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Drinking Less and Drinking Smarter: Direct and Indirect Protective Strategies in Young Adults

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Abstract

Efforts to increase the use of protective behavioral strategies are a common component in interventions for young adult drinking. Some strategies, including those utilized while drinking, are directly correlated with lower drinking levels (Cf. Martens et al., 2005). Other strategies, however, may be indirectly related to drinking and instead be more closely associated with alcohol-related consequences. Two studies assessed the Protective Strategies Questionnaire (PSQ; Palmer, 2004), which may be well-suited to the assessment of direct and indirect strategies. In Study 1, data from a sample of undergraduate drinkers ($N = 370$) was used to examine the structure of the PSQ with principle components analysis (PCA) and confirmatory factor analysis (CFA). In Study 2, data from a clinical sample of young adult drinkers ($N = 168$) was used to replicate the CFA model. In both studies, relationships among the factors, alcohol use and consequences were examined. PCA and CFA in split halves of the undergraduate sample and CFA in the clinical sample confirmed two factors: a Direct Strategies (e.g. "space drinks out over time") factor and an Indirect Strategies (e.g. "have a designated driver") factor. Direct Strategies were associated with lower alcohol consumption. Indirect Strategies were less strongly associated with drinking but were associated with fewer alcohol-related consequences. Interventions for young adult drinking may be tailored to patient goals to decrease consumption and/or consequences.

Keywords

protective behavioral strategies; young adult drinking; alcohol-related consequences

Alcohol use and misuse by college students continues to be a source of public health concern. Heavy episodic drinking, defined as five or more drinks on one occasion for men and four or more drinks on one occasion for women, is commonplace. Nearly half of all

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undergraduate students report at least one heavy drinking episode in the past two weeks or month (Substance Abuse and Mental Health Services Administration [SAMHSA], 2006; Wechsler et al., 2002). Importantly, these heavy drinking episodes are directly related to a wide-range of alcohol-related consequences, including academic, relational and legal problems (Park, 2004), as well as physical injury and unprotected sex (Hingson, Zha, & Weitzman, 2009). These persistently high rates of alcohol consumption and associated problems highlight the need to understand better the mechanisms by which alcohol interventions effectively target heavy drinking.

Alcohol interventions have been developed that can reduce college students' alcohol consumption and alcohol-related consequences (Carey, Scott-Sheldon, Carey, & DeMartini, 2007). A recent meta-analysis concluded that, although these interventions are effective, they are less effective for heavy drinkers who may require tailored interventions (Carey et al., 2007). One potential method of tailoring is via the inclusion of *protective behavioral strategies* (PBS), which are cognitive and behavioral strategies designed specifically to help individuals consume alcohol more responsibly, such as alternating non-alcoholic with alcoholic beverages, using a designated driver, keeping track of drinks, and setting a drink limit. Early research from a national sample indicated that individuals who used more protective strategies had lower odds of experiencing alcohol-related consequences (Martens et al., 2004). In another study, Benton and colleagues found that students who consumed at least six drinks on one occasion were less likely to experience negative alcohol-related consequences if they engaged in protective strategies while drinking (Benton et al., 2004).

This initial work illustrates that using protective strategies when drinking can decrease the experience of alcohol-related consequences. Since these initial findings were reported, research on the use of strategies has burgeoned. Multiple scales have been developed to measure protective strategy use, including the 15-item Protective Behavioral Strategies Survey (PBSS; Martens et al., 2005), the 27-item Strategy Questionnaire (SQ; Sugarman & Carey, 2007) and the 16-item Protective Strategy Questionnaire (PSQ; Palmer, 2004). To date, both the PBSS and SQ have undergone exploratory factor analysis (EFA) and the PBSS has also been subjected to confirmatory factor analysis (Martens, Pedersen, LaBrie, Ferrier, & Cimini, 2007). Though the item sets for the two scales do not completely overlap, EFA results showed that a 3-factor solution provided best fit to the data for both the PBSS and the SQ (Martens et al., 2005; Sugarman & Carey, 2007). Both scales include factors concerning strategies used while drinking (Manner of Drinking and Limiting/Stopping Drinking in the PBSS; Strategies While Drinking in the SQ) and strategies used to avoid more drinking or consequences (Serious Harm Reduction in the PBSS; Selective Avoidance and Alternatives in the SQ). This suggests that different types of strategies may be related to different alcohol-related outcomes.

That specific strategies could be related to different drinking outcomes (e.g., continue drinking or stop drinking) is corroborated by different patterns of correlations between the scales' factors and alcohol consumption and related problems. In a study by Martens et al. (2007), all PBSS factors correlated negatively with heavy episodic drinking, total drinks per week, and alcohol-related problems. Though these bivariate correlations indicated negative relationships between all factors and drinking and consequences, hierarchical regression analyses indicated that Manner of Drinking scores had the strongest relationship with alcohol consumption, whereas Serious Harm Reduction scores had the strongest unique relationship to alcohol-related problems. Limiting/Stopping Drinking was only related to peak drinking in one sitting (Martens et al., 2005). In a study examining the prospective relationship between protective strategies and alcohol consumption and problems, certain PBSS factors once again showed stronger relationships with consumption than problems (Martens, Martin, Littlefield, Murphy, & Cimini, 2011). Increased Manner of Drinking

scores were associated with fewer drinks per week six months after the first assessment, while increased Serious Harm Reduction scores were associated with fewer alcohol related problems. Changes in Limiting/Stopping drinking scores were not predictive of decreased consumption or problems (Martens et al., 2011). Additionally in a cross-sectional study, earlier age of alcohol use onset was associated with less PBS use, which in turn, predicted heavier drinking and more alcohol-related problems (Palmer, Corbin, & Crouse, 2010). Thus, some strategies appear to have a direct relationship to alcohol consumption, while others appear to have a more indirect relationship to alcohol-related consequences.

Results of studies using the SQ further highlight the importance of differentiating unique types of protective strategies, as certain SQ strategies have been found to be associated with *increased* alcohol use. For example, although the Selective Avoidance and Alternatives factors have been found to be associated with less alcohol consumption, the Strategies While Drinking factor, which includes items such as “Eating before and while you are drinking,” “Spacing drinks over time,” and “Limiting drinking to certain days of the week,” has been found to be positively associated with alcohol consumption (Sugarman & Carey, 2007). None of these items on the latter scale were included in the PBSS. Using multiple regression analyses, the authors also found a significant quadratic relationship between Strategies While Drinking and drinks per week and between Strategies While Drinking and heaviest blood alcohol concentration (BAC). Post-hoc analyses of the quadratic relationship revealed that those using the lowest intensity of Strategies While Drinking drank fewer drinks per week, had lower typical BACs, and lower heaviest BACs than medium or high intensity strategy users. There were no differences between medium and high utilizers of Strategies on measures of alcohol consumption (Sugarman & Carey, 2007). This finding is consistent with some early research that indicated that there is a curvilinear (i.e., an inverted U-shape) relationship between strategy use and alcohol consumption (Werch & Gorman, 1988). Moreover, in a study examining the effect of intervention instructions to increase strategy use, students instructed to increase their strategy use showed increases in PBS use on the SQ, but did not reduce alcohol consumption. The relationship between strategy use and alcohol-related consequences was not assessed (Sugarman & Carey, 2009). Thus, it appears that simply increasing overall strategy use does not necessarily result in decreased alcohol consumption. Rather, specific strategies could be associated with higher or lower drinking levels or perhaps not be related to level of alcohol consumption but instead be related more closely to consequences.

Given that protective behavioral strategies are a component of commonly utilized and efficacious alcohol interventions for college students, including the Brief Alcohol Screening and Intervention for College Students (BASICS; Dimeff, Baer, Kivlahan & Marlatt, 1999) and other alcohol-related interventions for young adult drinkers, such as web-based interventions (e.g. Kypri et al., 2009), it is critical to gain a better understanding of the specific protective strategies that contribute to decreased consumption and related negative consequences. Moreover, no studies on protective strategies have used a clinical sample of young adult drinkers. It would be helpful to know whether the relationships among strategies, alcohol consumption, and alcohol-related consequences are consistent across both general and clinical samples. Information about which strategies are most beneficial for young adults who enrolled in an alcohol reduction clinical trial would help clinicians focus on the specific strategies that are most beneficial.

The purpose of the current study is twofold. First, we sought to investigate the factor structure of the Protective Strategies Questionnaire (PSQ; Palmer, 2004) in both an undergraduate sample and a clinical sample of heavy drinking young adults. Prior studies using the PSQ have replicated the inverse correlation between the use of protective strategies and alcohol use (Palmer, McMahon, Rounsaville, & Ball, 2010b; Palmer et al.,

2010a) and have found that strategy use increased significantly between baseline and follow-up in an open label clinical trial of naltrexone for young adults, in which reductions in heavy drinking and alcohol-related problems were found concurrently (Leeman et al., 2008). Although prior studies using the PSQ have used the total score based on all items, unlike the PBSS and the SQ, the PSQ has not yet undergone even exploratory component analysis. This endeavor is an important one given that the PSQ includes items that are not included on either the PBSS or the SQ. In fact, initial examination of the items on the scale suggested that the items might be divided among those directly related to alcohol consumption and those less directly related to alcohol consumption but more strongly associated with alcohol-related consequences. This factor structure (if confirmed) would differ from that of other established measures and might have utility in both predicting different drinking outcomes, and in tailoring approaches that focus specifically on drinking behavior versus negative consequences. Thus, the PSQ may provide a briefer assessment of protective strategies and provide a succinct way to capture the two most important aspects of strategies that have been most consistently related to drinking behavior and consequences. Because no published data exist on the factor structure of this instrument, we sought formally to conduct these analyses using both PCA and CFA. Based on prior research and our initial examination of the item pool, we hypothesized that a two-component model would best fit the data: a) a component related to modifying drinking behavior and b) a component related to avoiding alcohol-related consequences. The second goal of the current studies was to determine whether the factors were differentially related to alcohol consumption and alcohol-related problems. We hypothesized that the direct strategies factor would be more strongly related to drinking and that the indirect factor would be more strongly related to consequences. We also hypothesized that there would be significant indirect effects of protective strategies on alcohol-related consequences through alcohol consumption. Finally, we also sought to examine measurement invariance of the PSQ by gender. If the PSQ is invariant by gender, it would allow meaningful comparisons of strategy use by men and women.

Study 1: University Sample

Method

Participants—The sample ($N = 370$) used to conduct the initial PCA and first CFA consisted of undergraduate students attending a private university. Most participants were Caucasian (77%) or African American (13%), which was consistent with the racial breakdown of the undergraduate student body. The mean age of the participants was 19.6 ($SD=1.5$) years of age. Approximately half the sample was male (48%) and the majority of students lived in on-campus housing in a university residence hall (88%). All undergraduate classes were represented (i.e. 36% freshman, 22% sophomore, 22% junior, 20% senior).

Procedure—Recruitment flyers were distributed throughout campus by residence hall staff within residence halls and student seating areas. The flyers stated: “Complete a survey: We want to understand the patterns of alcohol, tobacco, and other risky behaviors among college students.” To participate, students were asked to fill out the survey packet which took approximately 20 to 45 minutes. Students completed the packets in two large group sessions in the student union building. A total of 399 students completed a packet; however data from 25 participants were considered invalid based on obvious response sets or extreme inconsistency. An additional four students were excluded due to missing data for gender. Due to the voluntary and anonymous nature of the data collection, packets were distributed with a waiver of consent form on the cover of each packet that participants could remove and take with them. Students received \$15 for their participation in the study. All study procedures were approved by the Institutional Review Board for human subjects.

Measures

Protective Behavioral Strategies—The Protective Strategies Questionnaire (PSQ; Palmer, 2004) assessed the frequency with which participants engaged in protective strategies, cognitive-behavioral strategies designed to help individuals consume alcohol more responsibly. The measure has the following instructions: “The following items are designed to assess the extent to which students endorse common things they do before they drink alcohol or while they are drinking. Answer each of the following by checking the appropriate box.” All items on the 16-item PSQ begin with the following preface, “When I am drinking, I...” and are anchored on a 1–7 Likert scale (1 = never, 7 = always). Behaviors included “count the number of drinks I have over the course of the night,” “alternate drinks with non-alcoholic drinks,” “turn down a drink if I don’t want one,” and “have a reliable designated driver.” Coefficient alpha for the final set of items included in the scale (see Results below) was 0.84.

Alcohol Use—The Daily Drinking Questionnaire-Revised (DDQ-R), adapted from the original DDQ (Collins, Parks & Marlatt, 1985), assessed typical drinking behavior in the 3 months before assessment with two questions: 1) for each day of the week, report the number of times in the prior 13 weeks that any alcohol was consumed; 2) on a typical day when drinking took place, report the typical number of standard drinks consumed on that day. Total number of drinks per week was calculated by summing the number of drinks reported for each day.

Rutgers Alcohol Problem Index—(RAPI; White & Labouvie, 1989). The RAPI assessed total alcohol-related negative consequences. The RAPI consists of 23 items that ask how many times a person has experienced each problem in the 3 months prior to assessment. Responses are scored on a scale ranging from 0 (never) to 4 (more than 10 times). Cronbach’s alpha in the current sample was 0.93.

Analysis Plan

Descriptive statistics (means, standard deviations) were examined for each item on the PSQ to determine if any items displayed evidence of significant skew or low variance. The amount of missing data for each item was also examined. Parallel analysis (PA) was first used to determine the number of components in the data. Because it has been documented that using Kaiser’s Rule (i.e. eliminating components or factors with eigenvalues less than 1.0) for determining the number of components results in an overestimate of the number of components (Horn, 1965), PA was used to adjust for the effect of sampling error using a sample-based alternative (Hayton, Allen, & Scarpello, 2004).

The dataset was randomly split into samples of roughly equal size using PASW Statistics 18.0 (SPSS, Inc. 2009). A total of 197 cases were randomly selected for one half, with the other 173 selected for the second half. Principle component analysis (PCA) was then used to determine whether any items should be eliminated from the scale based on overall poor loadings or cross-loading on multiple factors. PCA was selected because it allows analysis of all variance and allows analysis of empirical associations among items, which is appropriate in the absence of any comprehensive, published psychometric data, including data about factor structure, on the PSQ (Tabachnick & Fidell, 2007). To achieve good simple structure, items were considered to have problematic cross-loading if they loaded higher than 0.30 on multiple factors (Tabachnick & Fidell, 2007). Items were retained if they loaded at least 0.40 on one factor and less than 0.30 on other factors. Any items found to be unsuitable for inclusion in the scale were removed, and the PCA was performed again without those items.

Using the second half of the university dataset, confirmatory factor analysis (CFA) was performed using Mplus (Muthen & Muthen, 1998–2009) to assess the fit of the solution. Parameters were estimated using maximum likelihood estimation with robust standard errors to best account for non-normal distributions of items in the scale. Fit was assessed using the covariance matrix and the residuals. The following fit indices were used to assess model fit: a) chi-square statistic (Hu & Bentler, 1999); b) the root-mean-square error of approximation (RMSEA; Steiger & Lind, 1980; Cf. Hu & Bentler, 1999); c) the standardized root mean square residual (SRMR; Bentler, 1995); d) the Comparative Fit Index (CFI; Bentler, 1990); and e) the Tucker-Lewis Index (TLI; Tucker & Lewis, 1973). A non-significant chi-square statistic indicates good fit (Tabachnick & Fidell, 2007). It cannot be used as a sole indicator of fit, however, because the statistic is quite sensitive to the size of the sample and with large samples and real-world data is often significant even when the model provides an acceptable representation of the data (Floyd & Widaman, 1995; Hatcher, 1994; Kline, 2005). RMSEA values larger than 0.10 indicate poor fit (Browne & Cudeck, 1993). Values between 0.05–0.08 indicate reasonable fit, and values < 0.05 indicate good fit (Hu & Bentler, 1999). SRMR values should be less than 0.08; CFI and TLI values greater than 0.95 indicate good-fitting models (Hu & Bentler, 1999).

To determine the relationship of the strategies factors to measures of alcohol consumption and alcohol-related problems, items loading onto each factor were summed to create total scores on each factor. Bivariate correlations among the two factor scores and total drinks per week and total alcohol-related problems were then examined. Path analysis with the maximum likelihood estimator was then used to examine direct effects of each factor on drinking and consequences, as well as indirect effects of each factor on consequences operating through total drinks per week. Standardized beta coefficients were used to examine the unique effect of each independent variable on the dependent variable.

Results

One item was removed from the PSQ prior to any additional analyses. Item 15, which read “Use birth control,” had a disproportionate amount of missing data compared to all other items. In Study 1, a total of 35 participants (10%) of the 370 participants declined to answer the question. Further examination of the item revealed that, of those who declined to answer the question, 26 of the 35 were male. This pattern was also seen in the Study 2 data. A total of 17 of the 168 participants declined to answer the question. Of those who declined to answer, 14 of the 17 were male. Thus, it appeared that this was not deemed a relevant item for many male respondents and was therefore removed from further analysis of the scale.

Sample Characteristics—Participants reported an average of 10.03 ($SD = 10.98$) drinks per week. Overall, they reported an average RAPI score of 12.61 ($SD = 12.65$) and reported an average total score of 31.65 ($SD = 13.43$) on the PSQ.

Parallel Analysis—PA was performed on Stata IC 10.1 for Macintosh (Statacorp, 2008). PA creates a number of correlation matrices of random variables based on the sample size and number of variables in the actual dataset. Eigenvalues from the random correlation matrix are then directly compared to data from the actual correlation matrix (e.g. the first observed eigenvalue is compared to the first random eigenvalue; the second observed eigenvalue is compared to the second random eigenvalue; and so on). Components are retained when actual eigenvalues are greater than the parallel average random eigenvalue (Hayton et al., 2004).

PA analysis was run with 10 repetitions on the 15 remaining PSQ items. This created 10 random datasets and PA eigenvalues were averaged over the 10 replications. Results

indicated the presence of two true components in the dataset. The first component was the largest and had an eigenvalue of 6.18, compared to the first random eigenvalue of 1.34. The second component had an eigenvalue of 1.58, which was larger than the random eigenvalue of 1.26. All other observed eigenvalues were less than the random eigenvalues. This suggested that the PSQ had two true components.

Principle Components Analysis—A principle components analysis was performed on the 15 remaining items comprising the PSQ using PASW 18.0.3 for Macintosh (SPSS, Inc., 2009). Because no comprehensive, published psychometric data exist on the factor structure of the PSQ, both orthogonal and oblique rotations were examined to determine which provided the most interpretable solution. As varimax rotation provided more easily interpretable results (Tabachnick & Fidell, 2007) and minimized negative loadings, the results of the varimax rotation are presented below. Because PA analysis revealed the presence of two true factors, PCA was run with a two-factor forced solution. The first component had an eigenvalue of 6.28 and the second had an eigenvalue of 1.62. Together, the two components accounted for 53% of the total variance.

Four items on the scale had significant cross-loadings and were removed. These items were, “Eat before I go out,” “Turn down a drink if I don’t want one,” “Drink slowly in a safe environment,” and “Eat while drinking.” One additional item (“Watch out for friends”) was removed because it shared wording with another item in the scale (“Plan with friends to watch out for each other”) and was considered redundant. We chose to eliminate the “Watch out for friends” item because it had a weaker loading on its primary factor than the “Plan with friends” item. After the removal of these items, Component 1 contained 6 items and Component 2 contained 4 items. A new PCA was then run with orthogonal and oblique rotations to obtain factor loadings on the final scale. Both oblique and orthogonal rotations produced nearly identical results, indicating the presence of a clear simple structure. Given that varimax results are most easily interpretable, these items and their loadings are displayed in Table 1.

Item content for items loading onto each factor was examined for interpretability and used to generate factor names. Factor 1 appeared to contain items that assessed use of strategies directly pertaining to drinking behavior, including spacing drinks and counting drinks. Therefore, this factor was named the “Direct Strategies” factor. Factor 2 appeared to contain items that assessed the use of strategies that can be employed to reduce harm while drinking. These strategies, therefore, are indirectly related to actual consumptive behavior. Consequently, this factor was named the “Indirect Strategies” factor.

Confirmatory Factor Analysis—Using the second half of the university sample, the solution generated by the PCA was tested with CFA. Fit indices are displayed in Table 2. As seen in Table 2, the model showed very good fit to the data. The chi-square for the model was non-significant [$\chi^2 = 48.16$ ($N = 176$), $p = 0.054$]. Each of the fit indices that should approach unity (i.e. CFI and TLI) indicated good fit (Hu & Bentler, 1999). Additionally, the RMSEA and SRMR indicated good fit. The correlations between the latent and observed variables ranged from 0.44 to 0.96. To assess the significance of each predictor on the latent factor, correlations were divided by their standard error terms (e.g. Estimated Loading/Standard Error). This value tests the null hypothesis that the parameter estimate is zero in the population from which the sample originated and can be interpreted as a z -score. Values that are 1.96 or -1.96 are significant at $p < 0.05$. In this model, all items were significantly predicted by their respective latent factors. Therefore, all items within each factor appeared to be measuring a common latent construct. Table 3 shows the standardized factor loadings and z -scores for the model.

Relationship with Alcohol Consumption and Consequences—Bivariate correlations among Direct Strategies, Indirect Strategies, total drinks per week and total RAPI score were examined to determine the relationships among these variables. Use of PSQ-Direct was more strongly correlated with total drinks per week ($r = -0.25$) than was PSQ-Indirect ($r = -0.11$). Conversely, use of PSQ-Indirect was more strongly correlated with alcohol-related problems ($r = -0.21$) than was PSQ-Direct ($r = -0.16$).

Path Analysis of Strategies, Consumption, and Consequences—Although use of PSQ-Direct was more strongly related to drinking behavior than alcohol-related consequences, simple bivariate correlations do not account for potential indirect effects of these strategies on negative consequences operating through heavier drinking. Thus, we conducted a path analysis of the relations among strategies, drinking, and consequences. We modeled direct paths from both protective strategies scores to alcohol consumption and negative consequences, in addition to a path from alcohol consumption (e.g. total drinks per week) to alcohol-related consequences (e.g. total RAPI score). The two protective strategies factors were also allowed to freely covary to account for their association ($r = 0.48$). This approach allowed us to determine whether either type of strategy had an indirect effect on consequences via drinking. Figure 1 provides a graphic depiction of the path model with standardized regression coefficients (betas) reported as path coefficients.

Consistent with the bivariate correlations, PSQ-Direct scores were significantly associated with alcohol consumption ($b = -0.26, p < 0.001$). However, the significant bivariate correlation between PSQ-Direct and alcohol consequences was not identified in the path model ($p = .30$), suggesting that the bivariate relation between PSQ-Direct and negative consequences was largely a function of the covariation between PSQ-Direct and PSQ-Indirect scores. Similarly, PSQ-Indirect scores were not associated with drinking in the path model ($p = 0.71$), despite a significant univariate correlation, suggesting that the correlation was largely a function of the covariation of PSQ-Direct and PSQ-Indirect scores. Consistent with the bivariate correlations and study hypotheses, PSQ-Indirect ($b = -0.18, p < 0.001$) was a significant predictor of alcohol-related consequences. Thus, PSQ-Indirect scores were associated with fewer alcohol-related consequences, whereas PSQ-Direct scores were associated with lower alcohol consumption. Total variance (R^2) explained was 0.06 ($p < 0.05$) for alcohol consumption and 0.27 ($p < 0.001$) for negative consequences.

As expected based on prior research, alcohol consumption was a significant predictor of negative consequences ($b = 0.48, p < 0.001$). Of greater interest, the indirect path from PSQ-Direct through alcohol consumption to consequences was significant ($b = -0.13, p < 0.001$). Thus, although PSQ-Direct did not have a direct effect on consequences, increased PSQ-Direct scores were associated with fewer alcohol-related consequences through an associated decrease in alcohol consumption. In contrast, the path from PSQ-Indirect through alcohol consumption to consequences was not significant ($p = 0.80$), suggesting that the effects of PSQ-Indirect on negative consequences is independent of levels of alcohol consumption.

Study 2: Clinical Sample

Method

Participants—Young adults between 18 and 25 years of age were recruited via flyers, newspaper, television, and online advertisements to participate in an ongoing 8-week randomized double-blind clinical trial to test the effect of placebo-controlled naltrexone combined with brief individual counseling to reduce the frequency of any alcohol use and the frequency of heavy episodic drinking. Motivation to change alcohol consumption was not a requirement of participation and compensation up to \$500 was advertised. Participants

were eligible if they reported heavy drinking (5 standard drinks for men and 4 standard drinks for women) on 4 or more days within the 28 days prior to intake. Those with a Clinical Institute of Withdrawal Assessment scale [CIWA; Sullivan, Sykora, Schneiderman, Naranjo, & Sellers, 1989] score of 8 or with a DSM-IV diagnosis of drug dependence other than nicotine were excluded from the study and referred for other treatment. Participants were excluded if urine drug screen results indicated illegal drug use, with the exception of marijuana. Due to high rates of marijuana use in college populations (O'Malley & Johnston, 2002), participants were excluded only if they were marijuana dependent to increase the representativeness of the sample. Individuals with a serious psychiatric illness (e.g. schizophrenia, substantial suicide risk) were also excluded, as were pregnant or lactating women.

A total of 168 participants completed intake assessments. The mean age of participants was 21.44 (SD = 2.17). The majority of the participants were Caucasian (71%, $n = 130$), male (66%) and single (91%, $n = 166$). Most participants had completed some college (48%, $n = 88$).

Procedure—Potential participants completed a preliminary eligibility screening either by telephone or via the internet. Those considered likely to be eligible were invited to schedule an intake appointment. At the intake appointment, individuals provided written informed consent to participate in the study. The intake process involved a diagnostic interview for alcohol and substance use disorders and psychiatric problems, and a physical examination that included routine blood work and, for women, pregnancy tests. Participants also completed internet-based self-report assessments either at their homes or at the research site. Those who could be excluded based on positive urinalysis results or the results of the clinical interview did not complete the self-report battery. Forthcoming reports will describe the treatment outcomes of this study. This report focuses only on the self-report information from participants at intake. The trial was approved by the Institutional Review Board.

Measures

PSQ—The PSQ was administered in Study 2 with no changes to instructions or item content. Coefficient alpha of the final set of ten items in the scale was 0.77.

Alcohol Use—The DDQ-R was administered in Study 2 with no changes to instructions or item content. As noted, the DDQ-R assessed typical drinking behavior in the 3 months before intake. In addition to total drinks per week, drinks per drinking day was equal to the mean number of drinks typically consumed on each day of the week, weighted by the number of days out of the prior 13 when drinking occurred. A composite measure of quantity and frequency of drinking was calculated by multiplying the weekly frequency of drinking by the weekly quantity of alcohol consumed. Heavy drinking was assessed with two self-report items in which participants reported the frequency with which they consumed 5 or more alcoholic drinks (4 or more drinks for females) within (a) a single day (i.e. heavy episodic drinking) and (b) within a 2-hour period (i.e. binge drinking). Participants responded on the following scale: 1 = 1 or 2 days in the past 3 months; 2 = 1 day/month; 3 = 2–3 times/month; 4 = 1 day/week; 5 = 2 days/week; 6 = 3–4 times/week; 7 = 5–6 times/week; and 8 = every day.

Young Adult Alcohol Consequences Questionnaire—(YAACQ; Read, Kahler, Strong, & Colder, 2006). The YAACQ is a 48-item measure that was specifically constructed to assess eight-domains of problematic drinking consequences: 1) Social-Interpersonal Consequences; 2) Impaired Control; 3) Self-Perception; 4) Self-Care; 5) Risk Behaviors; 6) Academic/Occupational Consequences; 7) Excessive Drinking; and 8)

Physiological Dependence. Participants respond using a dichotomous “yes/no” format to indicate whether or not they have experienced each problem in the past three months. Cronbach’s alpha for the total scale in this sample was 0.92.

Analysis Plan

A dataset from a clinical sample was used to determine whether the CFA solution would provide adequate fit to the data in a sample of heavy drinking young adults. Because this is a sample of heavy drinkers, they represent young adults who could be considered most in need of an intervention and for whom, research has shown, current interventions are less effective (Carey et al., 2007). The same fit indices described above were used to assess model fit in this dataset. As in Study 1, factor scores were calculated by summing items that loaded onto each factor. Bivariate correlations among the factor scores, frequency of binge drinking, composite alcohol use, typical frequency and quantity of drinking, and alcohol-related problems were then examined. Path analysis again examined both direct and indirect effects (operating through weekly drinking) of the protective strategies factors on negative consequences.

Results

Sample Characteristics—Participants reported an average of 23.08 ($SD = 17.89$) drinks per week and an average of 7.45 ($SD = 4.35$) drinks per drinking day. Participants reported an average of 4.76 ($SD = 1.54$) binge drinking episodes in a two-hour span and an average of 5.56 ($SD = 1.07$) heavy drinking episodes in a day. They reported experiencing an average of 20.30 ($SD = 9.82$) alcohol-related problems and an average total score on the PSQ of 50.37 ($SD = 12.71$).

Confirmatory Factor Analysis—Using the clinical dataset, the solution generated by PCA and subjected to CFA within the University sample was re-tested with a second CFA. Fit indices are displayed in Table 2. As in the first dataset, the model showed good fit to the data. The chi-square for the model was significant [$\chi^2 = 52.90$ ($N = 168$), $p < 0.05$], but this is often true for good fitting models with real-world data. As noted, due to limitations of the chi-square statistic (e.g. sensitivity to sample size and to correlations in real world data), it will often be significant despite the existence of a good fitting model and cannot be used as the sole indicator of fit (Kline, 2005). Both RMSEA and SRMR indicated that the model had adequate to good fit, and CFI and TLI indices also evidenced good fit (Hu & Bentler, 1999).

Table 3 shows the standardized factor loadings and z-scores for the model. The correlations between the latent and observed variables ranged from 0.36 to 0.84. Correlations were again divided by their standard error terms (e.g. Estimated Loading/ Standard Error) to assess the significance of each predictor on the latent factor. As with the first model, all items were significantly predicted by their respective latent factors. Therefore, all items are likely measuring a common latent construct.

Relationship with Alcohol Consumption and Consequences—First, correlations between each factor and various indices of drinking behavior were examined. Both PSQ-Direct and PSQ-Indirect were significantly, negatively correlated with frequency of binge drinking in a two-hour span ($r = -0.32$, $p < 0.01$ and $r = -0.18$, $p < 0.05$) and in a day ($r = -0.37$, $p < 0.001$ and $r = -0.20$, $p < 0.05$). Both PSQ-Direct and PSQ-Indirect were also negatively correlated with drinks per drinking day ($r = -0.38$, $p < 0.01$ and $r = -0.21$, $p < 0.01$) and the composite measure of weekly drinking on the DDQ-R ($r = -0.33$, $p < 0.01$ and $r = -0.16$, $p < 0.05$). Finally, correlations between each factor and the sub-scales of the YAACQ were calculated. Though scores on both factors were significantly associated with total alcohol-related problems, scores on PSQ-Indirect were somewhat more strongly

associated with total problems ($-0.27, p < 0.01$) than PSQ-Direct ($-0.23, p < 0.01$). PSQ-Indirect scores were also significantly correlated with more subscales of the YAACQ. Of note, only PSQ-Indirect was correlated with Social-Interpersonal Problems ($r = -0.21, p < 0.01$). Though both PSQ-Indirect and PSQ-Direct were correlated with most problems subscales, PSQ-Indirect scores were more strongly correlated with Impaired Control ($r = -0.22, p < 0.01$) and Risk Behaviors ($r = -0.33, p < 0.001$). PSQ-Direct scores were more strongly correlated with Academic/Occupational Problems ($r = -0.33, p < 0.001$) and Excessive Drinking ($r = -0.25, p < 0.01$). Thus, it appears that increased use of PSQ-Direct was more strongly associated with lower alcohol consumption, whereas increased use of PSQ-Indirect was more strongly associated with decreases across a wide spectrum of consequences.

Path Analysis of Strategies, Consumption, and Consequences—Using the clinical dataset, the path analysis model tested in Study 1 was re-tested with a second path analysis. Results of direct effects testing is presented in Figure 2. As in the model with the first sample, only PSQ-Direct scores were associated with composite alcohol consumption on the DDQ-R ($b = -0.32, p < 0.001$). PSQ-Indirect scores were not associated with drinking ($p = 0.49$). Also consistent with the previous model, PSQ-Indirect scores ($b = -0.21, p < 0.01$) were significant predictors of total alcohol-related consequences on the YAACQ (see Figure 2), whereas PSQ-Direct scores were not associated with consequences ($p = 0.30$). Thus, greater PSQ-Indirect use was associated with fewer alcohol-related consequences, and greater PSQ-Direct use was associated with lower levels of alcohol consumption. The Total variance (R^2) explained was 0.11 ($p < 0.05$) for alcohol consumption and 0.12 ($p < 0.05$) for negative consequences.

Indirect effects testing also replicated the pattern of results from Study 1. While the direct path from PSQ-Direct to alcohol-related consequences was not significant, the indirect path from PSQ-Direct through alcohol consumption to consequences was significant ($b = -0.06, p < 0.05$). Thus, although PSQ-Direct did not have a direct path to consequences, increased PSQ-Direct use was associated with fewer alcohol-related consequences through an associated decrease in alcohol consumption. The indirect effect of PSQ-Indirect through drinking to consequences was not significant ($p = 0.51$). Therefore, the effect of PSQ-Indirect on consequences operated independently from levels of alcohol consumption.

Measurement Invariance by Gender

Measurement invariance (MI) must be demonstrated to allow comparisons of strategies across groups of interest, including gender (Cf. Steenkamp & Baumgartner, 1998; Vandenberg & Lance, 2000). A measure that has MI similarly assesses the underlying construct (e.g. protective behavioral strategy use) across men and women, which ensures that scores reflect “true” positions on latent factors. If a measure is demonstrated to have MI, individual and group differences in mean scores reflect true differences across groups rather than discrepancies in factor structure or bias in specific items comprising the scales. Given that mean levels of alcohol consumption differ by gender, it is important to demonstrate MI on the PSQ to ensure the ability to make comparisons across gender. We used the whole sample of Study 1 ($N = 370$) to assess measurement invariance and to determine whether men and women differed in PSQ strategy use. The whole sample was used to provide adequate statistical power for multi-group analyses.

Configural Invariance

Configural invariance assesses whether a similar global latent factor structure is shared by both genders when no equality constraints are in place. We assessed whether the same 2-factor model fit for both men and women, whether the loadings of all items were significant

across gender, and whether the correlation between the two latent factors indicated potential problems with collinearity (see Steenkamp & Baumgartner, 1998).

A two-group CFA model was specified in Mplus to fit the two-factor model to men and women simultaneously. The maximum likelihood estimator with robust standard errors and chi-squares was used because all PSQ items were continuous. The factor loadings of the two factor metrics (i.e., the highest loading item for each factor) were set to 1.0 and factor means (e.g. mean of the Direct and Indirect factors) were set to 0.0. All other model parameters (e.g. factor loadings, intercepts, variances and covariances) were freely estimated. The resulting model evidenced good fit $\chi^2(60) = 143.23$, CFI = 0.932, TLI = 0.91, RMSEA = 0.077 (90% CI = 0.06–0.095), SRMR = 0.06. All items significantly loaded onto their respective factors for men and women (all loadings at $p < 0.001$). The Direct and Indirect latent factors were correlated within each gender ($r = 0.54$ for women; $r = 0.49$ for men), but not above the established threshold for collinearity ($r > .80$ Meyers, Gamst, & Guarino, 2006). The PSQ, therefore, demonstrated configural invariance.

Metric Invariance

Metric invariance assesses whether the latent factors are measured on the same scale. Metric invariance, therefore, establishes whether the strength of the relationships of the latent factors to their respective factor loadings is comparable for men and women.

We compared the fit of the configurally invariant model to the fit of the metric model for the two-group CFA model. Factor loadings of matching items on the Direct and Indirect factors were constrained to equality (e.g. factor loadings of Direct for men and women were set to equality) and latent factor means were set to zero. Non-invariance exists when the decrement in model fit exceeds SRMR = 0.03, RMSEA = 0.015, or CFI = -0.01 (Chen, 2007). The metric model did not evidence significant decrement in fit ($\chi^2(86) = 169.73$, SRMR = 0.073, RMSEA = 0.073 (90% CI = 0.056–0.089), CFI = 0.924, TLI = 0.921) when compared to the configurally invariant model (Δ SRMR = -0.013, Δ RMSEA = 0.007, Δ CFI = 0.006). Thus, the individual items of the PSQ were related to their respective factors equally across gender.

Scalar Invariance

Scalar invariance assesses whether the item origins are invariant across gender. Scalar invariance, therefore, establishes that strategy-specific (e.g. Direct and Indirect) differences in factor scores are differences in latent factor means and are not attributable to measurement bias (Cf. Chen, 2007; Steenkamp & Baumgartner, 1998).

We compared the fit of the metrically invariant model to the fit of the scalar model for the two-group CFA model. Factor loadings and intercepts (item means) of matching items were constrained to equality and latent factor means were freely estimated. Unique change in fit indices are considered to evaluate scalar invariance (Chen, 2007). Changes in CFI = -0.010 with a change in SRMR = 0.010 or RMSEA = 0.015 indicate non-invariance (Chen, 2007). The scalar model had no decrement in fit ($\chi^2(84) = 161.24$, SRMR = 0.062, RMSEA = 0.071 (90% CI = 0.054–0.088), CFI = 0.930, TLI = 0.925) compared to the metric model (Δ SRMR = -0.001, Δ RMSEA = 0.001, Δ CFI = 0.004). Therefore, men and women with the same latent variable score (e.g. same score on Direct or Indirect Strategies) will give similar responses on individual items, making mean comparisons between groups appropriate.

Gender Differences in Strategy Use

To determine whether men and women differentially used PSQ strategies, two independent samples t-tests were conducted. On PSQ-Direct, women used strategies more frequently (M

= 14.14, $SD = 8.08$) than men ($M = 11.76$, $SD = 7.76$) ($t(375) = 2.90$, $p < 0.01$). On PSQ-Indirect, women also used strategies more frequently ($M = 18.76$, $SD = 6.09$) than men ($M = 16.62$, $SD = 6.45$) ($t(375) = 3.14$, $p < 0.01$).

Discussion

The purpose of these studies was first, to assess the factor structure of the PSQ and second, to determine whether the factors of the PSQ were differentially related to alcohol consumption and alcohol-related negative consequences. We also sought to determine whether the PSQ was invariant by gender to allow comparisons in strategy use by gender. To do this, we used PCA and CFA in both a sample of undergraduate volunteers and a clinical sample of heavy young adult drinkers. In both samples, we correlated the factors of the PSQ to measures of consumption and problems and conducted path analysis to determine the direct and indirect effects of both types of strategies. Our findings indicate that the PSQ has two stable factors, Direct Strategies and Indirect Strategies, and that the factors are differentially and significantly related to consumption and problems.

The PSQ-Direct factor is characterized by items that assess protective strategies in which young adults may engage while drinking (e.g. “alternate alcoholic with non-alcoholic drinks”). The PSQ-Indirect factor is characterized by strategies in which a young adult may engage to reduce alcohol-related consequences (e.g. “plan with friends to watch out for each other”). This two-factor solution is consistent with previous research on protective strategies indicating that, though all strategies are broadly related to drinking outcomes, there are different types of drinking strategies (e.g. Martens et al., 2005; Sugarman & Carey, 2007). This scale, however, is the first with items that load onto only two basic factors of strategies directly related to drinking behavior and strategies related to consequence avoidance. Importantly, despite having only 10 items, this reduced version of the PSQ also includes items not present in other PBS measures, including “pre-planning transportation to get home,” “use protection with a sexual partner,” and “have a plan with a friend to watch out for each other.” Therefore overall, the PSQ provides a briefer assessment of protective strategies than was previously available, while also providing a concise assessment of both direct drinking and indirect drinking strategies.

Our results indicate that the PSQ-Direct factor and the PSQ-Indirect factor have different relationships to measures of alcohol consumption and alcohol-related consequences. Though both types of strategies were correlated with decreased alcohol consumption, path analysis results revealed that only PSQ-Direct had a unique relationship with alcohol consumption. Higher PSQ-Direct scores were uniquely associated with decreased alcohol consumption, whereas PSQ-Indirect scores were not. PSQ-Direct scores were also strongly correlated with fewer drinks per drinking day, binge drinking, and weekly composite use. In contrast, although both PSQ-Direct and PSQ-Indirect were associated with a decrease in alcohol-related consequences, PSQ-Indirect was more strongly correlated with problems across a variety of subscales and had a slightly stronger relationship to overall consequences. Importantly, path analysis revealed that only PSQ-Indirect scores were directly associated with decreased consequences. PSQ-Direct was not directly related to alcohol-related consequences, but did have an indirect effect on consequences through decreased alcohol consumption.

The finding that PSQ-Indirect use is only moderately correlated with alcohol consumption but is uniquely related to a reduction in alcohol-related consequences is important to consider in light of findings about the motivation of young adults to change drinking behavior. The PSQ was developed to evaluate the use of protective behavioral strategies prior to and post receipt of harm-reduction interventions such as BASICS (Dimeff et al.,

1999) and the Alcohol Skills Training Workshops (Miller et al., 2000). Because the goal of these interventions is not for a participant to achieve alcohol abstinence, an important component of these interventions is the provision of protective behavioral strategies and tips for using them. As noted, interventions for college student drinkers have been less effective for heavy drinkers (Carey et al., 2007), and participants in alcohol interventions may differ in their receptivity to intervention messages (Carey & DeMartini, 2010) or in their perception of the acceptability of the use of protective strategies (DeMartini, Carey, Lao & Luciano, 2011). Our results indicate that, even in a clinical sample of heavy drinkers, the use of PSQ-Indirect can have an impact on alcohol-related consequences. Moreover, given the moderate correlation between PSQ-Indirect and alcohol use, young adults who are less motivated to change their drinking behavior directly, via the use of strategies while they are drinking, may see a reduction in alcohol consumption associated with the use of PSQ-Indirect. Thus, there may be clinical utility to presenting and encouraging use of Indirect Strategies to less motivated young adult drinkers, first, as a way to reduce harm related to alcohol use and second, as a potential indirect way to impact overall consumption. Young adults who are motivated to change their drinking, in contrast, may benefit more from use of the PSQ-Direct or benefit from the use of both types of strategies.

The finding that PSQ-Indirect is more associated with alcohol-related consequences is consistent with research on the PBSS indicating that the Serious Harm Reduction (SHR) factor was most strongly associated with a decrease in alcohol-related problems (Martens et al., 2011). Importantly, though there is some item overlap between the SHR factor and our PSQ-Indirect factor, they are not identical. Both include items to assess use of a designated driver, and only the PBSS includes an item about watching your drink. The PSQ includes an additional item to assess pre-planning transportation. Notably, the PSQ-Indirect factor includes one item, "use protection with a sexual partner," that is not present on the SHR factor but is an important area to assess. As many as 400,000 college students engage in unprotected sex as a result of drinking in a given year (Hingson, Heeren, Zacoks, Kopstein, & Wechsler, 2002). In young adult samples, alcohol use has been strongly linked to the decision to have sex and to engage in forms of risky sex (e.g. having multiple partners and casual sex partners) (Cooper, 2002). Indeed, for sexual encounters with a casual partner, alcohol use has been associated with an increase in unprotected vaginal sex (Brown & Venable, 2007). Thus, the inclusion of an item to assess strategy use in sexual behavior represents an improvement in the overall assessment of alcohol-related protective behavioral strategies. Future research on protective strategies that includes both the PSQ and the PBSS could help to clarify whether the two scales, account for independent variance across a variety of drinking outcomes, including alcohol-related consequences.

Our finding that women use both PSQ-Direct and PSQ-Indirect strategies more often than men is consistent with similar findings on the PBSS (LaBrie, Lac, Kenney, & Mirza, 2011). On the PBSS, women endorsed more strategies on all three subscales than men (LaBrie et al., 2011). Men report more pressure to drink (Suls & Green, 2003) and less acceptance of PBS than women (DeMartini et al., 2011). In this context, it may be especially important for future alcohol intervention development to consider how to best engage men in the use of PBS for alcohol harm reduction.

Interpretation of these findings should be considered in light of study limitations. This research consists of two different samples of young adults' self-report data. In Study 1, the data were collected via self-report measures, and despite assurances of anonymity, it is possible that some reporting was inaccurate. In Study 2, data were collected from a sample of heavy-drinking young adults seeking participation in a pharmacotherapy treatment trial. Future studies could consider whether these findings generalize to other samples of heavy-drinking young adults. In both Study 1 and Study 2, inferences were made on the basis of

cross-sectional data. The associations between PSQ-Direct and PSQ-Indirect and alcohol consumption and alcohol-related consequences are suggestive of the impact that targeting PBS use in an alcohol intervention might have. Prospective data that assess pre-intervention and post-intervention strategy use are needed to determine a causal link between strategy use and decreased consumption and consequences. Future research may also consider examination of the relationship between PBS use and alcohol consumption for different types of participants, including those with less motivation to change or with different levels of alcohol problem severity, as well as PBS use following different types of interventions (e.g. brief motivational interventions vs. medication alone). This would allow a more nuanced understanding of the temporal relationships among these variables and would allow interventionists to better tailor interventions for specific young adults. Lastly, future research could consider whether use of protective strategies varies by region of the country, given that alcohol consumption and normative perceptions of alcohol consumption vary by region (Naimi et al., 2003).

Overall, the finding that PSQ-Direct and PSQ-Indirect have different relationships with alcohol consumption and alcohol-related negative consequences suggests that clinical interventions could be tailored to emphasize strategies appropriate to the specific goals or stage of change of young adult drinkers. Individuals who express a low motivation to reduce their drinking may be more motivated to experience fewer negative consequences due to their alcohol use and may be more willing to try Indirect Strategies that emphasize safety. The clear differentiation in the PSQ between Direct Strategies and Indirect Strategies would make it easy for interventionists to choose the strategies that might be most helpful to a given patient. Our results indicate that these relationships hold both within a general college sample and within a clinical sample of young adult heavy drinkers. Therefore, clinical interventions for young adult drinkers or those meeting criteria for alcohol dependence may be tailored to the goals of the individual to decrease consumption and/or decrease alcohol related problems. This tailoring could result in a greater reduction of both consumption and problems for a greater range of young adult drinkers.

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References

- Bentler PM. Comparative fit indexes in structural models. *Psychological Bulletin*. 1990; 107:238–246. [PubMed: 2320703]
- Bentler, PM. EQS structural equations program manual. Encino, CA: Multivariate Software; 1995.
- 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]
- 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]
- Brown JL, Vanable PA. Alcohol use, partner type, and risky sexual behavior among college students: findings from an event-level study. *Addictive Behaviors*. 2007; 32(12):2940–2952. [PubMed: 17611038]

- Browne, MW.; Cudeck, R. Alternative ways of assessing model fit. In: Bollen, KA.; Long, JS., editors. *Testing Structural Equation Models*. Beverly Hills, CA: Sage; 1993. p. 136-162.
- Carey KB, Scott-Sheldon LAJ, Carey MP, DeMartini KS. Individual-level interventions to reduce college student drinking: A meta-analytic review. *Addictive Behaviors*. 2007; 32:2469–2494. [PubMed: 17590277]
- Carey KB, DeMartini KS. The motivational context for mandated alcohol interventions for college students by gender and family history. *Addictive Behaviors*. 2010; 35:218–223. [PubMed: 19914002]
- Chen FF. Sensitivity of goodness of fit indexes to lack of measurement invariance. *Structural Equation Modeling*. 2007; 14(3):464–504.
- 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(2):189–200. [PubMed: 3998247]
- Cooper ML. Alcohol use and risky sexual behavior among college students and youth: Evaluating the evidence. *Journal of Studies on Alcohol, Suppl*. 2002; 14:101–117.
- DeMartini KS, Carey KB, Lao K, Luciano M. Injunctive norms for alcohol related consequences and protective behavioral strategies: Effects of gender and year in school. *Addictive Behaviors*. 2011; 36:347–353. [PubMed: 21236586]
- Dimeff, LA.; Baer, JS.; Kivlahan, DR.; Marlatt, G. *Brief Alcohol Screening and Intervention for College Students (BASICS): A harm reduction approach*. New York, NY: Guilford Press; 1999.
- Floyd FJ, Widaman KF. Factor analysis in the development and refinement of clinical assessment instruments. *Psychological Assessment*. 1995; 7:286–299.
- Hayton JC, Allen DG, Scarpello VG. Factor Retention Decisions in Exploratory Factor Analysis: A Tutorial on Parallel Analysis. *Organizational Research Methods*. 2004; 7:191–205.
- Hatcher, L. *A step-by-step approach to using the SAS system for factor analysis and structural equation modeling*. Cary, NC: SAS Institute Inc; 1994.
- Hingson RW, Heeren T, Zaccos RC, Kopstein A, Wechsler H. Magnitude of alcohol-related mortality and morbidity among U.S. college students ages 18–24. *Journal of Studies on Alcohol*. 2002; 63:136–144. [PubMed: 12033690]
- 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, Suppl*. 2009; 16:12–20.
- Hu L, Bentler PM. Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling*. 1999; 6:1–55.
- Kline, RB. *Principles and Practice of Structural Equation Modeling*. 2nd ed.. New York, NY: Guilford; 2005.
- Kypri K, Hallett J, Howat P, McManus A, Maycock B, Bowe S, Horton NJ. Randomized controlled trial of proactive web-based alcohol screening and brief interventions for university students. *Archives of Internal Medicine*. 2009; 169(16):1508–1514. [PubMed: 19752409]
- LaBrie JW, Lac A, Kenney SR, Mirza T. Protective behavioral strategies mediate the effect of drinking motives on alcohol use among heavy drinking college students: gender and race differences. *Addictive Behaviors*. 2011; 36:354–361. [PubMed: 21215529]
- Leeman RF, Palmer RS, Corbin WR, Romano DM, Meandzija B, O'Malley SS. A pilot study of naltrexone and basics for heavy drinking young adults. *Addictive Behaviors*. 2008; 33:1048–1054. [PubMed: 18502591]
- Martens MP, Ferrier AG, Sheehy MJ, Corbett K, Anderson DA, Simmons A. Development of the Protective Behavioral Strategies Survey. *Journal of Studies on Alcohol and Drugs*. 2005; 66:698–705.
- Martens MP, Martin JL, Littlefield AK, Murphy JG, Cimini MD. Changes in protective behavioral strategies and alcohol use among college students. *Drug and Alcohol Dependence*. 2011; 118:504–507. [PubMed: 21612879]
- Martens MP, Pederson ER, LaBrie JW, Ferrier AG, Cimini MD. Measuring alcohol-related protective behavioral strategies among college students: Further examination of the Protective Behavioral Strategies Scale. *Psychology of Addictive Behaviors*. 2007; 21:307–315. [PubMed: 17874881]

- 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]
- Muthèn, LK.; Muthèn, BO. *Mplus user's guide*. Los Angeles: Muthèn & Muthèn; 1998–2009.
- Myers, LS.; Gamst, G.; Gaurino, AJ. *Applied Multivariate Research*. Thousand Oaks, CA: Sage Publications; 2006.
- Naimi TS, Brewer RD, Mokdad A, Denny C, Serdula MK, Marks JS. Binge drinking among U.S. adults. *Journal of the American Medical Association*. 2003; 289:70–75. [PubMed: 12503979]
- O'Malley PM, Johnston LD. Epidemiology of alcohol and other drug use among American college students. *Journal of Studies on Alcohol, Supplement*. 2002; 14:23–39. [PubMed: 12022728]
- Palmer, RS. Efficacy of the alcohol skills training program in mandated and non mandated heavy drinking college students. Seattle: University of Washington; 2004. (Unpublished doctoral dissertation).
- Palmer RS, Corbin WR, Cronce JM. Protective strategies: A mediator of risk associated with age of drinking onset. *Addictive Behaviors*. 2010; 35:486–491. [PubMed: 20092955]
- Palmer RS, McMahon TJ, Rounsaville BJ, Ball SA. Coercive sexual experiences, protective behavioral strategies, alcohol expectancies and consumption among male and female college students. *Journal of Interpersonal Violence*. 2010b; 25(9):1563–1578. [PubMed: 20040711]
- Park CL. Positive and negative consequences of alcohol consumption in college students. *Addictive Behaviors*. 2004; 29:311–321. [PubMed: 14732419]
- Steenkamp JEM, Baumgartner H. Assessing measurement invariance in cross national consumer research. *Journal of Consumer Research*. 1998; 25:78–90.
- Steiger, JH.; Lind, JC. Statistically-based tests for the number of common factors. Paper presented at the Psychometrika Society Meeting; Iowa City. 1980.
- 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]
- Sugarman DE, Carey KB. Drink less or drink slower: The effects of instruction on alcohol consumption and drinking control strategy use. *Psychology of Addictive Behaviors*. 2009; 23:577–585. [PubMed: 20025364]
- Sullivan JT, Sykora K, Schneiderman J, Naranjo CA, Sellers EM. Assessment of alcohol withdrawal: the revised clinical institute withdrawal assessment for alcohol scale (CIWA-Ar). *British Journal of Addiction*. 1989; 84:1353–1357. [PubMed: 2597811]
- Suls J, Green P. Pluralistic ignorance and college student perceptions of gender specific alcohol norms. *Health Psychology*. 2003; 22:479–496. [PubMed: 14570531]
- Tabachnick, BG.; Fidell, LS. *Using multivariate statistics*. 5th Ed.. Boston: Allyn and Bacon; 2007.
- Tucker LR, Lewis C. A reliability coefficient for maximum likelihood factor analysis. *Psychometrika*. 1973; 38:1–10.
- Vandenberg RJ, Lance CE. A review and synthesis of the measurement invariance literature: suggestions, practices, and recommendations for organizational research. *Organizational Research Methods*. 2000; 3:4–70.
- Wechsler H, Lee JE, Kuo M, Seibring M, Nelson TF, Lee H. Trends in college binge drinking during a period of increased prevention efforts. Findings from 4 Harvard School of Public Health College Alcohol Student surveys: 1993–2001. *Journal of American College Health*. 2002; 51:203–217. [PubMed: 11990979]
- Werch CE, Gorman DR. Relationship between self-control and alcohol consumption patterns and problems of college students. *Journal of Studies on Alcohol*. 1988; 49:30–37. [PubMed: 3347074]
- White HR, Labouvie EW. Towards the assessment of adolescent problem Drinking. *Journal of Studies on Alcohol*. 1989; 50(1):30–37. [PubMed: 2927120]

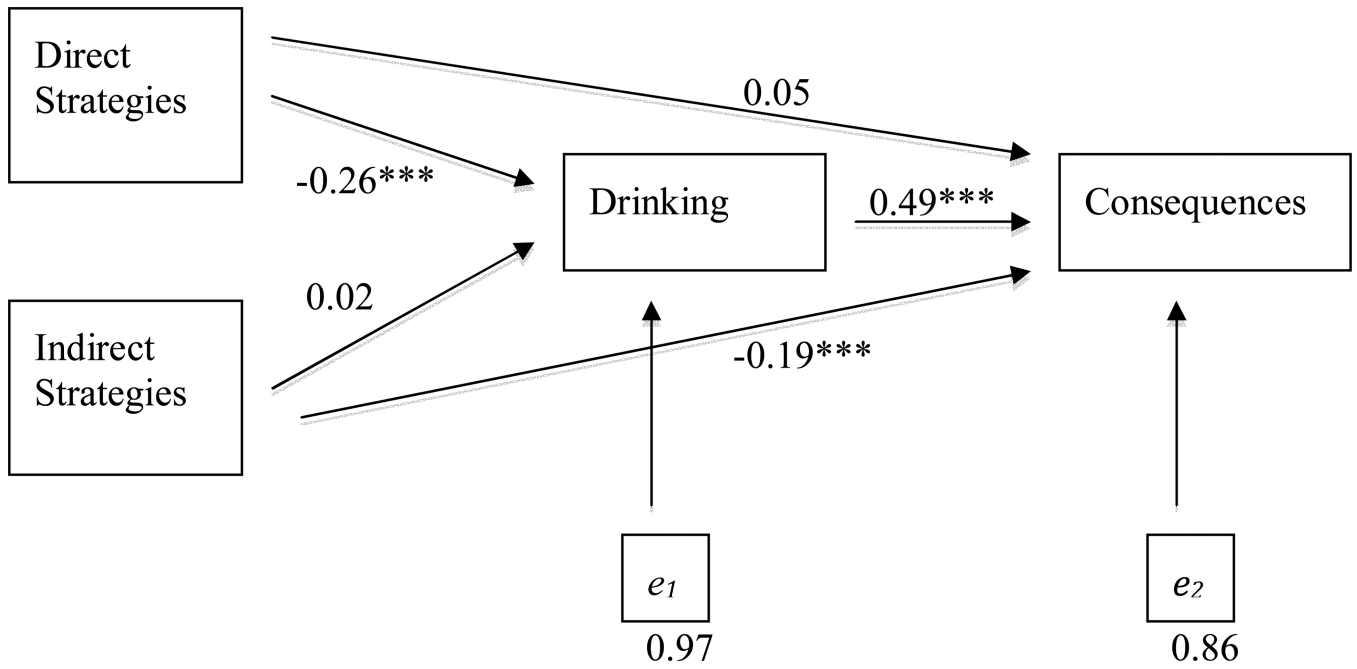


Figure 1. Path model of the relationships among Direct and Indirect Strategies, alcohol consumption, and alcohol-related consequences in a university sample ($N = 370$)
Note. Only direct effects are illustrated. $^{***} p < 0.001$.

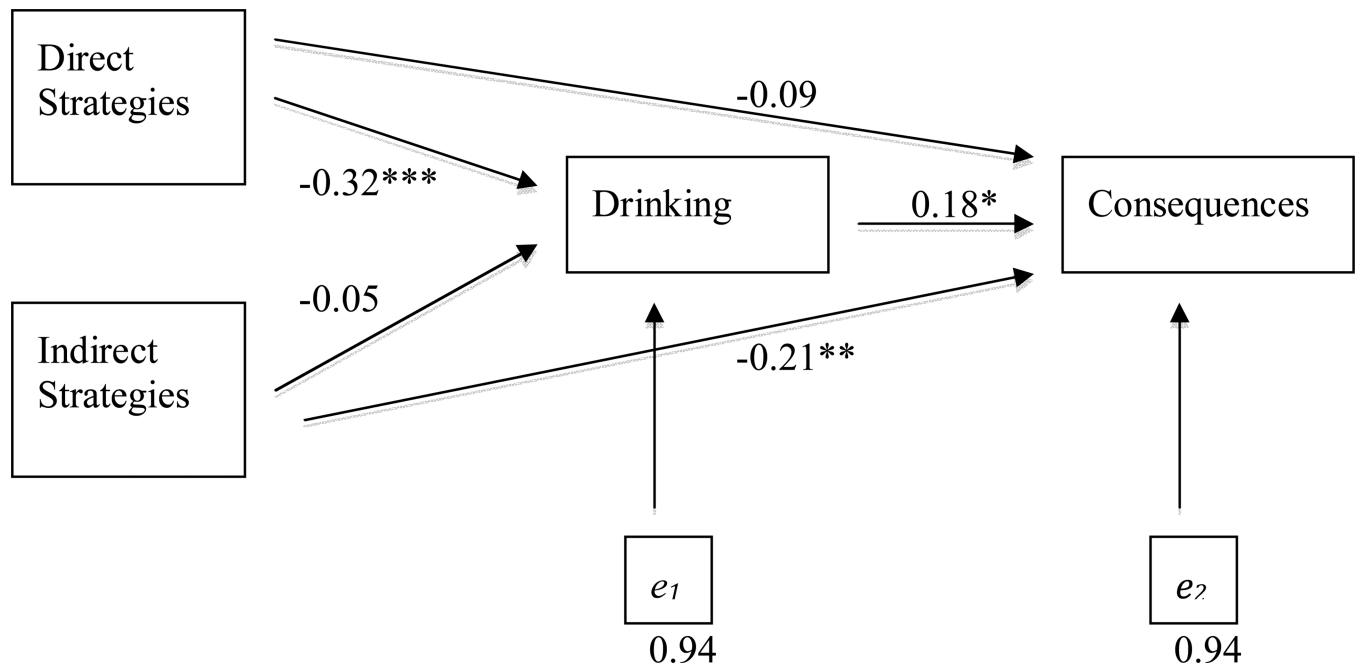


Figure 2. Path model of the relationships among direct and indirect strategies, alcohol consumption, and alcohol-related consequences in a clinical sample ($N = 168$)
Note. Only direct effects are illustrated. $^{***} p < 0.001$.

Table 1

Rotated Two-Factor Principle Components Analysis Solution for Protective Behavioral Strategies Questionnaire (N = 197)

Item	Direct Strategies Factor	Indirect Strategies Factor
Count the number of drinks I have over the course of the night	0.60	0.26
Have a set number of drinks I will have for the social occasion	0.73	0.18
Space my drinks out over time	0.76	0.25
Alternate alcoholic drinks with non-alcoholic drinks	0.71	0.21
Drink for quality not quantity	0.74	0.13
Avoid drinking games	0.63	0.11
Have a reliable designated driver	0.23	0.86
Pre-plan transportation to get home	0.13	0.89
Use protection with a sexual partner	0.21	0.72
Have a plan with a friend to watch out for each other	0.24	0.70

Note. Varimax rotation was used.

Table 2

Fit Indices for Confirmatory Factor Analyses on the Protective Behavioral Strategies Questionnaire Using Two Independent Samples of Young Adult Drinkers

Dataset	χ^2	<i>df</i>	<i>p</i>	CFI/TLI	RMSEA	SRMR
University	48.16	34	0.05	0.97/0.96	0.05	0.05
Clinical	52.90	34	0.02	0.95/0.93	0.06	0.06

Note. *N* for University Sample = 173. Total *N* for Clinical Sample = 168. CFI = Comparative Fit Index; TLI = Tucker-Lewis Index; RMSEA = Root-Mean-Square Error of Approximation; SRMR = Standardized Root Mean Square Residual

Table 3
Factors, Items, Standardized Item Loadings and Z-Scores for the Protective Behavioral Strategies (PBS) Scale in Two Independent Samples of Young Adult Drinkers

Factor and Item	Dataset		z-score
	University (<i>n</i> = 173)	Clinical (<i>n</i> = 168)	
	Item Loading	Item Loading	z-score
Factor 1 – Direct Strategies			
Count of the number of drinks I have over the course of the night	0.56	0.63	8.47
Have a set number of drinks I will have for the social occasion	0.60	0.62	7.40
Space my drinks out over time	0.75	0.76	13.79
Alternate alcoholic drinks with non-alcoholic drinks	0.66	0.69	13.00
Drink for quality not quantity	0.56	0.46	4.65
Avoid drinking games	0.52	0.44	5.58
Factor 2 – Indirect Strategies			
Have a reliable designated driver	0.96	0.81	13.63
Pre-plan transportation to get home	0.86	0.84	16.82
Use protection with a sexual partner	0.44	0.36	4.04
Have a plan with a friend to watch out for each other	0.57	0.43	5.55