The Relationship between Drinking Control Strategies and College Student Alcohol Use

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Abstract

Interventions designed to reduce heavy drinking among college students often contain suggestions for drinking control strategies. However, little is known about the relationship of the use of these strategies to alcohol consumption. This study developed a measure of drinking control strategies and investigated its psychometric properties in a sample of 250 college drinkers. Strategies clustered into three factors: selective avoidance of heavy drinking activities/situations, strategies used while drinking, and alternatives to drinking. These three types of strategies were independently associated with alcohol use; however, the first and last types were negatively associated with alcohol consumption, whereas the second type was positively associated with alcohol use. The findings from this study suggest that type of strategy recommended may be important when the goal is alcohol reduction.

Keywords

drinking control strategies; alcohol use; college students

Surveys of drinking in national samples of college campuses revealed that between 34 to 44% of students met criteria for heavy drinking (Douglas et al., 1997; Wechsler et al., 2002). Heavy drinking can lead to health risks (e.g., blackouts, personal injuries, physical illnesses, and unprotected sexual activity), in addition to academic, interpersonal, and legal problems (Hingson, Heeren, Winter, & Wechsler, 2005; Perkins, 2002; Aertgeerts & Buntinx, 2002). Due to the substantial risks associated with heavy college drinking, innovative risk reduction strategies are needed. Effective intervention programs have combined information, normative feedback and values clarification within a context of teaching college students skills to moderate risky drinking behaviors (Larimer & Cronce, 2002).

Skills-based interventions are designed to modify high risk drinking behaviors in two ways: (a) teaching how to cope with life stresses in ways other than alcohol use (e.g., building alternative stress management, relaxation, and social skills), and (b) teaching alcohol-specific harm reduction skills (e.g., drinking in ways to avoid extreme intoxication and negative consequences). These intervention components evolved from self-management approaches for controlled drinking. For example, Miller and Muñoz (2005) developed a manual titled *Controlling Your Drinking* which outlines self-control strategies in three domains: while you drink, before you drink, and instead of drinking. The 'while you drink' strategies focus on slowing down drinking. The 'before you drink' strategies focus on teaching ways to gain control over drinking by understanding and changing antecedents that lead to heavy drinking. Lastly, the 'instead of drinking' strategies focus on gaining understanding of the reinforcers

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of alcohol use and teaching alternate ways to achieve these reinforcing effects without alcohol use.

Many skills-based interventions designed for college students offer a menu of strategies or tips to students to help them moderate their drinking. However, little is known about the relationship between recommended strategies and college alcohol consumption. Some strategies developed for use by adult problem drinkers may not be as relevant for students in a college drinking environment as other strategies. For example, "alternating alcoholic and non-alcoholic drinks" may be more challenging for an underage college student than for an adult of legal drinking age who has more control over access to alcoholic and non-alcoholic beverages. It is possible that some strategies may be more effective than others in moderating college drinking patterns. A limited number of studies have explored the relationship of drinking control strategies to alcohol consumption in college student samples. A brief literature review will summarize studies that have examined the use of drinking control strategies by college students.

To determine if college students employ self-control strategies on their own to moderate their alcohol consumption, Werch and Gorman (1986) developed a Self-Control Questionnaire comprised of a list of 37 external self-control strategies and 14 internal self-control standards. These items were derived from behavioral self-control program manuals. External strategies referred to goal setting, self-monitoring, self-reinforcement, and self-punishment. Internal self-control standards focused on noticing physiological sensations and mood alterations that occur with alcohol consumption. Factor analysis of the Self-Control Questionnaire revealed seven factors for external self-control strategies: Rate Control, Self-reinforcement and Punishment, Alternatives, Avoidance, Limiting Driving and Cash, Controlling Time and Food, and Awareness. In addition, three factors for internal self-control were identified: Impairment, Relaxation, and Anxiousness (Werch & Gorman, 1986).

Significant relationships emerged between the frequency of use of external and internal self-control strategies with most alcohol-related problems (Werch & Gorman, 1988). However, the direction of these relationships is not clear based on the data available in this report. In addition, significant group differences emerged across quantity-frequency levels for six of the seven external control factors (the exception was "Alternatives"). An inverted-U shaped pattern between strategy use and alcohol consumption emerged for the six factors. Abstainers used the least number of strategies, with each successive category using more strategies than the next up to moderate drinkers (defined as drinking at least once a month with no more than 3–4 drinks, or at least once a week with no more than 1–2 drinks at any one sitting) using the greatest number of strategies. Strategy use declined successively in the moderate-heavy and heavy categories. The results of this study indicate that moderate drinkers use strategies most frequently, with abstainers and heavy drinkers using strategies at lower frequencies.

Using a briefer version of the Self-Control Questionnaire, Werch (1990) investigated the relationship of strategy use to consumption. Drinkers in this sample were categorized by the degree of self-control (low, moderate, and high) based on frequency of self-control strategy use. In this study, participants in the moderate self-control category reported the greatest mean alcohol consumption (number of drinking days last month and number of drinks per occasion). Participants who rarely used strategies and participants who often used strategies reported lower alcohol consumption than participants who sometimes used strategies.

This series of studies (Werch, 1990; Werch & Gorman, 1986; 1988) established the relevance of drinking control strategies for college drinkers and suggested that strategy use was related to alcohol consumption in somewhat complex ways. However, drinking control strategies were identified in these studies as a heterogeneous set of internal cues, avoidance behaviors, and self-management strategies.

Drinking control strategies have also been construed as protective behaviors. The concept of protective behaviors derives from problem-behavior theory (PBT), which was developed as a framework for understanding alcohol abuse and other problem behaviors (Jessor & Jessor, 1977). PBT focuses on three systems of psychosocial influence in the development of problem behaviors: (1) the personality system, (2) the perceived environment system, and (3) the behavior system. Protective behaviors are included in the third system and are hypothesized to decrease the likelihood of involvement in problem behaviors (Jessor, Costa, Krueger, & Turbin, 2006). Given this framework, protective behaviors have been examined in association with alcohol-related consequences and heavy drinking.

Cross-sectional survey data from a large random sample of undergraduate students found a dose-response relationship between protective behaviors (e.g. eat before or during drinking, avoid drinking games, use a designated driver) and alcohol-related consequences, such that students reporting the highest use of protective behaviors also reported the lowest number of consequences (Delva et al., 2004). This association was stronger for women than for men. Further support for this relationship was found in another study investigating the relationship of protective behavioral strategies (PBS) to alcohol-related consequences in a college student sample (Martens et al., 2004). In this study, the authors defined PBS as "behaviors that individuals can engage in while drinking alcohol in order to limit negative alcohol related consequences" (emphasis added). Martens et al. (2004) demonstrated that less frequent use of protective behavioral strategies was related to greater numbers of negative alcohol-related consequences.

Although some evidence links the use of self-control and/or protective strategies to alcohol-related consequences and heavy drinking, several limitations exist in the research on strategy use and college student drinking. First, the measures used in each of the reviewed studies varied in number and type of strategies. Limited information on the psychometric properties of the more comprehensive Werch and Gorman (1986) scales is available and a more recent measure with good psychometric properties addresses only a subset of strategies that can be employed while drinking (Martens et al., 2004). A comprehensive list of strategies that are appropriate and relevant to college students, with good psychometric properties, would help inform interventions designed for this population. Second, substantial percentages of students studied by Werch and colleagues (1988, 1990) were seniors and graduate students. Since alcohol use has been shown to decline throughout the college years (Schulenberg, O'Malley, Bachman, Wadsworth, & Johnston, 1996), the functional relationships between strategy use and consumption in underclassmen cannot be determined from these studies. Strategies employed by older students may differ or not have the same level of effectiveness for all college students.

The relationship of drinking control strategy use and alcohol consumption needs to be explored. A key element that is missing from the current literature is the effect of strategy use on blood alcohol content (BAC). A number of the strategies focus on maintaining low BACs (i.e. space out drinks, drink slowly, eat before drinking). Therefore, it may be that strategy use is more related to BACs than number of drinks consumed. This study will examine the effect of strategy use on students' average and peak BACs.

Our goals in the present study are threefold. First, we extend previous cross-sectional research by developing and pilot testing an expanded and revised list of strategies generated from a review of the literature. Second, we investigate the factor structure of the Strategy Questionnaire in a sample of college student drinkers. Third, we investigate the relationship of reported strategy use frequency with alcohol consumption (average number of drinks per week) and level of intoxication (an average BAC and peak BAC). It is hypothesized that strategy use frequency is negatively related to alcohol consumption and BAC.

Method

Item generation and refinement

Our goal with the item generation process was to create a comprehensive set of drinking control strategies relevant to college students. Items were assembled in three phases. First, we identified existing drinking control strategy lists from the literature. The Self-Control Questionnaire (Werch & Gorman, 1986) was the only psychometrically tested measure in the literature at the time of item generation. Second, a search was performed to identify drinking control strategies appearing in the literature on skills-based interventions. Items were extracted from Miller and Muñoz (2005), Dimeff and colleagues (1999), and Kivlahan and colleagues (1990). From these three sources, and the Werch and Gorman Self-Control Questionnaire, 22 unique drinking control strategies were derived. Items were chosen on the basis of relevance to college populations. Sample strategies included: "limiting cash before going out drinking", "avoiding shots", "drinking slowly", and "refusing drinks". This item set was assembled into a questionnaire that assessed how often participants used the 22 listed drinking reduction strategies in the past month. Response options were: "None," "1–2 times," "3–5 times," "6–10 times," "11–15 times," and "More than 15."

Third, we performed a pilot study to (a) investigate the types of strategies that college students endorse using frequently, and (b) use quantitative and qualitative data to develop and refine a comprehensive measure of strategy use, the Strategy Questionnaire. A sample of 96 undergraduates (68% women, 44% freshman) completed surveys about use of drinking control strategies and alcohol consumption in the past month. In addition, participants were asked to identify any items with unclear wording. Finally, to elicit additional strategies not already on the list, participants were asked to describe any other drinking reduction strategies that they used in the past month.

The three most frequently used strategies in this sample were: "Finding other ways besides drinking to reduce stress" (endorsed by 96% of sample), "Participating in enjoyable activities that do not include alcohol consumption" (endorsed by 99% of sample), and "Watching out for friends/having friends watch out for you" (endorsed by 89% of sample). The least frequently used strategies were: "Alternating alcoholic and nonalcoholic beverages when you are drinking" (endorsed by 32% of sample) and "Avoiding drinking games" (endorsed by 46% of sample). Students used an average number of 15 strategies at least once in the past month, suggesting that students are using the majority of the 22 listed strategies in their natural environment. Women reported using more strategies than men ($t = -2.89$, $df = 92$, $p < 0.01$), but no correlation was found between total number of strategies used and average number of drinks in a typical week.

Qualitative data collected from this pilot study were used to refine the Strategy Questionnaire. Seven strategy questions were reworded based on participant's suggestions for enhancing clarity. For example, some students reported that they frequently "avoid shots," but that they only avoid shots because shots are not available to them. This led to a rewording of the strategy to "choose not to do shots when available." In addition, new strategies were generated from participants' suggestions. New strategies suggested independently by two or more participants were added to the questionnaire. The one exception to this criterion was the suggestion generated by three participants to "use alternate substances;" this was not deemed an appropriate strategy for intervention use and thus was not included in the final item set. Five new strategies were generated from participant's responses: (1) Chose not to "pre-game" or "pre-bar" (i.e. drinking before going out), (2) Limit amount of alcohol at home, (3) Offer to be the designated driver to limit drinking, (4) Engage in activities while I am drinking to space out drinks (e.g. dancing, playing pool or darts), and (5) Limit drinking to certain days of the week. Thus, the revised version of the Strategy Questionnaire contained 27 items.

The last modification made as a result of the pilot data pertained to the response options. Because of the positively skewed response distribution of the pilot sample, the range of frequencies (None – More than 15) on the Strategy Questionnaire was reduced in range (None –More than 10) because the higher frequencies were not endorsed as often as the lower frequencies.

Information obtained from the pilot study confirmed previous findings that students are using a variety of drinking reduction strategies. Moreover, it appears that strategies include actions taken while drinking as well as those used to avoid or restrict risky drinking situations. However, the original Strategy Questionnaire used in the pilot study was revised and expanded as a result of participant feedback. Thus, re-administration of the revised Strategy Questionnaire would better assess the frequency of drinking reduction strategy use in college students and allow an evaluation of psychometric properties of the new measure.

Participants

In total, 282 undergraduate students 18 years of age or older were recruited from introductory psychology courses over one academic year. In exchange for their participation, students received credit toward their course research requirement. On average, students were 19 years of age ($SD = 0.9$) and predominately White (79%). Sixty percent of the students recruited were in their freshman year of college, and the sample consisted of more women (69%) than men, as is typical in introductory psychology classes from this campus.

Measures

Alcohol use—Recent alcohol use was assessed by asking participants to reconstruct the previous two weeks of drinking using the Timeline Follow-Back (TLFB) interview method in group format. The TLFB is a calendar-based assessment, in which participants indicate the amount of alcohol that was consumed (in standard drink format) and the amount of time spent drinking for each day of the week. One standard drink is defined as 12 ounces of beer, 5 ounces of wine, or 1.5 ounces of liquor straight or in a mixed drink (Dufour, 2001). The primary investigator presented the TLFB calendar on an overhead projector and prompted the participants to fill in anchor days and landmark events to enhance recall of drinking behavior. The TLFB provided an estimate of average drinks per week and average blood alcohol content (BAC).

Participants were also asked to report the amount of alcohol that they drank on the heaviest drinking day in the past two weeks, and to estimate the time spent drinking during this heaviest drinking day. These data were used to estimate peak BAC for the past two weeks.

Strategy use—Participants completed a questionnaire evaluating how often they have used drinking control strategies in the past two weeks. This 27-item Strategy Questionnaire was developed using the three-phase process described earlier. Sample strategies include: "limiting cash before going out drinking", "choose to avoid shots when available", "drinking slowly", and "refusing drinks" (see Table 1 for complete set of items). This measure yielded information on the number of unique strategies used in the past two weeks and the intensity of strategy use (using a Likert-type scale: None, Once, 2–3 times, 4–5 times, 6–10 times, More than 10).

Procedure

Participants convened in small group sessions of 10 people or less, and provided written informed consent. First, the primary investigator administered the two-week TLFB. Participants then completed a packet of questionnaires that included a demographic form, questions about typical and peak alcohol use in the past two weeks, and the Strategy Questionnaire.

Statistical Analysis Plan

First, items from the Strategy Questionnaire were submitted to a principal factor analysis with oblique rotation. Second, Cronbach alphas and inter-item covariances were calculated to determine the internal consistency of the identified factors. Third, the relationship of the identified factors to alcohol consumption was evaluated using correlation analyses. Lastly, exploratory analyses were performed using regression and ANOVA to clarify the nature of the relationships among strategy use and drinking variables.

Results

Data Preparation

All data were double-entered in Stata 8.2 (Stata Corporation, 2004) and compared for accuracy. Data from the TLFB were aggregated to compute an average number of drinks per week variable. Number of strategies used over a two-week period was computed from the Strategy Questionnaire. Summary statistics were generated to evaluate the distributions of variables, and to identify problems with skew that might require transformations. To correct for non-normality due to positive skew, the following variables were square-root transformed: average drinks per week, average BAC and heaviest BAC.

BAC for each drinking day reported on the TLFB was calculated by applying the formula outlined by Matthews and Miller (1979) to the data, and then an average BAC across drinking days was obtained. Heaviest BAC was calculated by applying this formula to data describing the single heaviest drinking day in the last two weeks.

Factor Analysis

In order to identify meaningful groupings of drinking control strategies within the set, the 27 strategy items were submitted to principal factor analysis with oblique rotation. Data from all participants reporting drinking at baseline (n = 250) were used in these analyses. Three participants did not fully complete the Strategy Questionnaire, thus 247 participants contributed data for the factor analysis. This analysis revealed three factors with an eigenvalue greater than one. The eigenvalues for the first 4 factors (in descending order) were: 7.55, 1.56, 1.09, and 0.99. Six items had low factor loadings (<|.40|) or strong cross-loadings (>|.40|) and thus were eliminated following criteria suggested by Floyd and Widaman (1995). The six eliminated items were: "making responsible drinking pacts with friends before going out," "watching out for other friends or having friends watch out for you," "setting a drinking limit," "monitoring your consumption of beverages that cover up their alcohol content with sweet flavors," "limiting the amount of alcohol you have at home," and "offering to be the designated driver to limit drinking." A second factor analysis on the remaining 21 items supported a three-factor solution which accounted for 92.9% of the variance. The first factor accounted for 65.0% of the variance, was labeled *selective avoidance of heavy drinking activities/situations*, and examples were "refusing drinks" and "choosing not to pre-game or pre-bar (i.e. drinking before going out)." The Selective Avoidance factor subsumed seven items, had an average inter-item covariance of 0.64, and a factor coefficient alpha of 0.80. The second factor accounted for 17.2% of the variance, was labeled *strategies used while drinking*, and consisted of strategies such as "drinking slowly" and "eating before and while you are drinking." This factor included 10 items, had an average inter-item covariance of 0.61, and had a factor coefficient alpha of 0.82. Finally, the third factor accounted for 10.8% of the variance and was labeled *alternatives to drinking*. Examples of strategies loading on this factor were "finding other ways besides drinking to reduce stress" and "practicing ways to be more comfortable in social settings without using alcohol." The Alternatives factor comprised four items, had an average inter-item covariance of 0.96, and had a factor coefficient alpha of 0.76. See Table 1 for factor loadings from the second factor analysis.

These results suggest that analyses performed with data from the Strategy Questionnaire should examine the three factors separately rather than as a total score. Thus, from the Strategy Questionnaire, three intensity scores were calculated to assess how often strategies were used in the last two weeks. Strategy intensity scores were calculated by summing the items from the three factors (range: Selective Avoidance = 0–35, Strategies While Drinking = 0–50, Alternatives = 0–20). Due to non-normality in the distribution of the Selective Avoidance intensity score, this variable underwent square-root transformation for subsequent analyses. Gender differences on the three subscales derived from the Strategy Questionnaire were examined with t-tests, resulting in no significant differences (all p values were > 0.10).

Relationship of Strategy Use to Alcohol Consumption

On average, students drank approximately 13 drinks per week (SD = 11.76), with an average BAC of 0.04 g/dl for drinking days (SD = 0.03), and an average heaviest BAC of 0.16 g/dl (SD = 0.10). In addition, the pattern of strategy use indicted that students were using multiple strategies. Students reported using an average of four out of seven possible Selective Avoidance strategies, seven out of ten Strategies While Drinking, and three out of four possible Alternatives.

Correlations were calculated between the three strategy variables and the three main drinking variables (average number of drinks per week, average BAC, and heaviest BAC). Transformed scores were used for skewed variables (Selective Avoidance, average drinks per week, average BAC and heaviest BAC). As summarized in Table 2, average drinks per week was negatively correlated with Selective Avoidance (r = −0.18) and Alternatives (r = −0.19), but positively correlated with Strategies While Drinking (r = 0.22). Correlation analyses examining the relationship of average BAC and strategy use (column 2 of Table 2) revealed significant negative correlations for Selective Avoidance (r = −0.18) and Alternatives (r = −0.17), and a significantly positive correlation for Strategies While Drinking (r = 0.15). Unlike the other drinking variables, heaviest BAC displayed no significant relationships with strategy use.

In light of the findings that Strategies While Drinking were positively correlated with alcohol use, and given the literature suggesting a curvilinear pattern between strategy use and alcohol consumption (Werch & Gorman, 1988), scatterplots corresponding with the correlations reported above were inspected. The scatterplots were suggestive of curvilinear relationships between two of the factors (Strategies While Drinking and Alternatives) and all three drinking variables, therefore exploratory analyses were performed. Regression analyses were used to examine linear and quadratic relationships between strategy use and alcohol consumption. Three separate regressions (one for each strategy variable) were performed for each of the three criterion variables (average drinks per week, average BAC, and peak BAC). With average drinks per week as the criterion variable, there was evidence of a linear relationship for all three strategy variables (Selective Avoidance: B = −0.24, t = −2.92, p < 0.01; Strategies While Drinking B = 0.06, t = 5.20, p < 0.001; B = −0.05, t = −2.35, p <0.05). However, there was also evidence supporting a quadratic relationship for Strategies While Drinking (B = −0.00, t = −5.53, p < 0.001) and Alternatives (B = −0.01, t = −2.16, p < 0.05) when predicting average drinks per week. This same pattern was evidenced when average BAC and heaviest BAC were the criterion variables, with the exception of the lack of a significant linear relationship of Alternatives predicting heaviest BAC.

To illustrate the curvilinear patterns, additional exploratory analyses focused on mean differences for participants with low, medium, and high intensity use on each of the three strategy variables. The strategy variables were split by obtaining the 33rd and 67th centile scores and then dividing each factor score accordingly into three categories delineated as low, medium, and high intensity of use. Table 3 displays the means and standard deviations for three consumption variables (average drinks per week, average BAC, and heaviest BAC) by each

level of intensity. One-way ANOVAs were performed to compare the three levels of intensity on alcohol consumption variables. Significant mean differences were found for level of Strategies While Drinking use and all three consumption variables. Tukey pairwise comparison tests revealed that students utilizing low intensities of Strategies While Drinking reported fewer drinks per week, lower BACs, and lower heaviest BACs compared to students utilizing medium and high intensities of Strategies While Drinking. However, there were no significant differences between medium and high intensity utilizers of Strategies While Drinking. Significant relationships were also found between level of Alternatives strategy use and average drinks per week and average BAC. However, unlike the previous pattern involving Strategies While Drinking, Tukey pairwise comparison tests revealed that students utilizing low intensities of Alternatives reported larger numbers of drinks per week and higher average BAC than students utilizing high intensities of Alternatives.

A final exploratory analysis examined the unique explanatory power of each strategy variable in a multivariate regression including linear and quadratic terms that were significant in the univariate regression analyses reported earlier. As shown in Table 4, results supported the unique contribution of the three strategy variables on all alcohol consumption variables. Linear relationships for all three strategy variables significantly predicted average drinks per week, as did the quadratic relationship of Strategies While Drinking. Linear relationships for Selective Avoidance and Strategies While Drinking predicted average BAC, as did the quadratic relationship of Strategies While Drinking. The same pattern of relationships as in average BAC was observed in predicting heaviest BAC.

Discussion

This study was designed to clarify patterns of natural strategy use and their relationship to alcohol consumption. Investigation of the ways in which college students use these strategies can help further our understanding of their utility as a harm reduction intervention tool. Our findings confirm that college students naturally use drinking control strategies in various degrees of frequency (Werch & Gorman, 1988; Sugarman, 2003).

Psychometric analysis of the strategies item set revealed a three-factor structure. The factor analysis results provided the rationale for examining the three factors separately, rather than as a total score. The first factor consisted of items related to the *selective avoidance of heavy drinking activities and situations*. Items on this factor resembled those labeled as 'Avoidance' by Werch and Gorman (1986). This set of strategies represents choices to avoid high-risk drinking behaviors but not avoidance of drinking per se. Participants who endorsed these strategies are drinkers who selectively avoid drinking situations that put them at risk for excessive consumption, such as drinking games, pre-gaming, and consuming shots. The second factor in our study consisted of *strategies used while drinking*, which represent ways a drinker can control rate of consumption and manage BAC. Strategies loading on this factor resembled Werch and Gorman's (1986) Rate Control factor, Miller and Muñoz's (2005) 'while you drink' strategies, and the Protective Behavioral Strategies described by Martens et al. (2004). However, this factor is broader than the set developed by Martens et al. (2004), which are limited to strategies used while consuming alcohol. In contrast, our Strategies While Drinking include those used while consuming alcohol (e.g. spacing drinks, eating food before and while drinking) or while in drinking situations (e.g. limiting cash, or avoiding carrying credit cards or ATM cards when going out to drink). The third factor included *alternatives to drinking*, which contained items similar to Werch and Gorman's (1986) factor labeled 'Alternatives' and resemble the self-management 'instead of drinking' strategies discussed by Miller and Munoz (2005). These results replicate previous research in that the three factors that emerged from this larger item set are consistent with the types of strategies that have been assessed in earlier studies. However, they also extend the literature in that these strategies have been modified

and refined based on quantitative and qualitative data in an effort to increase their applicability to college students. Furthermore, the Strategy Questionnaire represents a psychometrically sound, multidimensional measure with demonstrated internal consistency and factorial validity.

The results from this study generally supported the hypothesis that strategy use and alcohol consumption would be negatively related. Two out of the three factors of strategy use were negatively related to alcohol consumption: namely Selective Avoidance of heavy drinking activities/situations and Alternatives to drinking. Strategies of these two types can be described as limiting the amount consumed through selective avoidance of risky consumption practices (e.g. avoiding drinking games) or employing alternatives to drinking in order to avoid drinking entirely (e.g. choosing to participate in activities that do not include alcohol consumption). When employed, these strategies by nature prevent the student from consuming much, if any, alcohol. Thus it makes sense that employment of these strategies was related to lower numbers of average drink per week, since these scores are averaged across the time period assessed. Therefore, the more students employ these strategies per week, the less they drink per week on average.

Contrary to predictions, Strategies While Drinking were positively related to alcohol consumption. Unlike Selective Avoidance and Alternatives, Strategies While Drinking do not involve avoiding drinking but rather address the topography of drinking. Since these strategies essentially alter the pace or pattern of drinking, it could be argued that these types of strategies would be more effective in maintaining moderate or low BACs, rather than being associated with low numbers of drinks per week. However, the data from this study do not support this argument. Instead, these data indicate a curvilinear relationship between Strategies While Drinking and alcohol consumption, such that students using medium and high intensity levels of Strategies While Drinking are drinking more than students reporting low strategy use. It appears that using this set of drinking control strategies is not inconsistent with reaching high levels of intoxication, and may reflect drinkers "managing" their drinking occasions. These findings are consistent with the inverted-U shaped pattern between strategy use and alcohol consumption found by Werch and Gorman (1988). However, this study extends those findings by revealing that this pattern is not the same for all types of strategies.

Martens and colleagues (2004) have shown that greater use of strategies employed while drinking is associated with fewer negative consequences. Thus, it may be useful for future research to assess alcohol-related consequences with relation to these types of strategies. The results of this study combined with previous research (Martens et al., 2004) suggest that strategies used while drinking may not be related to how much students drink (or their BAC), but to the likelihood of experiencing negative consequences.

Findings regarding average BAC replicated the pattern of findings for weekly drinks, such that Selective Avoidance and Alternative strategies were negatively correlated with average BAC, whereas Strategies While drinking were positively correlated with average BAC. However, heaviest BAC was not significantly correlated with any of the three strategy scores. Unlike the other two measures of alcohol consumption, heaviest BAC is not an average. This measure refers specifically to one day in the assessment period. When assessed in relation to average strategy scores, the relationship may have weakened. It is possible that examining heaviest BAC and use of drinking control strategies at the event-level would help to clarify this relationship.

Results from the multivariate regression analyses extended previous research by confirming that each of the three types of strategies contributed uniquely to predicting alcohol consumption. The strongest evidence was in predicting average drinks per week, where all

three strategy variables had unique associations. These results provide further evidence that these strategies are differentially associated with alcohol consumption.

The findings of this study should be considered in light of its limitations. First, the cross-sectional design of the study does not allow for any causal conclusions. Second, reliance on self-report assessments may reduce the accuracy of the data. High BACs may interfere with memory for number of drinks consumed or for specific strategies employed while drinking (Clapp et al., 2006; Hustad & Carey, 2005). Finally, this study did not include a measure of alcohol consequences. Unfortunately, the research supporting the relationship between drinking control strategies and alcohol-related consequences (Delva et al., 2005; Martens et al., 2004) was published after the development of this study, thus we were unable to incorporate this information into the study design in order to address the differential relationships of strategies to consumption versus consequences.

Overall, this study provides evidence for three unique types of drinking control strategies. Furthermore, the findings indicate that all strategies are not equal in the way they are related to alcohol consumption. This research provides evidence that use of drinking control strategies does not always translate to lower alcohol consumption. These findings have testable hypotheses that may yield information relevant to alcohol interventions. If the intervention goal is to reduce alcohol consumption, encouraging the use of strategies that selectively avoid heavy drinking situations or provide alternatives to drinking may be most beneficial. The set of strategies used while drinking as defined in this study may not result in reduced alcohol consumption, although causal links have not been established. On the other hand, if the intervention goal is to decrease the negative consequences associated with alcohol use, it is possible that strategies used while drinking may be beneficial, consistent with the findings of Delva et al (2005) and Martens et al. (2004). Clearly, additional research is needed to refine our ability to match strategy use to drinking outcomes. Toward that end, the Strategies Questionnaire provides a psychometrically sound method of measuring use of three distinct sets of drinking control strategies.

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Table 1

Factor Loadings for Strategy Questionnaire

Strategy Questionnaire item	Selective Avoidance	Strategies While Drinking	Alternatives
17. Choose not to participate in drinking games when given the opportunity	*0.72*	−0.11	0.02
18. Refusing drinks	*0.67*	0.03	0.08
23. Choose not to "pre-game" or "pre-bar"	*0.58*	−0.05	0.09
21. Choose not to do shots when available	*0.55*	0.13	−0.01
22. Choose not to funnel, shotgun beers, or do keg stands when those activities are available	*0.54*	0.29	−0.09
1. Choose to avoid situations where heavy drinking is likely	*0.49*	−0.03	−0.001
16. Alternating alcoholic and nonalcoholic beverages when you are drinking	*0.42*	0.19	0.02
14. Eating before and while you are drinking	0.05	*0.67*	−0.02
12. Drinking slowly	0.05	*0.60*	0.16
19. Being aware of internal body sensations that indicate you are getting intoxicated	0.01	*0.59*	0.13
9. Limiting cash before going out to drink	−0.04	*0.59*	−0.24
20. Drinking beer with a lower alcohol content (light beer) instead of stronger alcoholic beverages	−0.16	*0.58*	0.03
26. Engage in activities while drinking to space out drinks (i.e. dancing, playing pool, darts)	−0.11	*0.56*	0.23
11. Keeping track of how many drinks you have	0.07	*0.50*	0.06
13. Spacing drinks over time	0.21	*0.50*	0.04
27. Limit drinking to certain days of the week	0.17	*0.47*	−0.02
10. Avoiding carrying credit cards or ATM cards when going out to drink	0.01	*0.47*	−0.13
2. Choose to participate in enjoyable activities that do not include alcohol consumption	0.01	−0.01	*0.64*
4. Practicing ways to be more comfortable in social settings without using alcohol	0.04	0.09	*0.64*
3. Finding other ways besides drinking to reduce stress	−0.01	0.03	*0.63*
5. Being prepared with effective coping strategies in situations where you think heavy drinking is likely	0.13	0.07	*0.57*

Note: $n = 247$, includes baseline data for all participants reporting alcohol use in the previous two weeks that fully completed the Strategy Questionnaire. Boldface and italic type indicate the highest factor loadings for each item.

Table 2

Intercorrelations among drinking and strategy use variables at baseline

Variable	1	2	3	4	5	Raw Mean (SD)
1. Average drinks per week [a]						13.25 (11.76)
2. Average BAC [a]	**0.90**					0.04 (0.03)
3. Heaviest BAC [a]	**0.67**	**0.81**				0.16 (0.10)
4. Selective Avoidance [a] Range: 0–30	−0.18	−0.18	−0.11			8.52 (6.28)
5. Strategies While Drinking Range: 0–50	**0.22**	**0.15**	0.12	**0.50**		18.59 (8.65)
6. Alternatives Range: 0–20	−0.19	−0.17	−0.11	**0.45**	**0.36**	8.68 (4.50)

Note: $n = 247$. Correlations ≥ |.13|, in boldface, have a $p < .05$. BAC = blood alcohol content.

[a] Denotes square-root transformed variables.

Table 3

Relationships among low, medium, and high strategy use and alcohol consumption.

Strategy use factors	Ave. drinks/week [a]*Mean* (SD)	Ave. BAC [a]*Mean* (SD)	Heaviest BAC [a]*Mean* (SD)
Selective Avoidance [a]	$F(2, 247) = 2.22$	$F(2, 237) = 2.39$	$F(2, 244) = 1.59$
Low	15.92 (13.86)	0.04 (0.03)	0.17 (0.10)
Medium	12.69 (10.47)	0.04 (0.03)	0.17 (0.10)
High	11.48 (10.93)	0.03 (0.04)	0.15 (0.11)
Strategies While Drinking	$F(2, 247) = 21.33$ ***	$F(2, 237) = 10.74$ ***	$F(2, 244) = 5.10$ **
Low	8.36 (10.26)	0.03 (0.03)	0.14 (0.11)
Medium	17.46 (12.97)	0.05 (0.03)	0.18 (0.09)
High	14.16 (10.39)	0.04 (0.04)	0.17 (0.11)
Alternatives	$F(2, 247) = 4.04$ *	$F(2, 237) = 3.30$ *	$F(2, 244) = 0.85$
Low	15.34 (12.94)	0.04 (0.03)	0.17 (0.10)
Medium	14.06 (11.92)	0.04 (0.03)	0.16 (0.09)
High	10.88 (10.15)	0.03 (0.03)	0.15 (0.11)

Note: Analyses based on transformed variables; raw means and standard deviations reported in table.

[a] Denotes square-root transformed variables.

*** $p < 0.001$

** $p < 0.01$

* $p < 0.05$

Table 4

Multivariate regression analyses for strategy variables predicting alcohol consumption.

Variable	Ave. Drinks/Week [a] (N = 250)			Ave. BAC [a] (N = 240)			Heaviest BAC [a] (N = 247)		
	B	SE B	β	B	SE B	β	B	SE B	β
Selective Avoidance -Linear	-.45	.09	-.34***	-.02	.01	-.30***	-.02	.01	-.21**
Selective Avoidance - Quadratic	-	-	-	-	-	-	-.01	.01	-.07
Strategies While Drinking - Linear	.09	.01	.54***	.00	.00	.44***	.00	.00	.32***
Strategies While Drinking - Quadratic	-.00	.00	-.30***	-.00	.00	-.29***	-.00	.00	-.22**
Alternatives - Linear	-.05	.02	-.15**	-.00	.00	-.11	-.00	.00	-.03
Alternatives - Quadratic	-.00	.00	-.04	-.00	.00	-.05	-.00	.00	-.13
R^2 (Adjusted R^2)	.29 (.28)***			.22 (.20)***			.15 (.13)***		

[a] Denotes square-root transformed variables.

***
$p < .001$

**
$p < .01$.

*
$p < .05$.