e.g., beer, mixed drinks). Setting limits ($\alpha = .80$) was constructed from the following five items: keeping track of drinks consumed, determining in advance not to exceed a set number of drinks, having a friend let one know when he/she has had enough, setting limits based on one's blood alcohol content (BAC), and thinking about one's BAC when drinking. Diluting ($\alpha = .71$) consisted of the following four items: switching between alcoholic and non-alcoholic beverages, drinking an alcoholic look-alike, drinking water at the same time, and

putting extra ice in one's drink. Finally, the social awareness variable (α = .79) consisted of three items including walking home with friends, watching one's drink being made, and knowing where one's drink has been at all times.

2.3.2. Drinking-related risk behaviors—Eleven drinking-related risk behaviors were assessed with the same prompt and response options as protective behaviors (Ray et al., 2007). Risk behavior items were averaged within category to create an overall score for three constructs: social partying, mixing, and competitive drinking behaviors. Social partying (α = .75) was constructed from the following five items: playing drinking games (e.g., flip cup, quarters, kings, etc.), playing beer pong, drinking too quickly, pregaming, and drinking shots of liquor. The composite mixing variable (α = .75) consisted of two items including mixing different types of alcohol without keeping track of quantity and drinking mixed drinks without knowing how much alcohol they contain. Finally, the competitive drinking variable (α = .87) consisted of four items including using beer funnels, and participating in power hours, case races, and keg stands.

2.3.3. Alcohol use—Two indicators of alcohol use were assessed including heavy-episodic drinking and weekend drinking. To assess heavy-episodic drinking, participants were asked to indicate the number of times they consumed five or more drinks in a row (four or more if female) during the two weeks prior to the assessment (Wechsler, Davenport, Dowdall, Moeykens, & Castillo, 1994). We coded the heavy-episodic drinking item into three response categories to aid in the interpretation of the LPA model with covariates: *0 times in past two weeks* (0), *1–2 times* (1), and *3 or more times* (2). Weekend drinking was assessed by summing Friday and Saturday drinking totals from the Daily Drinking Questionnaire (DDQ; Collins, Parks, & Marlatt, 1985). We coded the weekend drinking item into four response categories that approximate a quartile split of response frequencies: *0–5 drinks* (0), *6–10 drinks* (1), *11–15 drinks* (2) and *16 or more drinks* (3).

2.3.4. Drinking-related consequences—We assessed consequences with five items from the Young Adult Alcohol Problems Screening Test (YAAPST; Hurlbut & Sher, 1992) including vomiting, black outs, drunk driving, fights, and regretted sex. These items were selected because they represent a broad range of categories including physical, legal, interpersonal, and sexual consequences. Each consequence was coded as a "0" if a participant did not report experiencing the consequence in the previous year and as a "1" if a participant experienced the consequence one or more times in the past year. Items were summed to create a composite consequence score.

2.3.5. Demographic and background variables—Participants' fraternity/sorority status was assessed by asking them to indicate whether they were a member of, or intended to join, a fraternity or sorority. Family history of alcoholism was determined by responses to two items that asked participants if their biological mother/father was an alcoholic. Participants were considered to have a positive family history if they responded that either their mother or father was an alcoholic. Participants were also asked to recall their most recent GPA. Responses to the GPA items were coded as *2.5 or below* (0), *2.6 to 2.9* (1), *3.0 to 3.4* (2), and *3.5 or higher* (3). Age of onset was assessed with two items that asked participants to report the first time they drank more than a few sips of alcohol with (or without, for 2nd item) permission from their parents. Age of onset was determined by taking the youngest age reported from the two responses. The response option coding ranged from *13 years old or younger* (0) to *18 years or older* (5) in one year increments.

2.4. Analytic plan

LPA was used to identify distinct, categorical latent profiles of participants' protective and risk behavior use based on mean patterns of these variables. The LPA model was fit following the recommendations of Lanza, Collins, Lemmon, and Schafer (2007) using Mplus Version 6.11 (Muthén & Muthén, 2010). The first step in determining the best fitting model (i.e., the model with the appropriate number of profiles to describe the data) is to fit a model constrained to a one-profile solution. The next step is to fit a model that allows a two-profile solution and compare the fit indices of this model to the subsequent one-profile solution. If fit indices improve, the two-profile model is retained and becomes the comparison model for a three-profile solution. Model testing continues until model fit indices fail to improve over the previous model. At this point the previous solution is retained. Fit indices typically used for LPA models are the Akaike Information Criteria (AIC) and the Bayesian Information Criteria (BIC) in which lower values indicate better model fit (Muthén & Shedden, 1999). Also critical in determining the best fitting model is the extent to which a given model converges, as well as the practical interpretability of the profiles. Covariates were included in the LPA model through a series of multinomial logistic regression analyses (Muthén & Muthén, 2010). LPA with covariates estimates an additional set of parameters that represent the influence of the covariates on the log-odds that an individual belongs to a particular latent profile relative to a reference profile.

3. Results

3.1. Latent profile analysis

Fit indices for the LPA are presented in Table 1. AIC and BIC values decreased as the number of profiles tested in each model increased from one to three. In each of these models, model estimation terminated normally using 250 randomly generated start values and the best loglikelihood value replicated. The four-profile model failed to properly converge (produced a non-positive definite first-order derivative product matrix) which is often indicative of the over extraction of profiles (O'Connor & Colder, 2005). This issue was not resolved by increasing the number of random start values. Thus, the three-profile solution was retained. The entropy value for the three-profile solution was 0.83, which suggests well separated profiles and good predictive value of profiles based on the protective and risk indicator variables (Celeux & Soromenho, 1996). The means of the protective and risk behavior variables within each profile are presented in Table 2. Tukey's HSD tests were used to examine mean differences in these variables across each latent profile.

The mean response pattern of profile 1 described 30% of the sample ($n = 65$). Individuals described by this profile reported significantly lower mean levels of pacing (1.38), setting limits (1.14), diluting (0.84), and social awareness behaviors (2.91) and significantly greater mean levels of social partying (2.94), mixing (2.43), and competitive drinking (1.90) behaviors compared to those in profiles 2 and 3 (all ps $< .05$). These individuals reported, on average, rarely using protective behaviors (with the exception of social awareness behaviors) and more frequently engaging in risk behaviors. This profile was labeled HRISK based on these patterns.

Profile 2 described 60% of the sample ($n = 128$). Individuals assigned to this profile reported mean levels of pacing (2.11), setting limits (1.81), and diluting protective behaviors (1.28) that were significantly higher compared to those in profile 1 and significantly lower than those in profile 3. For social awareness actions, the mean use for those assigned to this profile (3.51) was significantly higher than those assigned to profile 1, but not different than individuals assigned to profile 3. Mean levels of social partying (2.30), mixing (1.30), and competitive drinking (0.63) behaviors were all significantly lower than those described by

profile 1 and significantly higher than those in profile 3. Given that individuals assigned to this profile reported moderate use of most drinking-related protective and risk actions, this profile was labeled MIXED.

The final profile described 10% of the sample ($n = 22$). Individuals in profile 3 reported significantly higher mean levels of pacing (3.21), setting limits (2.93), and diluting (2.08) protective behaviors compared to those described by profiles 1 and 2. Mean levels of social awareness behaviors were significantly higher than profile 1. Those described by profile 3 reported the lowest mean levels of social partying (1.27), mixing (0.44), and competitive drinking (0.19) risk behaviors. These individuals, on average, used protective drinking behaviors the most often and tended to engage in risk behaviors rarely or never. Accordingly, this profile was labeled HPROTECT.

3.2. Demographic and background covariates

We next estimated the LPA model with all of the demographic and background variables entered as a single block of covariates. Membership in the profiles was not significantly different based on fraternity or sorority status, participants' GPA, or family history of alcohol use (all ps > .05). However, both gender and age of onset of alcohol use were significant predictors of profile membership. Compared to males, females were significantly less likely to belong to the HRISK profile compared to the HPROTECT profile (OR = 0.19, $p < .05$), holding the other covariates constant. Participants who reported later ages of alcohol onset were significantly less likely to be in the MIXED profile (OR = 0.27, $p < .001$) or the HRISK profile (OR = 0.18, $p < .001$) compared to the HPROTECT profile.

3.3. Drinking outcome covariates

The final step was to estimate the effect of heavy-episodic drinking, weekend drinking, and consequences on latent profile membership. Higher scores on the weekend drinking measure were associated with significantly higher odds of belonging to either the MIXED profile (OR = 7.39, $p < .001$) or the HRISK profile (OR = 26.58, $p < .001$) compared to the HPROTECT profile. Similar findings emerged for heavy-episodic drinking, with more episodes associated with higher odds of belonging to either the MIXED profile (OR = 4.10 $p < .01$) or the HRISK profile (OR = 16.61, $p < .001$) compared to the HPROTECT profile. Finally, higher scores on the consequence measure were also associated with increased odds of belonging to the MIXED profile (OR = 7.17, $p < .001$) or the HRISK profile (OR = 15.80, $p < .001$) compared to the HPROTECT profile.

In order to better understand the relationship between the drinking behavior profiles and the drinking outcome covariates, we converted the logistic odds ratios derived from the LPA with covariates to odds and then to probabilities as described in the Mplus manual (see Table 3). These probabilities aid in the interpretation of the log odds by allowing for a comparison of the latent profile probabilities at various levels of the drinking outcome covariates (Muthèn & Muthèn, 2006). In models with significant covariates, these probabilities often differ compared to the LPA profile probabilities from the baseline (non-covariate) model. For example, recall that the probabilities for the latent profiles from the non-covariate model were as follows: 0.30 (HRISK), 0.60 (MIXED), and 0.10 (HPROTECT). Among participants who reported consuming 0–5 drinks per weekend those probabilities (reading left to right) become 0.03 (HRISK), 0.56 (MIXED), and 0.42 (HPROTECT). Participants who reported drinking 16 or more drinks per weekend were most likely to be in the HRISK profile (0.71) followed by the MIXED profile (0.29). In general, those who reported more drinking or a higher number of reported consequences were more likely to belong to the HRISK profile compared to the HPROTECT profile. The

probabilities of belonging to the MIXED profile are the highest at moderate levels of the drinking-related outcomes.

4. Discussion

4.1. Patterns of protective and risk behavior use

The goal of the present study was to examine distinct drinker subgroups, or profiles, based on individual-level patterns of use of both protective and risk behaviors. Three distinct patterns of use were identified: those who reported less frequent use of protective and more frequent use of risk behaviors (HRISK), those who reported moderate use of both protective and risk behaviors (MIXED), and those who reported less frequent use of risk and more frequent use of protective behaviors (HPROTECT) relative to the other profiles. Although it may seem intuitive in hindsight that drinkers would behave in such a way (e.g., some frequently engage in protective and rarely engage in risk behaviors, some engage in risk behaviors much more frequently than protective actions, and some engage in both types of behaviors at similar rates), understanding the pattern of use of these behaviors is an important and previously unanswered empirical question. Within each group similar trends emerged in terms of which types of behaviors were used most frequently.

The HPROTECT profile described a minority of the student drinkers (10%). These students reported frequent use of social awareness behaviors such as walking home with a friend in addition to behaviors related to pacing and setting limits, and moderate use of methods to dilute their alcoholic beverages. Conversely, they reported infrequent engagement in social partying behaviors such as pregaming, as well as risky mixing behaviors and competitive drinking activities that lead to mass consumption of alcohol (e.g., beer funnels or case races). Accordingly, probabilities of belonging to this group were observed to be higher for individuals who reported the lowest levels of alcohol use and related consequences.

The HRISK profile described 30% of the drinkers in the sample. Students assigned to this profile rarely engaged in protective behaviors related to diluting their beverages, setting limits, and pacing. Further, they usually engaged in social partying behaviors, sometimes to usually engaged in risky mixing behaviors, and sometimes engaged in competitive drinking. These drinkers did report usually engaging in social awareness behaviors but at levels that were significantly lower than the other profiles. Given the lack of engagement in protective actions and more frequent use of risk behaviors, it is not surprising that students who reported higher levels of weekend drinking, heavy-episodic drinking, and related consequences had a higher probability of belonging to this subgroup.

The MIXED profile described the largest proportion of participants (60%). Drinkers in this group reported moderate use of actions related to pacing drinks, setting limits on alcohol intake, and diluting beverages. However, similar to those in the HPROTECT profile, they reported frequent use of social awareness behaviors. Yet these individuals also reported moderate use of social partying and mixing risk behaviors. Average use of competitive drinking behaviors was infrequent among these individuals, but still significantly higher than those assigned to the HPROTECT profile, and significantly lower than those in the HRISK profile. When considering the drinking outcome covariate analysis, probabilities of belonging to the MIXED group were highest for students who reported consuming between 6 to 10 drinks per weekend (78%), as well as for those who reported 1 to 2 heavy-episodic drinking occasions (69%). However, the probability of being in the mixed group closely approximated the original non-covariate model (i.e., close to 60%) for other levels of drinking as well, including those who reported consuming 0 to 5 drinks and 11 to 15 drinks per weekend, in addition to students who reported zero heavy-episodic drinking episodes.

When considering individuals' reports of alcohol-related harm, those who reported 2 to 3 consequences had the highest probability of MIXED group membership.

A model with demographic and background covariates suggested there was a significant difference in the distribution of the profiles among males and females and among those with a differing age of onset of alcohol use. When considering gender, the ratio of students in the HRISK relative to the HPROTECT group was higher for males than females, suggesting that males are more likely to belong to the HRISK group. This finding is consistent with recent studies on correlates of protective behavior use (Nguyen et al., 2011; Walters et al., 2007), yet at odds with some current research on risk behavior use including frequency of drinking game participation (Pedersen & LaBrie, 2006) and pregaming (Borsari et al., 2007). Thus, more research on the relationship between gender and stylistic drinking behaviors seems warranted. Consistent with other studies of both protective drinking behaviors (Palmer, Corbin, & Cronce, 2010) and drinking game participation (Borsari, Bergen-Cico, & Carey, 2003), a later age of onset was associated with a stronger probability of being in the HPROTECT group. Taken together, this suggests that students who report a later age of alcohol use onset are more likely to be characterized by a drinking style that includes more frequent use of behaviors that limit consumption and related harm and less frequent use of actions that lead to increased alcohol use and harm.

The use of social awareness behaviors across all profiles is notable. Social awareness behaviors included walking home with friends, watching one's drink being made, and knowing where one's drink has been at all times. Use of these actions was reported more frequently relative to all other protective behavior categories. Previous research has also found social awareness behaviors to be the most utilized type of protective action, especially among women (Walters et al., 2007). It is possible that students are more likely to engage in social awareness behaviors because such actions are not tied directly to alcohol consumption like pacing, setting limits, and diluting behaviors. In other words, students do not have to regulate their alcohol intake to engage in social awareness behaviors, as these behaviors seem to focus more on reducing potential harm from others. Accordingly, it is plausible these actions are more appealing than slowing down one's drinking, or setting limits on how much one drinks. For example, even drinkers who like to engage in social partying or competitive drinking behaviors can know where their drinks are or go home with friends at the end of the night. Given that individuals in the MIXED group use this behavior just as often as those in the HPROTECT group, but report more alcohol-related harm, it may be important to consider the impact of such actions in the context of other protective and risk behaviors. Further research could be helpful in understanding the specific influence of social protective behaviors on alcohol consumption and consequences.

4.2. Implications for prevention and intervention efforts

The small percentage of students who reported drinking in an arguably safe manner (HPROTECT; 10%) relative to other students, defined by frequent use of protective behaviors and infrequent use of risk behaviors, is disconcerting. The majority of college student drinkers in the current sample reported moderate use of both drinking-related protective and risk behaviors (MIXED), and 30% of students fit a profile of drinking in which they were more likely to engage in risk behaviors relative to protective behaviors (HRISK). Thus, for intervention efforts geared towards drinkers, the consideration of only protective or only risk behavior constructs may not provide an accurate assessment of student’s drinking experience. For example, brief, motivational interventions such as BASICS and other personalized feedback approaches (e.g., mailed and computerized) often include a component on protective behavioral strategies students can, or already do, use to reduce their alcohol use and related harm (Dimeff et al., 1999; Larimer et al., 2007). Yet

these same interventions often lack substantive content addressing risk behaviors beyond that of quantity and frequency of alcohol use.

Consistent with previous recommendations (Borsari, 2004; Borsari et al., 2007), those who administer and design prevention and intervention programs may want to consider the addition of content that addresses alcohol-related risk behaviors. These intervention approaches may benefit from a more specific focus on the relationship between specific types of risk behaviors, alcohol use, and related problems. For example, for interventions delivered in person (e.g., BASICS), it may be beneficial for therapists, counselors, or peer providers delivering sessions to explore students' experiences with risk behaviors such as those identified in the current study. It is possible that connecting specific risk behaviors (e.g., participation in drinking games, mixing drinks without paying attention to quantity of alcohol) to negative outcomes may be more salient for students as opposed to focusing solely on quantity and frequency of alcohol use. Perhaps in conjunction with a component on protective behaviors, interventions that also include feedback on risk behaviors may see an improvement in drinking outcomes as a focus on only protective *or* only risk behaviors would potentially miss an important component of college students' drinking experience.

For student drinkers who fit the MIXED profile, meaning they sometimes engage in protective behaviors, and sometimes risk behaviors, an in-session focus on both types of actions could be particularly important. Counselors would have the opportunity to explore students' drinking outcomes on occasions when drinking-related protective versus risk behaviors were utilized, and reinforce the notion that more frequent use of protective actions, along with fewer risk behaviors, leads to less consumption and related harm. As previously noted, this approach may help students to see how specific types of drinking behaviors are related to levels of consumption and related harm. Counselors could also explore contextual factors unique to each student that are associated with use of both types of drinking behaviors and work with students to strategize ways to make them more comfortable using protective actions and avoiding risk behaviors.

It is also plausible that college student drinkers who fit the HRISK profile could benefit from a focus on both types of behaviors within a motivational feedback style of intervention. Counselors would have the opportunity to connect students' frequent use of risk behaviors to occasions of increased consumption and related harm, as well as introduce the idea of engaging in protective actions. Particularly relevant to this group, counselors may want to focus on the barriers to protective behavior use as these students rarely engage in these actions. Another potential avenue for this group would be to encourage modifications to risk behaviors that would serve to make them less risky. For example, a student who always pregames with their roommates on weekends may be resistant to changing this aspect of his or her drinking. Yet, this student could be encouraged to consume only one drink during this time versus two or three, for example, which would reduce his or her alcohol use, but allow the student to remain a part of the social event.

For universities that implement social norms campaigns (e.g., DeJong et al., 2006) or include social norms messages within the context of another approach (e.g., personalized feedback; Neighbors, Larimer, & Lewis, 2004), it may be important to include information regarding norms of both protective and risk behaviors, as opposed to just quantity and frequency of alcohol use. These findings suggest that a majority of students (10% HPROTECT and 60% MIXED) typically use a variety of protective behaviors at least some of the time when they drink. Other research has identified discrepancies in this domain such that students tend to underestimate the use of protective behaviors and overestimate the use of risk behaviors among their peers (Benton et al., 2008; Pedersen & LaBrie, 2008). In addition, one's perception of peer approval of protective and risk behavior use has been

linked to drinking outcomes (Ray et al., 2009). A potentially useful harm reduction message would be to emphasize that the majority of college students engage in protective behaviors when drinking.

4.3. Limitations and future directions

There are some limitations of the research. First, analyses were conducted with one sample of first-year college students at a single campus. It is unclear if similar subgroups would emerge when considering the entire college population as opposed to only first-year students. It's also plausible that profiles of protective and risk behavior use could vary depending on campus-specific factors or that percentages of students in each drinker type identified in the current study may differ from campus to campus. Although the LPA solution exhibited good statistical properties, confidence in the findings would be increased with replication in additional samples. It is also important to remember that the groups observed in the current study are useful heuristics of how individuals behave and do not represent the exact responses of individual participants.

Future work is needed regarding the incorporation of both protective and risk behaviors into intervention efforts. For intervention programs that are limited in time and scope, it is not clear whether the best strategy would be to reinforce the protective behaviors that students use most frequently (e.g., social awareness and pacing behaviors), or encourage students to engage in actions that are used less often (e.g., setting limits and diluting behaviors). Similarly, there is little known empirically as to whether efforts should focus on reducing risk behaviors used most frequently (social partying behaviors such as pregaming, playing drinking games, and drinking shots), or ones that are used less often (mixing, competitive drinking behaviors), as the latter may be more amenable to change given that students do not use them as consistently.

Additional etiological work in this domain also seems warranted. Although our study provided empirical evidence that a large percentage of student drinkers engage in both drinking-related protective and risk behaviors, additional questions remain regarding the use of these actions from one event to the next. It’s plausible some students may engage in both types of behaviors within the same occasion. For example, one could pregame at the start of the evening, but then set limits on their drinking for the remainder of the night and/or make sure to walk home with a friend. It is also possible that students engage in mainly protective behaviors one night and engage in mainly risk behaviors on another. Moreover, in a recent study of drinking control strategies, Sugarman and Carey (2009) noted that not all behaviors work to reduce alcohol use in a similar way. A study that examines the use of protective and risk behaviors at the event level, along with the contextual and intrapersonal factors that influence their use, could provide a greater understanding of the relationship between use of these behaviors and alcohol-related outcomes and, in turn, shed light as to which variables may be most important to focus on via intervention efforts. Further, longitudinal studies are needed to examine patterns of drinking-related protective and risk behavior use and their associations with drinking outcomes over time.

4.4. Conclusions

In sum, the results of this study offer further evidence of the magnitude of the college-drinking problem as it relates to specific types of drinking behaviors, beyond that of quantity and frequency of alcohol use. Findings are suggestive of distinct patterns of first-year college student alcohol use based on their use of drinking-related protective and risk behaviors. Intervention efforts may benefit from an enhanced focus on increasing protective behaviors and decreasing risk behaviors.

Highlights

- 3 patterns of drinking-related protective and risk behavior use were identified.
- 10% of students primarily engaged in protective behaviors.
- 60% of reported moderate use of both protective and risk behaviors.
- 30% of students primarily engaged in risk behaviors.
- Social protective behaviors were used most frequently across all students.

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References

Barnett NP, Murphy JG, Colby SM, Monti PM. Efficacy of counselor vs. computer-delivered intervention with mandated college students. Addictive Behaviors. 2007; 32:2529–2548. [PubMed: 17707594]

Benton SL, Downey RG, Glider PJ, Benton SA. College students' norm perception predicts reported use of protective behavioral strategies for alcohol consumption. Journal of Studies on Alcohol and Drugs. 2008; 69:859–865. [PubMed: 18925344]

Benton SL, Schmidt JL, Newton FB, Shin K, Benton SA, Newton DW. College student protective strategies and drinking consequences. Journal of Studies on Alcohol. 2004; 65:115–121. [PubMed: 15000510]

Borsari B. Drinking games in the college environment: A review. Journal of Alcohol and Drug Education. 2004; 48:29–51.

Borsari B, Bergen-Cico D, Carey KB. Self-reported drinking-game participation of incoming college students. Journal of American College Health. 2003; 51:149–154. [PubMed: 12735390]

Borsari B, Boyle KE, Hustad JT, Barnett NP, Tevyaw TO, Kahler CW. Drinking before drinking: Pregaming and drinking games in mandated students. Addictive Behaviors. 2007; 32:2694–2705. [PubMed: 17574344]

Celeux G, Soromenho G. An entropy criterion for assessing the number of clusters in a mixture model. Journal of Classification. 1996; 13:195–212.

Collins RL, Parks GA, Marlatt GA. 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. 1985; 53:189–200. [PubMed: 3998247]

DeJong W, Schneider SK, Towvim LG, Murphy MJ, Doerr EE, Simonsen NR, Scribner RA. A multisite randomized trial of social norms marketing campaigns to reduce college student drinking. Journal of Studies on Alcohol. 2006; 67:868–879. [PubMed: 17061004]

Delva J, Smith MP, Howell RL, Harrison DF, Wilke D, Jackson DL. A study of the relationship between protective behaviors and drinking consequences among undergraduate college students. Journal of American College Health. 2004; 53:19–26. [PubMed: 15266726]

Dimeff, LA.; Baer, JS.; Kivlahan, DR.; Marlatt, GA. Brief alcohol screening and intervention for college students (BASICS): A harm reduction approach. New York, NY: The Guilford Press; 1999.

Haines MP, Barker G, Rice RM. The personal protective behaviors of college student drinkers: Evidence of indigenous protective norms. Journal of American College Health. 2006; 55:69–75. [PubMed: 17017302]

Hingson R, Heeren T, Winter M, Wechsler H. Magnitude of alcohol-related mortality and morbidity among U.S. college students ages 18–24: Changes from 1998 to 2001. Annual Review of Public Health. 2005; 26:259–279.

Hingson RW, Zha W, Weitzman ER. Magnitude of and trends in alcohol-related mortality and morbidity among U.S. college students ages 18–24, 1998–2005. Journal of Studies on Alcohol and Drugs. 2009; 16:12–20. [PubMed: 19538908]

Hurlbut SC, Sher KJ. Assessing alcohol problems in college students. Journal of American College Health. 1992; 41:49–58. [PubMed: 1460173]

Johnson TJ, Sheets VL. Measuring college students' motives for playing drinking games. Psychology of Addictive Behaviors. 2004; 18:91–99. [PubMed: 15238050]

LaBrie JW, Kenney SR, Lac A, Garcia JA, Ferraiolo P. Mental and social health impacts the use of protective behavioral strategies in reduce risky drinking and alcohol consequences. Journal of College Student Development. 2009; 50:35–49.

LaBrie JW, Pedersen ER. Prepartying promotes heightened risk in the college environment: An event-level report. Addictive Behaviors. 2008; 33:955–959. [PubMed: 18387749]

Lanza ST, Collins LM, Lemmon DR, Schafer JL. PROC LCA: A SAS procedure for latent class analysis. Structural Equation Modeling. 2007; 14:671–694. [PubMed: 19953201]

Larimer ME, Cronce JM. Identification, prevention, and treatment revisited: Individual-focused college drinking prevention strategies 1999–2006. Addictive Behaviors. 2007; 32:2439–2468. [PubMed: 17604915]

Larimer ME, Lee CM, Kilmer JR, Fabiano PM, Stark CB, Geisner IM, Neighbors C. Personalized mailed feedback for college drinking prevention: A randomized clinical trial. Journal of Consulting and Clinical Psychology. 2007; 75:285–293. [PubMed: 17469886]

Lewis MA, Rees M, Logan DE, Kaysen DL, Kilmer JR. Use of drinking protective behavioral strategies in association to sex-related alcohol negative consequences: the mediating role of alcohol. Psychology of Addictive Behaviors. 2010; 24:229–238. [PubMed: 20565149]

Marlatt GA, Baer JS, Kivlahan DR, Dimeff LA, Larimer ME, Quigley LA, Williams E. Screening and brief intervention with high-risk college student drinkers: Results from a two-year follow-up assessment. Journal of Consulting and Clinical Psychology. 1998; 66:604–615. [PubMed: 9735576]

Martens MP, Cimini MD, Barr AR, Rivero EM, Vellis PA, Desemone GA, Horner KJ. Implementing a screening and brief intervention for high-risk drinking in university-based health and mental health care settings: Reductions in alcohol use and correlates of success. Addictive Behaviors. 2007a; 32:2563–2572. [PubMed: 17574769]

Martens MP, Ferrier AG, Cimini MD. Do protective behavioral strategies mediate the relationship between drinking motives and alcohol use in college students? Journal of Studies on Alcohol and Drugs. 2007b; 68:106–114. [PubMed: 17149524]

Martens MP, Karakashian MA, Fleming KM, Fowler RM, Hatchett ES, Cimini MD. Conscientiousness, protective behavioral strategies, and alcohol use: testing for mediated effects. Journal of Drug Education. 2009; 39:273–287. [PubMed: 20196332]

Martens MP, Martin JL, Hatchett ES, Fowler RM, Fleming KM, Karakashian MA, Cimini DM. Protective behavioral strategies and the relationship between depressive symptoms and alcohol-related negative consequences among college students. Journal of Counseling Psychology. 2008; 55:535–541. [PubMed: 22017560]

Martens MP, Taylor KK, Damann KM, Page JC, Mowry ES, Cimini MD. Protective behavioral strategies when drinking alcohol and their relationship to negative alcohol-related consequences in college students. Psychology of Addictive Behaviors. 2004; 18:390–393. [PubMed: 15631613]

Mundt MP, Zakletskaia LI, Fleming MF. Extreme college drinking and alcohol-related injury risk. Alcoholism: Clinical and Experimental Research. 2009; 33:1532–1538.

Muthén, BO. Latent variable analysis: Growth mixture modeling and related techniques for longitudinal data. In: Kaplan, D., editor. Handbook of quantitative methodology for the social sciences. Newbury Park, CA: Sage Publications; 2004.

Muthén, LK.; Muthén, BO. Mplus User's Guide: Sixth Edition. Los Angeles, CA: Muthén & Muthén; 2010.

Muthén BO, Shedden K. Finite mixture modeling with mixture outcomes using the EM algorithm. Biometrics. 1999; 55:463–469. [PubMed: 11318201]

Nagoshi CT, Wood MD, Cote CC, Abbit SM. College drinking game participation within the context of other predictors of alcohol use and problems. Psychology of Addictive Behaviors. 1994; 8:203–213.

Neighbors C, Larimer ME, Lewis. Targeting misperceptions of descriptive drinking norms: efficacy of a computer-delivered personalized normative feedback. Intervention Journal of Consulting and Clinical Psychology. 2004; 72:434–447.

Nguyen N, Walters ST, Wyatt TM, DeJong W. Use and correlates of protective drinking behaviors during the transition to college: Analysis of a national sample. Addictive Behaviors. 2011; 36:1008–1014. [PubMed: 21719203]

O'Connor RM, Colder CR. Predicting alcohol patterns in first-year college students through motivational systems and reasons for drinking. Psychology of Addictive Behaviors. 2005; 19:10–20. [PubMed: 15783273]

Palmer RD, Corbin WR, Cronce JM. Protective strategies: a mediator of risk associated with age of drinking onset. Addictive Behaviors. 2010; 35:486–491. [PubMed: 20092955]

Pedersen ER, LaBrie J. Drinking game participation among college students: Gender and ethnic implications. Addictive Behaviors. 2006; 31:2105–2115. [PubMed: 16600523]

Pedersen ER, LaBrie J. Partying before the party: Examining prepartying behavior among college students. Journal of American College Health. 2007; 56:237–245. [PubMed: 18089504]

Pedersen ER, LaBrie JW. Normative misperceptions of drinking among college students: a look at the specific contexts of prepartying and drinking games. Journal of Studies on Alcohol and Drugs. 2008; 69:406–411. [PubMed: 18432383]

Ray, AE.; Turrisi, R.; Abar, BW.; Abar, CC.; Peters, KE. Examination of theoretical models predicting why students choose to engage in risk and protective behaviors when drinking. Poster presented at the annual scientific meeting of the Research Society on Alcoholism; Chicago, IL. 2007.

Ray AE, Turrisi R, Abar B, Peters KE. The utility of predicting protective drinking behaviors and reducing alcohol-related consequences among college students. Addictive Behaviors. 2009; 34:911–917. [PubMed: 19540676]

Sugarman DE, Carey KB. The relationship between drinking control strategies and college student alcohol use. Psychology of Addictive Behaviors. 2007; 21:338–345. [PubMed: 17874884]

Thombs DL, Olds RS, Bondy SJ, Winchell J, Baliunas D, Rehm J. Undergraduate drinking and academic performance: a prospective investigation with objective measures. Journal of Studies on Alcohol and Drugs. 2009; 70:776–785. [PubMed: 19737503]

Turrisi R, Larimer ME, Mallett KA, Kilmer JR, Ray AE, Mastroleo NR, Montoya H. A randomized clinical trial evaluating a combined alcohol intervention for high-risk college students. Journal of Studies on Alcohol and Drugs. 2009; 70:555–567. [PubMed: 19515296]

Walters ST, Roudsari BS, Vader AM, Harris TR. Correlates of protective behavior utilization among heavy-drinking college students. Addictive Behaviors. 2007; 32:2633–2644. [PubMed: 17669596]

Wechsler H, Davenport A, Dowdall G, Moeykens B, Castillo S. Health and behavioral consequences of binge drinking in college: A national survey of students at 140 campuses. Journal of the American Medical Association. 1994; 272:1672–1677. [PubMed: 7966895]

Zamboanga BL, Calvert BD, O'Riordan SS, McCollum EC. Ping-pong, endurance, card, and other types of drinking games: Are these games of the same feather? Journal of Alcohol and Drug Education. 2007; 51:26–39.

Table 1

Fit Indices for the Latent Profile Analysis Models

Model	AIC	BIC
1 Profile Solution	3659.64	3706.83
2 Profile Solution	3395.21	3469.36
3 Profile Solution	3294.41	3395.53

Note. AIC = Akaike information criteria; BIC = Bayesian information criteria; 4-class solution did not converge.

Table 2

Conditional Means and Variances on the Indicator Variables within Profiles

	Profile 1 HRISK (*n* = 65; 30%)	Profile 2 MIXED (*n* = 128; 60%)	Profile 3 HPROTECT (*n* = 22; 10%)	σ^2
Protective Behaviors				
Pacing	1.38 [2,3]	2.11 [1,3]	3.21 [1,2]	0.37
Setting Limits	1.14 [2,3]	1.81 [1,3]	2.93 [1,2]	0.47
Diluting	0.84 [2,3]	1.28 [1,3]	2.08 [1,2]	0.49
Social	2.91 [2,3]	3.51 [1]	3.79 [1]	0.36
Risk Behaviors				
Drinking to get Drunk	2.94 [2,3]	2.30 [1,3]	1.27 [1,2]	0.29
Mixing	2.43 [2,3]	1.30 [1,3]	0.44 [1,2]	0.52
Mass Consumption	1.90 [2,3]	0.63 [1,3]	0.19 [1,2]	0.42

Note. Superscripts (e.g., [1]) indicate a significant mean difference, $p < .05$, with the numbered profile.

Table 3

Probabilities[1] of Group Membership Based on Latent Profile Analysis with Drinking Outcome Covariates

Variable	Level	HRISK	MIXED	HPROTECT
Drinks per Weekend	0–5	0.03	0.56	0.42
	6–10	0.14	0.78	0.08
	11–15	0.40	0.59	0.01
	16 or more	0.71	0.29	0.00
Heavy-episodic Drinking Episodes	0	0.05	0.64	0.31
	1–2	0.23	0.69	0.08
	3 or more	0.56	0.43	0.01
Number of Consequences	0	0.01	0.10	0.90
	1	0.05	0.42	0.54
	2	0.18	0.70	0.13
	3	0.36	0.63	0.02
	4	0.55	0.45	0.00
	5	0.73	0.27	0.00

Note.

[1] Probabilities were converted from log odds provided from LPA with covariates.