

# Measuring Alcohol-Related Protective Behavioral Strategies Among College Students: Further Examination of the Protective Behavioral Strategies Scale

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Heavy drinking among college students has been recognized as a public health problem on American college campuses (e.g., R. Hingson, T. Heeren, M. Winter, & H. Wechsler, 2005). Recently, protective behavioral strategies, or cognitive-behavioral strategies that can be implemented when using alcohol to reduce consumption and resulting negative consequences, have been shown to be associated with less alcohol use and fewer alcohol-related problems (e.g., S. L. Benton et al., 2004; M. P. Martens et al., 2005). The purpose of the present study was to conduct additional psychometric work on a measure designed to assess the use of such strategies: the Protective Behavioral Strategies Scale (PBSS; M. P. Martens et al., 2005). Data were collected on 505 undergraduate students from 2 universities who reported having consumed alcohol at least once in the past 30 days. Results of a confirmatory factor analysis supported the hypothesized 3-factor version of the PBSS, and scores on each subscale were correlated in the expected direction with both alcohol use and alcohol-related problems. Thus, the PBSS appears to be reliable and valid for use among college student drinkers.

*Keywords:* alcohol, college students, protective behaviors, assessment

The problem of excessive alcohol use among college students has been well established. National studies have indicated that approximately 40% of college students report having engaged in heavy episodic drinking at least once in the preceding 2 weeks (Johnston, O'Malley, Bachman, & Schulenberg, 2005; Wechsler et al., 2002), that approximately 20% of college students met diagnostic criteria for alcohol abuse or dependence in the preceding 12 months (Dawson, Grant, Stinson, & Chou, 2004), and that college students tend to drink more than their non-college-attending peers (Dawson et al., 2004). Furthermore, epidemiological studies documenting the larger public health problems caused by heavy drinking among college students have estimated that each year 1,700 deaths, 500,000 unintentional injuries, and 600,000 assaults can be attributed to college student drinking (Hingson, Heeren, Winter, & Wechsler, 2005). Heavy drinking is also associated with disrup-

tions in both personal and academic life ranging from missed classes and poor grades to relationship and legal problems (Hingson et al., 2005; Wechsler, Lee, Kuo, & Lee, 2000); it also interferes with the lives of nondrinking, or lighter drinking, peers (Perkins, 2002).

Given the scope of the problem of college student drinking, it is important that researchers identify strategies or behaviors associated with reduced alcohol use and alcohol-related consequences. Recently, researchers have established that specific protective behavioral strategies are associated with less drinking and fewer alcohol-related problems (Benton et al., 2004; Delva et al., 2004; Martens et al., 2004, 2005). The purpose of the present study was to conduct additional psychometric work on a measure designed to assess such strategies: the Protective Behavioral Strategies Scale (PBSS; Martens et al., 2005).

Researchers have established that a host of general protective factors are associated with decreased risk of heavy drinking, including biochemical and genetic factors, a number of familial variables (e.g., high parental bonding, parental abstinence), and fewer early behavioral problems (for reviews, see Hawkins, Catalano, & Arthur, 2002; Hawkins, Catalano, & Miller, 1992). Although these factors are useful in understanding the reasons for which an individual may eventually engage in heavy drinking and may be important in community-based prevention activities, they have limited utility in the context of understanding ways to reduce such drinking via individual intervention efforts. This is primarily because many of the factors (e.g., one's ethnicity, parental treatment as a child, biochemical makeup) are either difficult or im-

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possible to change via intervention efforts. In contrast, protective behavioral strategies are defined as specific cognitive-behavioral strategies that can be used by an individual to help reduce his or her alcohol use and the negative consequences resulting from such use. Protective behavioral strategies, then, have the potential to be an active component in alcohol-related clinical and educational interventions.

Protective behavioral strategies are consistent with the harm reduction model of reducing heavy drinking (Marlatt, Baer, & Larimer, 1995; Marlatt, Larimer, Baer, & Quigley, 1993), an approach that is especially relevant for college students considering the pervasive role of alcohol in the social culture at many institutions. The harm reduction model places behaviors such as alcohol consumption on a continuum of harmful consequences. Any reduction of such consequences is considered "successful," even if the individual does not abstain completely from the behavior. In previous research, protective behavioral strategies have been generally conceptualized as strategies that one can implement when choosing to use alcohol. For example, researchers have assessed the degree to which individuals engage in behaviors such as alternating alcoholic and nonalcoholic beverages, making one's own drinks, and avoiding drinking games (Benton et al., 2004; Martens et al., 2005), all of which assume that the individual will be consuming some alcohol. Therefore, protective behavioral strategies can be conceptualized as harm-reduction strategies that are especially relevant to populations in which most individuals engage in at least some alcohol consumption, such as the collegiate population.

Initial research on protective behavioral strategies among college students has been promising, as a number of studies have found that their use was associated with fewer alcohol-related consequences. Delva et al. (2004) demonstrated a direct relationship between use of the strategies and fewer alcohol-related problems, whereas Benton et al. (2004) and Martens et al. (2004) both found that use of the strategies was associated with fewer alcohol-related consequences even after controlling for alcohol consumption. All three of these studies, however, suffered from methodological limitations involving self-report measures of the construct. Specifically, the researchers in each of these studies failed to provide adequate support for the validity of their instruments. Both Benton et al. (2004) and Martens et al. (2004) used the protective behavioral strategies measure from the National College Health Assessment (American College Health Association, 2005). Although both groups of researchers reported adequate internal consistency of the individual items ( $\alpha = .74-.80$ ), they did not specify any construct validation procedures such as factor analysis. Benton et al. (2004) did conduct a principal components analysis on their set of items, but with inconclusive results. For example, they reported that in their initial principal components analysis the scree plot and Kaiser's criteria supported a two-factor solution, but the authors chose to retain a one-factor solution due to low internal consistencies and item-total correlations of the second factor. These equivocal results suggest that it is not clear if the protective behavioral strategies construct is best represented by one general factor or multiple subfactors. Additionally, the researchers in these studies made no mention of how the specific items were developed (i.e., content validity procedures).

In an effort to address the methodological limitations of this prior research, Martens et al. (2005) developed a new self-report measure

designed to assess protective behavioral strategies: the Protective Behavioral Strategies Scale (PBSS). The authors initially constructed a set of 25 potential items and, through a variety of procedures including exploratory factor analysis (EFA), found support for the construct validity of a 15-item, three-factor version of the scale. Results of the EFA indicated that the three factors (which were labeled Stopping/Limiting Drinking, Manner of Drinking, and Serious Harm Reduction) were empirically distinct from one another, and, as a whole, the solution accounted for more than 50% of the variability in the items. All items loaded on only their primary factor (the highest crossloading was .28), and most of the loadings were strong in magnitude ( $> .50$ ). Other validity analyses indicated that, after controlling for various demographic factors, PBSS scores were associated with 10% to 17% of the variance in measures of alcohol consumption and alcohol-related problems.

Although results from the Martens et al. (2005) study provided initial support for the construct validity of the PBSS, there were two important methodological limitations to their work. First, the validity of the PBSS factor structure was tested via EFA only; the three-subscale version of the measure has not yet been tested via confirmatory factor analysis (CFA) on an independent sample. CFA is generally considered to be a more stringent test of an instrument's factor structure because, in comparison to EFA, the researcher must specify a priori the hypothesized structure of the measure (Hoyle & Duvall, 2004). Additionally, the researcher can test the degree to which his or her theoretical model provides a better fit to the data than competing, yet theoretically plausible, models (Noar, 2003). It is therefore useful, after a scale's initial factor structure has been established via EFA, for a researcher to attempt to confirm (or disconfirm) this hypothesized structure. Second, the Martens et al. (2005) study used a homogeneous sample that comprised volunteer students from a large state university in a single geographic region (the Northeast). A more diverse sample is needed to provide additional external validity for the measure, as the psychometric properties of a scale can vary among different subgroups of the population of interest. It is possible, for example, that the factor structure of the PBSS would be different when assessed among individuals from different types of institutions or among volunteer versus judicially mandated students (i.e., individuals who have committed a campus alcohol infraction). Judicially mandated students participating in a research project may, in general, engage in more severe or risky types of drinking than volunteer participants (Barnett et al., 2004; Fromme & Corbin, 2004), and research has shown that drinking rates often vary based on factors such as the geographic location of an institution (Wechsler et al., 2000). Therefore, research demonstrating that the psychometric properties of the PBSS are consistent between samples of volunteer and judicially mandated students and among samples of students from diverse geographic locations would provide strong support for the generalizability of the measure. The purpose of the present study, then, was to conduct CFAs on a sample of college students from different institutions that included both volunteer and judicially mandated participants.

## Method

### *Participants*

Participants for this study were 505 undergraduate students who reported having consumed alcohol at least once over the

past 30 days. Approximately two thirds of the sample ( $n = 327$ ) was from a large public university in the Northeast, whereas the remaining students ( $n = 178$ ) were from a midsize private university on the West Coast. Among the students from the Northeast university, 27.5% ( $n = 90$ ) were volunteer students, whereas the remaining ( $n = 237$ ) participated in the study as an option for satisfying an alcohol-related campus judicial infraction. All of the participants from the West Coast subsample volunteered for class credit through their psychology department subject pool. The mean age for the sample was 19.14 years ( $SD = 1.39$ ). Most of the participants were either freshmen (38.6%) or sophomores (36.2%), with juniors (15.4%) and seniors (9.7%) less represented. There were slightly more men (50.3%) than women, and most of the participants were White (74.9%). Other ethnic representations were as follows: 10.1% Hispanic, 5.3% Asian/Pacific Islander, 4.4% biracial, 3.0% Black, and 2.4% other. There were no significant gender, year in school, or age differences between the combined Northeast subsamples and West Coast subsample (ethnic differences were not assessed because of low numbers in many ethnicity categories). However, the judicially mandated subsample from the Northeast university had more men (62.0%) than the other subsamples (30.0% for the volunteer Northeast subsample and 44.9% for the West Coast subsample), and the volunteer Northeast subsample was older ( $M = 19.94$  years) than the other subsamples ( $M = 19.16$  years and 18.81 years for the judicially referred Northeast and West Coast subsamples, respectively).

### Measures

**PBSS.** Participants completed the PBSS (Martens et al., 2005) to assess cognitive-behavioral strategies designed to reduce high-risk drinking and resulting negative alcohol-related consequences. We discussed the measure earlier in the article and will provide only a brief summary here. Participants are asked to "indicate the degree to which you engage in the following behaviors when using alcohol or 'partying'" and respond to the 15 items via a 6-point scale ranging from 1 (*never*) to 6 (*always*). Scores are reported on three subscales: Stopping/Limiting Drinking (e.g., "Determine not to exceed a set number of drinks"), Manner of Drinking (e.g., "Drink slowly, rather than gulp or chug"), and Serious Harm Reduction (e.g., "Use a designated driver"). A copy of the measure is provided in the Appendix.

**Alcohol consumption measures.** We used two indices of alcohol consumption. First, all participants completed a measure of heavy episodic drinking in the past 2 weeks, which was defined as either five (for all men and for women in the volunteer Northeast subsample) or four (for women in the judicially referred Northeast and West Coast subsamples) or more drinks at one sitting. We also calculated average drinks per week for all participants. This was done via the Daily Drinking Questionnaire (Collins, Parks, & Marlatt, 1985) in the Northeast subsamples and self-report quantity/frequency items in the West Coast subsample.

**Rutgers Alcohol Problem Index (RAPI).** All participants completed the RAPI (White & Labouvie, 1989) as a measure of problems experienced as a result of alcohol consumption. The RAPI consists of 23 items that ask how many times the person has experienced each problem over a specific period of time (the past 6 months for the Northeast subsamples and the past 1 month for

the West Coast subsample in the present study). Responses are scored on a Likert scale ranging from 0 (*never*) to 4 (*more than 10 times*). The RAPI has been shown to be a valid measure of alcohol-related problems (e.g., White & Labouvie, 1989). The internal consistency with the present sample was satisfactory ( $\alpha = .90$ ).

**Demographics questionnaire.** Participants completed a brief demographics questionnaire that included information such as gender, ethnicity, year in school, and age.

### Procedures

Data collection procedures differed for the three subsamples, but all data were collected online. Volunteer Northeast participants were recruited from several general undergraduate classes that included students with different majors. A research assistant went into the classes, explained that the purpose of the study was to assess factors related to alcohol use among college students, and obtained e-mail addresses from interested individuals. These students were then e-mailed a link to a Web site that contained a consent form and the survey questionnaires. They were informed that the study had been approved by the university institutional review board, participation was voluntary, and they were eligible for one of two \$50 raffle drawings as compensation for participating in the study. Overall, 123 participants took part in the assessment, but 33 participants who had not consumed alcohol at least once in the past month or who did not complete the PBSS measure were excluded from the analyses.

Data from the judicially referred Northeast students were collected as part of a larger study testing the effectiveness of different interventions among judicially mandated college students. Students who committed an alcohol-related infraction at the university were required to attend some type of intervention program but were not required to enroll in the research project. They could choose to enroll in the research project and participate in one of the study's interventions, or they could choose to participate in a brief intervention provided by the university counseling center that involved no research activity. Both the study intervention and counseling center intervention were of similar length. Students who chose to participate in the research project completed a baseline questionnaire that included the measures used in the present study. Those who expressed an interest in participating in the project were contacted by a research assistant and scheduled for an in-person enrollment meeting. At this meeting, participants signed a consent form indicating that they knew that although they were required by the university to participate in some type of alcohol intervention program as a result of their judicial sanction, participation in the current research was voluntary and that all of their research data would be kept confidential. Participants then completed the study measures in a research office and were compensated with a \$25 gift card for their time.

Participants from the West Coast subsample were recruited through the university psychology subject pool. In order to gain subject pool credit, participants agreed to participate in an online assessment questionnaire of alcohol use and attitudes towards alcohol. Each participant was given the option to recruit one or two college-aged peers to complete the online assessment for an additional credit per recruit. A maximum of three credits was given to the subject pool participants. Four other studies independent from

the present study were offered to students as an option to gain subject pool credit. Overall, 229 participants with varying majors took part in the online alcohol assessment. Two participants older than age 25 were excluded from analyses, as were 49 participants who had not drunk at least once in the past month or who did not complete the PBSS measure. Credits were granted to participants regardless of age or drinking status. Prior to the online survey, participants electronically signed a consent form approved by the local institutional review board and were assured of the confidentiality of their responses.

### Data Analysis

After calculating descriptive statistics, including comparisons between our subsamples, we used CFA to test the hypothesized factor structure of the PBSS. As part of our CFAs, we included model comparison procedures and invariance testing. After analyzing the factor structure of the measure, we conducted other tests of reliability and validity, including internal consistency analyses and correlations of the PBSS subscales with measures of alcohol use and alcohol-related problems. Finally, because understanding the negative consequences related to alcohol use is arguably more important than understanding heavy drinking per se (e.g., National Institute on Alcohol Abuse and Alcoholism, 2002), we conducted a relatively stringent test of the relationship between PBSS scores and alcohol-related problems. Specifically, we used hierarchical multiple regression analyses to assess for the relationship between PBSS scores and such problems after controlling for the effects of demographic factors and alcohol consumption itself.

## Results

### Descriptive Statistics

Overall, participants reported a mean of 17.49 drinks per week ( $SD = 17.65$ ,  $Mdn = 14.00$ ), 2.60 heavy episodic drinking episodes in the previous 2 weeks ( $SD = 2.50$ ,  $Mdn = 2.00$ ), and a RAPI score of 9.30 ( $SD = 10.00$ ,  $Mdn = 7.00$ ).<sup>1</sup> The mean maximum number of drinks consumed on a single occasion over the past 30 days was 10.44 ( $SD = 5.33$ ,  $Mdn = 10.00$ ) among those who were asked that question (the judicially referred Northeast and West Coast subsamples,  $n = 414$ ).

There were, however, subsample differences on the variables of interest. For drinks per week,  $F(2, 502) = 21.12$ ,  $p < .001$ , and heavy episodic drinking occasions,  $F(2, 501) = 11.50$ ,  $p < .001$ , the volunteer Northeast subsample ( $M_s = 21.21$  and 2.91, respectively) and judicially mandated Northeast subsample ( $M_s = 21.08$  and 3.01, respectively) reported heavier drinking than the West Coast subsample ( $M = 10.83$  and 1.89, respectively). There were no differences between the two Northeast subsamples. There were also subsample differences on the RAPI,  $F(2, 498) = 9.52$ ,  $p < .001$ , with judicially mandated Northeast ( $M = 10.81$ ) and volunteer Northeast ( $M = 10.48$ ) students reporting more alcohol-related problems than the West Coast subsample ( $M = 9.52$ ). Again, though, no differences emerged between the two Northeast subsamples. Finally, a multivariate analyses indicated between-group differences on the set of three PBSS subscales,  $F(6, 1000) = 2.87$ ,  $p < .01$ . Follow-up univariate analyses indicated significant differences on the Stopping/Limiting Drinking subscale,  $F(2,$

502) = 4.71,  $p < .01$ , and differences approached statistical significance on the Manner of Drinking subscale  $F(2, 502) = 2.63$ ,  $p = .07$ . No subsample differences emerged on the Serious Harm Reduction subscale. For both Stopping/Limiting Drinking and Manner of Drinking, the West Coast subsample reported significantly more use of the protective behavioral strategies than the judicially referred Northeast subsample.

### CFA

*Three-factor PBSS model.* For all CFAs, we used maximum likelihood estimation procedures. For identification purposes, the variance of the factors was set to 1, as was the variance of the error terms. The covariance among the factors was freely estimated, and we also freely estimated the covariance between the error terms for two of the PBSS items: "Leave the bar/party at a predetermined time" and "Stop drinking at a predetermined time." In our initial analysis the modification index for the covariance between the two terms was exceedingly large (Lagrange multiplier test = 112.97). In general, CFA experts caution against correlating error terms unless researchers have a strong theoretical justification for doing so (e.g., Boomsma, 2000; Hoyle & Panter, 1995). In the present example, correlating the error terms associated with these items was theoretically defensible because both items ask about a similar action (stopping one's behavior at a specific time). Therefore, it was plausible that the sources of error for both items were related to each other. Finally, we found that our data did not demonstrate multivariate normality. Therefore, even though maximum likelihood estimation procedures have been shown to be robust to normality violations (Amemiya & Anderson, 1990; Browne & Shapiro, 1988; Chou, Bentler, & Satorra, 1991), we also estimated our data using the Satorra-Bentler adjusted indices (Satorra & Bentler, 1994, 2001), which corrects for deviations from normality. The results from these analyses were almost identical to the regular maximum likelihood estimates, so we decided to report the output from the standard estimation procedures.

To assess model fit, we used the chi-square statistic, comparative fit index (CFI; Bentler, 1990), incremental fit index (IFI; Bollen, 1989), root mean square error of approximation (RMSEA; Steiger & Lind, 1980), and standardized root mean square residual (SRMR). Higher CFI and IFI values and lower RMSEA and SRMR values are associated with better model fit. Values at or above .90 to .95 for the CFI and IFI, values at or below .05 to .08 for the SRMR, and values at or below .06 to .08 for the RMSEA are considered indicative of a well-fitting model (e.g., Browne & Cudeck, 1993; Byrne, 2001; Hatcher, 1994; Hu & Bentler, 1999; MacCallum, Browne, & Sugawara, 1996; Sun, 2005).

Fit indices from the three-factor model are presented in Table 1, and the standardized regression parameters (i.e., factor loadings) are presented in Table 2. In general, the model provided a good fit to the data. Although the chi-square statistic was statistically significant (and therefore not indicative of a good model fit),  $\chi^2(86, N = 505) = 318.73$ ,  $p < .001$ , a significant chi-square will often occur with well-fitting models when there is a large sample size because of high statistical power (Gerbing & Anderson, 1993;

<sup>1</sup> Note that, as described in the Method section, heavy episodic drinking was defined slightly differently for women across the subsamples, as was the timeframe associated with RAPI scores.

Table 1  
Summary of Fit Indices for PBSS Confirmatory Factor Analysis Models

Model	$\chi^2$	df	CFI	IFI	RMSEA	SRMR
Three-Factor PBSS	318.73	86	.91	.91	.07	.06
Two-Factor PBSS	452.14	88	.85	.85	.09	.07
One-Factor PBSS	529.40	89	.82	.82	.10	.07

Note. PBSS = Protective Behavioral Strategies Scale; CFI = Comparative Fit Index; IFI = Incremental Fit Index; RMSEA = Root mean square error of approximation; SRMR = Standardized root mean square residual.

Marsh, Balla, & McDonald, 1988). In contrast, the values for the CFI, IFI, RMSEA, and SRMR all indicated a good model fit. The CFI and IFI values were above common thresholds for acceptable fit, whereas the RMSEA and SRMR were below such thresholds. The magnitude of the standardized factor loadings also supported the fit of the three-factor model.

*Model comparison.* CFA experts warn against testing only one model when conducting CFA/structural equation modeling analyses for two main reasons: Multivariate data sets often contain multiple models that could explain the data, and researchers are susceptible to confirmation biases when testing only a single model (MacCallum & Austin, 2000; McDonald & Ho, 2002). Therefore, in the present study we compared the fit of the three-factor model with a single-factor PBSS model that would be theoretically plausible (i.e., the data were best represented by a single Protective Behaviors latent construct). We also tested a two-factor model, as one could argue that the Serious Harm Reduction items (e.g., “Know where your drink has been at all times”) are conceptually similar to the Manner of Drinking items. Because all models are nested, we used the chi-square difference test to determine if the three-factor PBSS model provided a significantly better fit than the one- and two-factor models. Results indicated that the chi-square value for the three-factor model was significantly lower than the value for the two-,  $\chi^2_{diff}(2) = 133.41$ ,

$p < .001$ , and one-factor models,  $\chi^2_{diff}(3) = 210.67$ ,  $p < .001$ . Furthermore, fit indices for the one- and two-factor models were worse than for the three-factor model (see Table 1). Therefore, we concluded that the hypothesized three-factor model provided the best fit to the data.

*Invariance testing.* We conducted invariance testing to determine if PBSS estimated regression parameters and factor covariances were consistent across two separate comparisons: judicially mandated versus volunteer students, and Northeast versus West Coast students. Invariance testing involves estimating two models: one where the parameters of interest are freely estimated between the two subgroups, and one where the parameters are constrained to be equivalent between the groups. If the model is in fact invariant between the groups, then the fit of the two models will not differ from each other. For the volunteer–judicially mandated comparisons, results from the chi-square difference test indicated that the fits of the freely estimated and constrained models were not significantly different,  $\chi^2_{diff}(19) = 20.51$ ,  $p = .36$ , and therefore invariant. Similarly, for the Northeast–West Coast comparisons, the chi-square difference test was not significantly different,  $\chi^2_{diff}(19) = 21.21$ ,  $p = .33$ . Thus, we concluded that the regression parameters and covariances of the three-factor model were consistent between both volunteer and judicially mandated participants and participants from both universities, indicating that the

Table 2  
Item Standardized Regression Coefficients, Squared Multiple Correlations (SMCs), and Item Descriptive Statistics for the Three-Factor PBSS

Item	Coefficient	SMC	M	SD
<b>Stopping/Limiting Drinking</b>				
2. Determine not to exceed a set number of drinks	.75	.57	3.23	1.58
3. Alternate alcoholic and nonalcoholic drinks	.65	.43	2.71	1.50
4. Have a friend let you know when you have had enough to drink	.65	.43	2.90	1.66
6. Leave the bar/party at a predetermined time	.64	.41	2.69	1.42
10. Stop drinking at a predetermined time	.65	.43	2.63	1.40
11. Drink water while drinking alcohol	.47	.22	2.94	1.57
12. Put extra ice in your drink	.52	.28	2.48	1.48
<b>Manner of Drinking</b>				
5. Avoid drinking games	.60	.36	2.50	1.51
9. Drink shots of liquor	.32	.10	2.79	1.21
13. Avoid mixing different types of alcohol	.69	.48	3.34	1.58
14. Drink slowly, rather than gulp or chug	.76	.57	3.52	1.42
15. Avoid trying to “keep up” or “out-drink” others	.65	.43	3.85	1.53
<b>Serious Negative Consequences</b>				
1. Use a designated driver	.31	.09	5.08	1.28
7. Make sure that you go home with a friend	.81	.65	4.87	1.48
8. Know where your drink has been at all times	.67	.45	5.12	1.29

Note. PBSS = Protective Behavioral Strategies Scale. Item 9 is reverse scored.

PBSS hypothesized factor structure was supported across the different groups of students.

### *Additional Reliability and Validity Analyses*

We conducted convergent validity analyses by correlating scores on the PBSS subscales with measures of alcohol consumption and alcohol-related problems via RAPI total scores. Results of these analyses are presented in Table 3 and suggest that all three subscales were associated with both alcohol consumption and alcohol-related problems in the expected direction (higher PBSS scores were associated with less alcohol use and fewer alcohol-related problems). Additionally, correlations between the PBSS subscales and the alcohol-related outcome variables were comparable across the subsamples and statistically significant for each comparison, with the exception of the Serious Harm Reduction–drinks per week correlation for the volunteer Northeast subsample ( $p = .09$ ). Correlations among the subscales themselves were .35 (Manner of Drinking–Serious Harm Reduction), .41 (Stopping/Limiting Drinking–Serious Harm Reduction), and .60 (Manner of Drinking–Stopping/Limiting Drinking), suggesting that the subscales measured related, yet distinct, constructs. Furthermore, hierarchical multiple regression analyses indicated that, as a whole, the three subscales were significant predictors of RAPI total scores, even after controlling for relevant demographic variables (gender and age) and actual alcohol consumption,  $\Delta F(3, 492) = 3.78, p = .01, \Delta R^2 = .02$ . Of the three subscales, Serious Harm Reduction demonstrated the strongest unique relationship with RAPI scores ( $\beta = -.10, p = .03$ ). Although the magnitude of the overall effect was relatively small, one should consider that this analysis involved a stringent test of PBSS incremental validity in predicting RAPI scores, as heavy episodic drinking and demographic variables accounted for a considerable portion of variance on the measure (24%). Finally, coefficient alphas were .82, .74, and .59 for the Stopping/Limiting Drinking, Manner of Drinking, and Serious Harm Reduction subscales, respectively. The relatively low internal consistency score for Serious Harm Reduction can be partially attributed to the fact that the subscale contains only three items, but also because the item “Use a designated driver” demonstrated a moderate item–total correlation for the subscale ( $r = .23, p < .01$ ). Overall, however, the results of these additional reliability and validity analyses provided further support for the psychometric properties of the PBSS.

### Discussion

The purpose of the present study was to conduct psychometric analyses on a recently developed measure, the PBSS, which was

designed to assess behaviors that will theoretically limit alcohol use and resulting negative consequences among college students. Results of the study provide support for the hypothesized three-factor PBSS model (Stopping/Limiting Drinking, Manner of Drinking, and Serious Harm Reduction) in three ways: The model fit from a CFA was good, the model fit of the three-factor model was superior to that of a one- or two-factor model, and the model parameters were consistent between the samples of students from the different universities used in the study. Furthermore, scores on the PBSS subscales were correlated with relevant criterion measures in the expected direction. Although minor psychometric limitations emerged, we believe that the strengths of the measure outweigh these limitations and that the PBSS shows promise as both a research and clinical tool.

There are a number of potentially important research implications associated with developing a psychometrically sound measure of protective behavioral strategies. The use of such strategies has been discussed in alcohol intervention manuals (e.g., the Brief Alcohol Screening and Intervention for College Students program; Dimeff, Baer, Kivlahan, & Marlatt, 1999), but until recently no means of systematically and accurately assessing protective behavioral strategies existed. We envision that the PBSS may be used in various ways during future research studies with college students. First, we believe that one’s use of protective behavioral strategies can be included as an independent or predictor variable in understanding different alcohol-related outcome variables. This research and prior work (e.g., Martens et al., 2005) have shown that scores on the measure are associated with alcohol use and related problems, but one’s use of protective behavioral strategies may also be associated with other alcohol-related variables. For example, scores on the PBSS may correlate with constructs such as drinking motives, alcohol expectancies, and positive alcohol-related consequences. Assessing the degree to which one’s use of protective behavioral strategies is associated with such variables would provide researchers with enhanced understanding of different mechanisms related to heavy alcohol use among college students. Second, we anticipate that scores on the PBSS may be important mediating and/or moderating variables in intervention studies designed to reduce heavy alcohol use or in longitudinal studies designed to explain drinking among college students. It is possible, for example, that use of protective behavioral strategies would mediate a relationship between intervention condition and treatment outcome, such that participating in the treatment condition would increase one’s use of protective behavioral strategies, which would subsequently decrease alcohol use and negative alcohol-related consequences. Finally, and considering the correlational relationships between PBSS scores and alcohol use, we

Table 3  
*Correlation of Protective Behavioral Strategies Scale Subscales With Alcohol Consumption and Alcohol-Related Problems*

Alcohol variable	Stopping/limiting drinking	Manner of drinking	Serious harm reduction
Heavy episodic drinking ( $n = 501$ )	-.28**	-.33**	-.15**
Drinks per week ( $n = 505$ )	-.33**	-.34**	-.16**
Rutgers Alcohol Problem Index score ( $n = 501$ )	-.24**	-.27**	-.21**

\*\*  $p < .01$ .

believe that protective behavioral strategies are a meaningful criterion variable in and of themselves. Therefore, studies that assess variables associated with changes in one's use of such strategies may be useful in combating the problem of heavy drinking among college students.

In addition to the aforementioned research implications, the PBSS may have promise as a clinical tool, particularly in terms of brief, feedback-based motivational interventions. We believe that using the PBSS in brief intervention formats has particular promise, as the specific strategies assessed on the PBSS are tangible and would be straightforward to address in an intervention session. For example, in a commonly used two-session model in which an individual completes a number of assessments in the first session and meets with a clinician to receive personalized feedback in the second (e.g., Borsari & Carey, 2000; Marlatt et al., 1998), a student's use of each PBSS item could be assessed. Then, in the meeting with the clinician, part of the session could be devoted to reinforcing those specific strategies that are already used and exploring ways to increase the use of those strategies that are not endorsed. Charting changes in one's use of specific behaviors could also be a useful marker for individual treatment improvements. Finally, we believe that students will find that the behaviors addressed in many of the items are consistent with common drinking experiences in the collegiate environment (e.g., drinking shots, participating in drinking games, keeping up with others' drinking rates), which would make the strategies more salient and easy to implement. We do recommend some caution regarding the clinical use of the PBSS until more studies have been conducted on the scale, but we nonetheless believe that the measure has potentially useful implications for experts conducting alcohol-related interventions and treatments with college students.

Limitations to this study do exist, including two potential concerns regarding the psychometric properties of the PBSS. First, the items that assessed drinking shots of liquor and using a designated driver had relatively low factor loadings, although both loadings were statistically significant. Although concern regarding the magnitude of these items' loadings is reasonable, we nonetheless feel that they are important elements of any measure designed to assess protective behavioral strategies among college students. Both items demonstrated significant individual correlations with the alcohol-related criterion measures ( $r_s = -.14$  to  $-.22$ ,  $p < .002$ ), supporting their external validity in predicting less alcohol use and fewer alcohol-related consequences. Furthermore, both items could potentially be useful components of clinical applications involving the PBSS, as they may represent protective behavioral strategies that are intuitive and fairly easy to implement for many college students. A second finding that could raise concerns is the relatively low internal consistency of the Serious Negative Consequences subscale. This subscale, though, demonstrated adequate external validity through significant correlations with the alcohol-related criterion variables, most notably a significant relationship with alcohol-related problems even after controlling for demographic variables and alcohol consumption itself. Therefore, and considering the overall psychometric support for the entire three-factor, 15-item measure, we believe that the strengths of the PBSS outweigh these potential limitations.

Other methodological limitations mark the study. First, all data were collected via self-report questionnaires, and the honesty of the responses could not be determined. Participants were guaran-

teed anonymity or confidentiality, though, and self-report measures of alcohol-related variables have generally been shown to be reliable and valid (e.g., Babor, Steinberg, Anton, & del Boca, 2000; Miller et al., 2002). Second, even though data were collected from different universities with three different samples of students, the generalizability of the results to all college students cannot be determined. Finally, our convergent validity analyses were conducted within the same sample used to test the factor structure of the measure, although we should note that the results of these analyses were consistent with those of other studies in the area of protective behavioral strategies (e.g., Delva et al., 2004; Martens et al., 2005).

Despite these limitations, this study provides additional psychometric support for the PBSS and evidence that the measure has promise for use in research and clinical work in the area of college student drinking. We encourage future researchers to continue to conduct psychometric analyses of the PBSS, particularly with samples that differ from those used in prior studies on the measure (e.g., samples that include more students of color). We also encourage researchers to examine potential gender and ethnic differences in PBSS scores. We noted that women in the present study used protective behavioral strategies more frequently than men, but understanding why this occurred was beyond the scope of the study. Finally, we especially hope that researchers will begin testing the utility of the measure in clinical or treatment-oriented studies, as we believe that the PBSS has particular promise in helping to address the problems associated with excessive alcohol consumption in the collegiate environment.

## References

- Amemiya, Y., & Anderson, T. W. (1990). Asymptotic chi-square tests for a large class of factor analysis models. *Annals of Statistics*, *18*, 1453–1463.
- American College Health Association. (2005). The American College Health Association National College Health Assessment (ACHA-NCHA), Spring 2003 reference group report. *Journal of American College Health*, *53*, 199–210.
- Babor, T. F., Steinberg, K., Anton, R., & del Boca, F. K. (2000). Talk is cheap: Measuring drinking outcomes in clinical trials. *Journal of Studies on Alcohol*, *61*, 55–63.
- Barnett, N. P., Tevyaw, T. O., Fromme, K., Borsari, B., Carey, K. B., Corbin, W. R., et al. (2004). Brief alcohol interventions with mandated or adjudicated college students. *Alcoholism: Clinical and Experimental Research*, *28*, 966–975.
- Bentler, P. M. (1990). Comparative fit indexes in structural models. *Psychological Bulletin*, *107*, 238–246.
- Benton, S. L., Schmidt, J. L., Newton, F. B., Shin, K., Benton, S. A., & Newton, D. W. (2004). College student protective strategies and drinking consequences. *Journal of Studies on Alcohol*, *65*, 115–121.
- Bollen, K. A. (1989). A new incremental fit index for general structural equation models. *Sociological Methods and Research*, *17*, 303–316.
- Boomsma, A. (2000). Reporting analyses of covariance structures. *Structural Equation Modeling*, *7*, 461–483.
- Borsari, B., & Carey, K. B. (2000). Effects of a brief motivational intervention with college student drinkers. *Journal of Consulting and Clinical Psychology*, *68*, 728–733.
- Browne, M. W., & Cudeck, R. (1993). Alternative ways of assessing model fit. In K. A. Bollen & J. S. Long (Eds.), *Testing structural equation models* (pp. 136–162). Newbury Park, CA: Sage.
- Browne, M. W., & Shapiro, A. (1988). Robustness of normal theory

- methods in the analysis of linear latent variate models. *British Journal of Mathematical and Statistical Psychology*, *41*, 193–208.
- Byrne, B. M. (2001). *Structural equation modeling with AMOS: Basic concepts, applications, and programming*. Mahwah, NJ: Erlbaum.
- Chou, C., Bentler, P. M., & Satorra, A. (1991). Scaled test statistics and robust standard errors for non-normal data in covariance structure analysis: A Monte Carlo study. *British Journal of Mathematical and Statistical Psychology*, *44*, 347–357.
- Collins, R. L., Parks, G. A., & Marlatt, G. A. (1985). Social determinants of alcohol consumption: The effects of social interaction and model status on the self-administration of alcohol. *Journal of Consulting and Clinical Psychology*, *53*, 189–200.
- Dawson, D. A., Grant, B. F., Stinson, F. S., & Chou, P. S. (2004). Another look at heavy episodic drinking and alcohol use disorders among college and noncollege youth. *Journal of Studies on Alcohol*, *65*, 477–488.
- Delva, J., Smith, M. P., Howell, R. L., Harrison, D. F., Wilke, D., & Jackson, D. L. (2004). A study of the relationship between protective behaviors and drinking consequences among undergraduate college students. *Journal of American College Health*, *53*, 19–26.
- Dimeff, L. A., Baer, J. S., Kivlahan, D. R., & Marlatt, G. A. (1999). *Brief alcohol screening and intervention for college students: A harm reduction approach*. New York: Guilford Press.
- Fromme, K., & Corbin, W. (2004). Prevention of heavy drinking and associated negative consequences among mandated and voluntary college students. *Journal of Consulting and Clinical Psychology*, *72*, 1038–1049.
- Gerbing, D. W., & Anderson, J. C. (1993). Monte Carlo evaluations of goodness-of-fit indices for structural equation models. In K. A. Bollen & J. S. Long (Eds.), *Testing structural equation models* (pp. 40–65). Newbury Park, CA: Sage.
- Hatcher, L. (1994). *A step-by-step approach to using SAS® system for factor analysis and structural equation modeling*. Cary, NC: SAS Institute.
- Hawkins, J. D., Catalano, R. F., & Arthur, M. W. (2002). Promoting science-based prevention in communities. *Addictive Behaviors*, *27*, 951–976.
- Hawkins, J. D., Catalano, R. F., & Miller, J. (1992). Risk and protective factors for alcohol and other drug problems in adolescence and early adulthood: Implications for substance abuse prevention. *Psychological Bulletin*, *112*, 64–105.
- Hingson, R., Heeren, T., Winter, M., & Wechsler, H. (2005). Magnitude of alcohol-related mortality and morbidity among U.S. college students ages 18–24: Changes from 1998–2001. *Annual Review of Public Health*, *26*, 259–279.
- Hoyle, R. H., & Duvall, J. L. (2004). Determining the number of factors in exploratory and confirmatory factor analysis. In D. Kaplan (Ed.), *The Sage handbook of quantitative methodology for the social sciences* (pp. 301–315). Thousand Oaks, CA: Sage.
- Hoyle, R. H., & Panter, A. T. (1995). Writing about structural equation models. In R. H. Hoyle (Ed.), *Structural equation modeling: Concepts, issues, and applications* (pp. 158–176). Thousand Oaks, CA: Sage.
- Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling*, *6*, 1–55.
- Johnston, L. D., O'Malley, P. M., Bachman, J. G., & Schulenberg, J. E. (2005). *Monitoring the future national results on adolescent drug use: Overview of key findings, 2004*. (National Institutes of Health Publication No. 05–5726). Bethesda, MD: National Institute on Drug Abuse.
- MacCallum, R. C., & Austin, J. T. (2000). Applications of structural equation modeling in psychological research. *Annual Review of Psychology*, *51*, 201–226.
- MacCallum, R. C., Browne, M. W., & Sugawara, H. M. (1996). Power analysis and determination of sample size for covariance structure modeling. *Psychological Methods*, *1*, 130–149.
- Marlatt, G. A., Baer, J. S., Kivlahan, D. R., Dimeff, L. A., Larimer, M. E., Quigley, L. A., et al. (1998). Screening and brief intervention for high-risk college student drinkers: Results from a 2-year follow-up assessment. *Journal of Consulting and Clinical Psychology*, *66*, 604–615.
- Marlatt, G. A., Baer, J. S., & Larimer, M. E. (1995). Preventing alcohol abuse in college students: A harm-reduction approach. In G. M. Boyd, J. Howard, & R. A. Zucker (Eds.), *Alcohol problems among adolescents: Current directions in prevention research* (pp. 147–172). Hillsdale, NJ: Erlbaum.
- Marlatt, G. A., Larimer, M. E., Baer, J. A., & Quigley, L. A. (1993). Harm reduction for alcohol problems: Moving beyond the controlled drinking controversy. *Behavior Therapy*, *24*, 461–504.
- Marsh, H. W., Balla, J. R., & McDonald, R. P. (1988). Goodness-of-fit indices in confirmatory factor analysis: Effects of sample size. *Psychological Bulletin*, *103*, 391–411.
- Martens, M. P., Ferrier, A. G., Sheehy, M. J., Corbett, K., Anderson, D. A., & Simmons, A. (2005). Development of the Protective Behavioral Strategies Scale. *Journal of Studies on Alcohol*, *66*, 698–705.
- Martens, M. P., Taylor, K. K., Damann, K. M., Page, J. C., Mowry, E. S., & Cimini, M. D. (2004). Protective factors when drinking alcohol and their relationship to negative alcohol-related consequences. *Psychology of Addictive Behaviors*, *18*, 390–393.
- McDonald, R. P., & Ho, M. R. (2002). Principles and practice in reporting structural equation analyses. *Psychological Methods*, *7*, 64–82.
- Miller, E. T., Neal, D. J., Roberts, L. J., Baer, J. S., Cressler, S. O., Metrik, J., Marlatt, G. A. (2002). Test–retest reliability of alcohol measures: Is there a difference between internet-based assessment and traditional methods? *Psychology of Addictive Behaviors*, *16*, 56–63.
- National Institute on Alcohol Abuse and Alcoholism. (2002). *A call to action: Changing the culture of drinking at U.S. colleges* (National Institutes of Health Publication No. 02–5010). Bethesda, MD: Author.
- Noar, S. M. (2003). The role of structural equation modeling in scale development. *Structural Equation Modeling*, *10*, 622–647.
- Perkins, H. W. (2002). Surveying the damage: A review on consequences of alcohol misuse in college populations. *Journal of Studies on Alcohol*, *S14*, 91–100.
- Satorra, A., & Bentler, P. M. (1994). Confirmatory factor analysis of ordered categorical variables with large models. *British Journal of Mathematical and Statistical Psychology*, *46*, 273–286.
- Satorra, A., & Bentler, P. M. (2001). A scaled difference chi-square test statistic for moment structure analysis. *Psychometrika*, *66*, 507–514.
- Steiger, J. H., & Lind, J. C. (1980, May). *Statistically based tests for the number of common factors*. Paper presented at the annual meeting of the Psychometric Society, Iowa City, IA.
- Sun, J. (2005). Assessing goodness of fit in confirmatory factor analysis. *Measurement and Evaluation in Counseling and Development*, *37*, 240–256.
- Wechsler, H., Lee, J. E., Kuo, M., & Lee, H. (2000). College binge drinking in the 1990s: A continuing health problem. *Journal of American College Health*, *48*, 199–210.
- Wechsler, H., Lee, J. E., Kuo, M., Seibring, M., Nelson, T. F., & Lee, H. (2002). Trends in college binge drinking during a period of increased prevention efforts. *Journal of American College Health*, *50*, 203–217.
- White, H. R., & Labouvie, E. W. (1989). Towards the assessment of adolescent problem drinking. *Journal of Studies on Alcohol*, *50*, 30–37.

## Appendix

## Protective Behavioral Strategies Scale

**Instructions:** Please indicate the degree to which you engage in the following behaviors when using alcohol or “partying.”

	Never	Rarely	Occasionally	Sometimes	Usually	Always
1. Use a designated driver	1	2	3	4	5	6
2. Determine not to exceed a set number of drinks	1	2	3	4	5	6
3. Alternate alcoholic and nonalcoholic drinks	1	2	3	4	5	6
4. Have a friend let you know when you have had enough to drink	1	2	3	4	5	6
5. Avoid drinking games	1	2	3	4	5	6
6. Leave the bar/party at a predetermined time	1	2	3	4	5	6
7. Make sure that you go home with a friend	1	2	3	4	5	6
8. Know where your drink has been at all times	1	2	3	4	5	6
9. Drink shots of liquor	1	2	3	4	5	6
10. Stop drinking at a predetermined time	1	2	3	4	5	6
11. Drink water while drinking alcohol	1	2	3	4	5	6
12. Put extra ice in your drink	1	2	3	4	5	6
13. Avoid mixing different types of alcohol	1	2	3	4	5	6
14. Drink slowly, rather than gulp or chug	1	2	3	4	5	6
15. Avoid trying to “keep up” or “out-drink” others	1	2	3	4	5	6

*Note.* Item 9 is reverse scored. Stopping/Limiting Drinking = Items 2, 3, 4, 6, 10, 11, 12. Manner of Drinking = Items 5, 9, 13, 14, 15. Serious Harm Reduction = Items 1, 7, 8. The Protective Behavioral Strategies Scale is copyrighted 2005 by Matthew P. Martens.

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### Call for Nominations

The Publications and Communications (P&C) Board of the American Psychological Association has opened nominations for the editorships of **Psychological Assessment**, **Journal of Family Psychology**, **Journal of Experimental Psychology: Animal Behavior Processes**, and **Journal of Personality and Social Psychology: Personality Processes and Individual Differences (PPID)**, for the years 2010-2015. Milton E. Strauss, PhD, Anne E. Kazak, PhD, Nicholas Mackintosh, PhD, and Charles S. Carver, PhD, respectively, are the incumbent editors.

Candidates should be members of APA and should be available to start receiving manuscripts in early 2009 to prepare for issues published in 2010. Please note that the P&C Board encourages participation by members of underrepresented groups in the publication process and would particularly welcome such nominees. Self-nominations are also encouraged.

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Prepared statements of one page or less in support of a nominee can also be submitted by e-mail to Emnet Tesfaye, P&C Board Search Liaison, at [etesfaye@apa.org](mailto:etesfaye@apa.org).

Deadline for accepting nominations is **January 10, 2008**, when reviews will begin.