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A Cross-Lagged Panel Model Examining Protective Behavioral Strategies: Are Types of Strategies Differentially Related to Alcohol Use and Consequences?

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Abstract

Protective behavioral strategies (PBS) are skills that can be used to reduce the of risk alcohol-related negative consequences. Studies have shown that, in general, PBS are related to less alcohol consumption and fewer negative consequences; however, other studies have suggested that not all types of PBS (e.g., stopping/limiting drinking [SLD], manner of drinking [MOD] and serious harm reduction [SHR]) are equally effective at reducing alcohol risk. In addition, few studies have explored the longitudinal relationships among PBS, alcohol use and consequences. Using a sample of heavy drinking college students (N = 338), the current study examined PBS use, alcohol consumption and consequences across two time points three months apart. Cross-lagged panel models revealed that MOD predicted a reduction in alcohol use and negative consequences. SHR was longitudinally related to fewer negative consequences, but unrelated to alcohol use. SLD was not associated with drinking or consequences at follow-up. These results highlight the need for future research to examine the effects of different types of PBS and have implications for alcohol intervention programs that incorporate PBS skills training.

Keywords

Alcohol; college students; consequences; protective behavioral strategies

1. Introduction

Approximately 64% of college students report drinking alcohol in the past 30 days, with 14% consuming 10 or more drinks on a single occasion (Johnston, O'Malley, Bachman, & Schulenberg, 2012). Alcohol use can lead to a range of negative consequences both for students who drink (e.g., unintentional injuries, problems with friends, interference with school work) and the larger community (e.g., victims of assault or humiliation, damage to property, interrupted sleep) (Hingson, Zha, & Weitzman, 2009; Nelson, Xuan, Lee, Weitzman, & Wechsler, 2009). Given these risks, the development and implementation of effective intervention efforts remains a priority on college campuses.

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Past research has suggested that protective behavioral strategies (PBS) provide one approach to reducing the potential negative effects of drinking. PBS are strategies that students can use before, during or after drinking (e.g., avoiding heavy drinking situation, spacing out drinks, using a designated driver) to reduce the amount of alcohol consumed or the risks associated with drinking. Past studies utilizing cross-sectional research designs have demonstrated that PBS are related to lower levels of alcohol use and fewer negative consequences (Araas & Adams, 2008; D'Lima, Pearson, & Kelley, 2012; LaBrie, Lac, Kenney, & Mirza, 2011; Martin et al., 2012; Patrick, Lee, & Larimer, 2011; Ray, Turrisi, Abar, & Peters, 2009). PBS also appear to moderate the effects of risk factors for drinking. For example, impulsivity (Weaver, Martens, & Smith, 2012) and poorer mental health (LaBrie, Kenney, & Lac, 2010; LaBrie, Kenney, Lac, Garcia, & Ferraiolo, 2009) are less positively related to drinking and negative consequences among those who use more PBS.

PBS are a recommended component of college alcohol prevention programs (Larimer & Cronce, 2007; Martens et al., 2004) and information about PBS is often incorporated into multi-component interventions (Dimeff, Baer, Kivlahan, & Marlatt, 1999; Kypri et al., 2009; Murphy et al., 2012). Furthermore, research suggests that PBS are an important mediator of multi-component intervention effects (Barnett, Murphy, Colby, & Monti, 2007; Larimer et al., 2007; Murphy et al., 2012). For example, Barnett et al. demonstrated that a Brief Motivation Intervention (BMI) prevented increases in alcohol consumption because students increased their use of PBS post-intervention. Similarly, in a judicially-mandated intervention, students who reported the greatest increases in PBS post-intervention also reported the greatest decreases in drinking and consequences (Cimini et al., 2009). Increases in PBS use are not, however, always associated with reductions in alcohol use. Sugarman and Carey (2009) instructed students to increase their PBS use (without additional training) and found that increases in PBS were not associated with decreases in drinking. Differences in how PBS are assessed may help explain these inconsistent findings.

It is currently unclear whether all types of PBS are equally beneficial. Research using the Strategies Questionnaire (Sugarman & Carey, 2007, 2009) suggests that strategies focused on avoiding situations where heavy drinking occurs or choosing to engage in activities other than drinking are negatively related to alcohol consumption. In contrast, strategies used during drinking (e.g., drinking slowly) are related to more alcohol use. Some types of strategies appear to influence consequences without impacting actual drinking. For instance, using the Protective Strategy Questionnaire (PSQ; Palmer, 2004), DeMartini et al., (2012) demonstrated that indirect strategies (e.g., having a designated driver) were negatively related to consequences but not to how much students drank.

The Protective Behavioral Strategies Survey (PBSS; Martens et al., 2005) is the most commonly used measure of PBS (Frank, Thake, & Davis, 2012). Research using the PBSS further demonstrates the need to consider the role of different types of PBS when examining student alcohol outcomes. The three subscales of the PBSS assess strategies used to stop or slow drinking (*Stopping/ Limiting Drinking; SLD*), change the way one drinks (*Manner of Drinking; MOD*) and avoid serious hazards associated with drinking (*Serious Harm Reduction; SHR*). Cross-sectional studies indicate that MOD strategies are most consistently related to less drinking and consequences (Frank et al., 2012; Martens et al., 2005; Pearson, Kite, & Henson, 2012a, 2012b). In fact, Martens et al. suggest that strategies that involve slowing the pace at which students drink (i.e., MOD strategies) might be particularly effective at reducing alcohol use and risk. In contrast, SHR strategies are more closely associated with consequences than drinking (Martens et al., 2005; Pearson et al., 2012a, 2012b). This finding likely reflects the fact that this subscale specifically addresses ways in which students can protect themselves by, for example, using a designated driver or going home with friends, and does not include strategies for reducing alcohol intake. However, not

all studies have produced consistent findings. Using a modified event-level version of the PBSS, Frank et al., (2012) found that SHR strategies were not associated with either drinking or consequences. Surprisingly, there is limited data supporting the protective benefits of SLD strategies for reducing alcohol use or consequences (Martens et al., 2005; Pearson et al., 2012a). In fact, Frank et al. found that those who used more SLD strategies' actually experienced greater alcohol-related problems. It is possible that for some students using PBS might actually allow them to consume greater quantities of alcohol (Ray et al., 2009), or that the use of ineffective strategies may lead to complacency and increased alcohol risk (Frank et al., 2012).

Although several cross-sectional studies have explored the relationships among PBS and alcohol outcomes, relatively few longitudinal studies have examined these relationships. Longitudinal research offers an opportunity to explore the temporal relationships among these variables and assess whether the current use of PBS predicts later drinking behavior and consequences. Demonstrating these causal relationships has several important implications. Firstly, we can examine which types of PBS might be more effective at reducing future drinking and consequences. Given that cross-sectional data suggest that not all PBS are alike, longitudinal data can provide additional evidence to inform recommendations for whether PBS interventions should focus on teaching some types of PBS rather than others. Secondly, we can determine whether people experiencing high levels of consequences use more PBS in the future. This could help inform whether there is a need for formal interventions to teach students specific PBS strategies, or whether experiences of negative consequences are sufficient to motivate greater PBS use.

In one of the few studies to address these longitudinal relationships, Leubbe and colleagues (2009) used a 6-item measure of PBS to assess undergraduate women's use of PBS at two time points. Their results indicated that although baseline PBS did not predict baseline consequences, they did predict consequences four months later. Women who used more PBS experienced fewer consequences at follow-up. Luebbe et al. suggest that use of PBS may allow women to gain a more accurate perception of their alcohol use, which reduces the likelihood of experiencing future consequences. Interestingly, baseline consequences did not predict PBS use at follow-up. This suggests that women who experienced greater consequences did not naturally increase their use of PBS. Leubbe et al. did not, however, examine the influence of different types of PBS.

A longitudinal study using the subscales of PBSS highlights the potentially complex relationships among PBS and alcohol outcomes (Martens, Martin, Littlefield, Murphy, & Cimini, 2011). For example, using multiple regression Martens et al., (2011) found that PBS use at baseline was not related to drinking six months later. However, greater use of SLD strategies was associated with less drinking at 12 months. Furthermore, greater use of MOD and SHR strategies were positively related to drinking at follow-up. Martens et al. suggest that these findings may have resulted from suppression effects. With respect to negative consequences, baseline PBS predicted fewer consequences at 6 months, but not at 12 months. Furthermore, only SHR were associated with fewer consequences at follow-up, while SLD were associated with more consequences. It is not clear from these findings if some types of PBS may be more useful than others at reducing future alcohol use and consequences.

Given the limited and inconsistent longitudinal data on this topic, the current study aimed to examine the relationships between PBS use and drinking outcomes across two time points. The study uses cross-lagged panel models, which statistically controls for all other constructs assessed at the same time point. Doing so will allow the present study to profitably unravel the underlying temporal precedence of these measures. Informed by

findings from previous cross-sectional research, we predicted that, after controlling for all variables: (1) baseline SLD would not be associated with drinking or consequences at follow-up; (2) baseline MOD strategies would be the strongest predictor of less drinking and fewer consequences at 3 month follow-up; and (3) baseline SHR strategies would predict fewer consequences, but not less drinking at follow-up. Furthermore, given the limited data examining the relationship between past consequences and future PBS use (Luebbe et al., 2009), we sought to explore whether, after controlling for baseline PBS use, those who reported more consequences at baseline reported greater use of PBS at follow-up. Hypothesized relations were evaluated using a path-analytic framework.

2. Method

2.1 Participants

Participants were undergraduate college students recruited from two west-coast universities (a large public university and a medium-sized private university). The current study utilized a sub-sample from a larger longitudinal alcohol intervention study conducted over two consecutive years (N = 3,238; see LaBrie, Hummer, Pedersen, Lac, & Chithambo, 2012; LaBrie, Lac, Kenney, & Mirza, 2010 for more details). Data for the current study included only participants who were assigned to a non-alcohol related control condition and did not receive any alcohol intervention during the study (N = 432). Our final sample consisted of control participants (N = 338; 78.4%) who completed both baseline and 3 month follow-up measures. Participants for the current study were 59.7% female and had a mean age of 20.06 years (SD = 1.33). Students were 72.5% White/Caucasian, 16.5% Asian, 5.9% Multiracial, 1.6% African American/Black, 0.5% Native American, 1.4% Pacific Islander, and 1.6% identified as “other”. With respect to ethnicity, 8.2% of students identified as Hispanic. Participants reported consuming an average of 11.6 drinks per week (SD = 11.55).

2.2 Procedure

A randomly selected sample of students from each university were invited via e-mail to participate in the study. The e-mail provided a link to a screening survey URL as well as a unique Personal Identification Number that the student used to access the survey. The responses provided in the screening survey determined eligibility for participation in baseline and follow-up surveys. In order to be eligible to take part, participants had to report at least one heavy drinking episode in the past month (5+ drinks in a row for males, 4+ drinks in a row for females). After providing informed consent, participants completed the online survey and received $20 as compensation (T1). Three months after the initial baseline survey, participants were asked to complete a second online survey (T2). All procedures were approved by each university's respective Institutional Review Board.

2.3 Measures

The following measures were assessed at both the baseline and 3-month follow up surveys.

2.3.1 Alcohol use—Prior to answering questions related to alcohol consumption, participants were provided with the definition of a standard drink (i.e., a drink containing one-half ounce of ethyl alcohol) and examples of how to calculate number of drinks. Participants’ alcohol use was measured by the Daily Drinking Questionnaire (Collins, Parks, & Marlatt, 1985). Participants were asked, “Consider a typical week within the past month. How much alcohol, on average (measured in number of drinks), do you drink on each day of the week?” Participants then reported the drinks they consumed each day of the week. The open-ended responses for each of the seven days were summed to create a measure of total drinks consumed in a typical week.

2.3.2 Protective Behavioral Strategies—The 15-item Protective Behavioral Strategy Scale (Martens et al., 2005) (α = .83) was used to assess participants use of protective behaviors. Using a scale ranging from 1 (*never*) to 5 (*always*), participants indicated how frequently they currently engaged in each protective behavior when using alcohol or "partying." The PBSS has three subscales: Stopping/Limiting Drinking (7 items, α = .80; e.g., "Leave the bar/party at a predetermined time"), Manner of Drinking (5 items, α = .65; e.g., "Avoid mixing different types of alcohol"), and Serious Harm Reduction (3 items, α = .74, e.g., "Make sure that you go home with a friend"). Higher scores on each of the subscales indicated more frequent use of PBS.

2.3.3 Negative Consequences—Negative alcohol-related consequences were assessed using a 25-item version of the Rutgers Alcohol Problem Index (RAPI; White & Labouvie, 1989) (α = .94). This measure includes two items assessing drinking and driving and has been used in previous studies (Ehret, Ghaidarov, & LaBrie, 2013; LaBrie, Ehret, & Hummer, 2013; LaBrie, Hummer, Neighbors, & Larimer, 2010). Participants indicated how frequently they had experienced consequences in the last three months as a result of drinking. Examples of items include "Not able to do your homework or study for a test," "Caused shame or embarrassment to someone," and "Felt that you had a problem with alcohol." Items were scored on a scale of 0 (*never*) to 4 (*more than 10 times*).

3. Results

3.1 Analytic Plan

Specified with the EQS 6.2 program (Bentler, 2001), cross-lagged panel models were undertaken with path analysis. Cross-lagged analysis makes use of longitudinal data to infer underlying processes of reciprocal causality among the set of constructs (Kenny, 1975; Shadish, Cook, & Campbell, 2002). For each of the three types of protective behavioral strategies, separate models were estimated. In each model, the T1 (baseline) constructs of the PBS subscale, alcohol use, and negative consequences were allowed to simultaneously predict these same constructs assessed at T2 (3 month follow-up). As recommended by Anderson & Williams (1992), the three exogenous measures at T1 were specified to be correlated, and so were the three endogenous measures at T2. In Bentler-Weeks equations, as it is statistically impossible to allow endogenous variables to be correlated, the error terms of these variables remaining after prediction were correlated as a proxy (Bentler, 2001). Fully cross-lagged models require the saturated estimation of all possible path combinations, but this would produce just-identified models containing zero degrees of freedom. Fit indices are only offered in over-identified models (Ullman, 2007). Thus, in each model a single relation was not estimated (i.e., fixed to zero), specifically the error correlation between the PBS subscale and negative consequences, justified on the basis that they were shown to have the lowest correlation values among the T2 measures.

Overall fit of each estimated model was evaluated with several fit indices. Desired was a non-significant chi-square test, which signifies that that the model approximates the underlying data and therefore should not be rejected (Bollen, 1989). Also evaluated were the Comparative Fit Index (CFI) and the Non-Normed Fit Index (NNFI). Possible values range from 0.00 to 1.00, with higher values signifying a better fitting model (Ullman, 2007; Ullman & Bentler, 2003). Hu and Bentler (1998) found that the Standardized Root Mean-Square Residual (SRMR), a residual-based index, is helpful in detecting model misspecification. They suggested that values below .08 are desirable.

Upon obtaining optimal model fit indices, the specific paths of each model were then scrutinized. Cross-lagged models contain three types of relations (Shadish et al., 2002). The synchronous correlations are the non-directional associations between two different

constructs assessed at the same round (e.g., T1 alcohol use and T1 negative consequences). Temporal stability, or autoregression, is defined as the same construct assessed at a previous round predicting its subsequent measurement (e.g., T1 alcohol use to T2 alcohol use), while statistically controlling for all other lagged antecedents. Generally, these test-retest paths of the same construct are expected to reveal the strongest magnitude of effect in the model. Most relevant for evaluating research hypotheses are the cross-lagged paths of two conceptually distinct constructs assessed at different time points (e.g., T1 serious harm reduction to T2 negative consequences). These predictive paths show, after accounting for the temporal history of all the constructs, whether explanatory relations remain.

3.2 Descriptive Data

Outlier values of composite variables were winsorized by setting extreme values at two standard deviations from the mean (Wilcox, 2005; Wilcox & Keselman, 2003). None of the composites exceeded skewness or kurtosis levels of 1.5 after the adjustment. The means, standard deviations, and correlation matrix are presented in Table 1. All the variables were significantly correlated, in and across both rounds of measurement. The three subscales of PBS were not strongly correlated, supporting the decision to evaluate these types of strategies separately. Each of the PBS subscales negatively correlated with alcohol use and negative consequences. Alcohol use positively correlated with negative consequences.

3.3 Cross-Lagged Panel Models

The cross-lagged model for the protective strategy of SLD revealed strong fit indices, as presented in Figure 1, $\chi^2 = 0.47$, $df = 1$, $p = .49$, CFI = 1.00, NNFI = 1.00, SRMR = .01. After controlling for all other variables, only T1 SLD strategies ($\beta = .61$, $p < .001$) significantly predicted T2 SLD strategies. The T1 measures of alcohol use ($\beta = .64$, $p < .001$) and negative consequences ($\beta = .13$, $p < .01$) each uniquely contributed to greater quantity of T2 alcohol use. Results also show that T1 measures of alcohol use ($\beta = .14$, $p < .01$) and negative consequences ($\beta = .54$, $p < .001$) each uniquely forecasted greater consequences at T2. Overall, this model indicated that, after accounting for prior drinking and consequences, SLD strategies were not protective against subsequent alcohol use and its negative consequences.

The model for MOD as the PBS yielded desirable fit indices, as displayed in Figure 2, $\chi^2 = 0.05$, $df = 1$, $p = .82$, CFI = 1.00, NNFI = 1.00, SRMR = .00. After controlling for the other variables, only T1 MOD ($\beta = .60$, $p < .001$) significantly contributed to T2 MOD. Alcohol use at T2 was simultaneously explained by previously (T1) lower usage of MOD strategies ($\beta = -.09$, $p < .05$), greater alcohol use ($\beta = .62$, $p < .001$), and greater consequences ($\beta = .12$, $p < .01$). Greater consequences at T2 were encountered by participants who used less MOD strategies ($\beta = -.14$, $p < .01$), consumed greater levels alcohol ($\beta = .12$, $p < .05$), and experienced greater consequences ($\beta = .53$, $p < .001$) at T1. Overall, this model revealed that, after accounting for both prior drinking and consequences, MOD conferred the protective effect of subsequently lower alcohol use and consequences.

Finally, the model for SHR also produced an excellent approximation of the data, as shown in Figure 3, $\chi^2 = 0.37$, $df = 1$, $p = .54$, CFI = 1.00, NNFI = 1.00, SRMR = .00. The use of SHR at T2 was anticipated by prior use of SHR ($\beta = .60$, $p < .001$) and fewer negative consequences ($\beta = -.12$, $p < .05$). Later alcohol use was uniquely predicted by earlier episodes of alcohol consumption ($\beta = .63$, $p < .001$) and negative consequences ($\beta = .13$, $p < .01$). Negative consequences were anticipated by lower use of SHR strategies ($\beta = -.15$, $p < .001$), greater alcohol use ($\beta = .12$, $p < .01$), and greater negative consequences ($\beta = .52$, $p < .001$) at T1. Overall, after controlling for prior drinking and consequences, adopting SHR strategies was protective against subsequent alcohol consequences but not alcohol use..

Across all three models, over and beyond the rather powerful test-retest of each construct, significant PBS factors were found to contribute to alcohol use and negative consequences. These differences in predictive validity systematically varied with respect to the type of PBS strategy used.

4. Discussion

The current study extends research on PBS and alcohol-related outcomes by examining the interrelationships among PBS use, drinking, and alcohol-related consequences across two time points (baseline and three months follow-up) in cross-lagged panel analyses. We sought to examine each distinct PBS subscale (SLD, MOD, SHR) as potential predictors of future drinking and consequences, while controlling for both prior drinking and consequences. In addition, we examined whether the experience of alcohol-related consequences at baseline would influence participants' prospective use of PBS. Findings aimed to shed light on the potential effectiveness of distinct types of PBS to inform alcohol-related harm reduction interventions.

After controlling for prior drinking and consequences and in support of hypotheses, current use of SLD strategies at baseline did not predict reported drinking or alcohol-related negative consequences during the subsequent three months; greater use of MOD strategies at baseline predicted lower levels of future drinking and alcohol-related consequences; and SHR strategies predicted fewer consequences, but not drinking. These longitudinal findings advance prior cross-sectional research that has revealed similar relationships (Frank et al., 2012; Martens et al., 2005; Pearson et al., 2012a, 2012b). The results presented in this study substantiate concerns that SLD strategies may be ineffective in independently producing lower levels of alcohol consumption and consequences. It appears that students' use of strategies intended to slow the amount of alcohol consumed during drinking occasions may not decrease later alcohol risk. In part, this may be due to the flexible nature of SLD strategies, which require students to choose strategy parameters. For example, "determining not to exceed a set number of drinks" or "leaving a bar/party at a predetermined time" requires students to designate drinks and times that will protect them from excessive drinking and harm. It is possible that the self-determined and flexible nature of these strategies 1) may enable students to set goals and implement strategies that do not reduce drinking and consequences (e.g., determining not to exceed ten drinks) and 2) may be challenging to implement in the context of drinking (e.g., losing track of the time by which a student had intended to leave a party). Notably however, SLD strategies were found to be most commonly endorsed by participants in the present sample. Therefore, gaining a better understanding of students' choices and execution of SLD strategies is needed. Facilitator-led focus groups may be a valuable approach for revealing potential difficulties that prevent students from effectively implementing SLD strategies. These findings may then be used to inform psycho-educational skills training. Students may need to acquire additional skills or strategies for overcoming barriers associated with SLD strategies (e.g., choosing a reliable friend to let you know when you have had enough to drink; setting an alarm on a personal cell phone to signal when you wanted to leave a party). Interactive group sessions may be particularly valuable in enabling students to share effective strategies.

In contrast to SLD strategies, MOD strategies appear to protect college students from excessive drinking and consequences, over and above drinking. Avoiding risky drinking behaviors (i.e., drinking shots, playing drinking games, mixing different types of alcohol, "keeping up" with others, chugging) appear effective when used. As expected, SHR strategies (using designated driver, going home with friend, knowing where drink is at all times) did not predict drinking, but did predict fewer alcohol-related consequences. While drinking, it may be easiest for students to avoid behaviors entirely, thereby enabling them to

adhere consistently to strategies in a variety of drinking situations. Alcohol harm-reduction interventions should train students to use MOD and SHR strategies, both of which appear to offer easily implementable protective benefit to college students. Targeted PBS-based skills training may be a cost-effective and efficacious approach for reducing harm among subgroups of heavy drinking college students. SHR strategies (e.g., going home with friend, knowing where drink is at all times), for example, may be particularly effective in protecting first-year college women from sexual victimization. MOD strategy skills training tailored for heavy drinking college subgroups that exhibit high rates of extreme consumption drinking (e.g., fraternities/sororities, athletes) may be advantageous.

The current findings support and extend Luebbe and colleagues' (2009) findings showing that baseline consequences did not predict overall PBS use four months later. In the current study, experience of alcohol-related negative consequences did not predict later use of SLD or MOD strategies, and predicted lesser use of SHR strategies (controlling for baseline PBS). Overall, these results suggest that experiencing adverse effects of alcohol does not motivate college students to develop strategies to avoid similar consequences in the future. In fact, experiencing alcohol-related consequences may indicate a pattern of high-risk drinking that further reduces the likelihood of implementing SHR strategies. Some students may not consider the consequences of drinking to be negative (Mallett, Bachrach, & Turrisi, 2008) and thus may not be motivated to reduce drinking or increase PBS use in response to these experiences. Even students who recognize that their behaviors are risky and need to change may remain ambivalent toward reducing their alcohol use (Kaysen, Lee, LaBrie, & Tollison, 2009; Lewis, 2005). These findings therefore reinforce the need for PBS skills training for students experiencing alcohol-related consequences and who may not be familiar with protective strategies, why they are useful, or how to utilize them. For example, targeting students violating campus alcohol policy or presenting at health centers as a result of alcohol-related experiences may be useful.

4.1 Limitations

Results are tempered by several limitations. First, the sample used in the present study was restricted to heavy drinking college students and thus should not be generalized to all college students or non-college populations. Heavy drinking students are at increased risk of both experiencing and causing alcohol-rated problems. Although this population may have the most to gain from PBS, infrequent and novice drinkers may also benefit from learning about and applying PBS. Although the vast majority of studies on PBS have utilized college samples, some research suggests that the relationship between PBS and drinking outcomes might be uniquely different for non-college populations. For instance, in contrast to findings examining general college samples, Litt and colleagues (2013) found that MOD strategies were not significantly correlated with drinking in a national sample of lesbian and bisexual young adult women. Future research should examine the efficacy of PBS in alternative populations such as non-college attending young adults and high school students, and whether the relationships between PBS and drinking outcomes differ by demographic characteristics such as sex and race/ethnicity.

Second, data relied on participants' self-reported drinking-related behaviors and experiences. In order to minimize the risk of response bias, respondents were ensured that surveys were confidential. Finally, although the current findings advance research by examining the unique relationships between unique PBS subscales and prospective drinking and overall consequences, it is likely that PBS subscales differentially relate to types and severity of consequences. Pearson et al. (2012b), for example, found that college students' use of MOD strategies was related to fewer common alcohol-related consequences (i.e., BYAACQ) but unrelated to more serious alcohol-related consequences (i.e., RAPI). Future

research should therefore examine the predictive influence of PBS subscales on experiencing unique types of consequences (e.g., academic, sexual, psychological, physical).

4.2 Conclusion

Although PBS use is consistently linked to lower levels of alcohol risk, it appears that some types of PBS may be more effective than others. Moreover, there is limited longitudinal data examining the predictive influence of these forms of PBS on drinking and alcohol-related consequences. The current findings advance this line of research and support the need for PBS-based interventions that focus on MOD and SHR strategies to reduce excessive drinking and serious drinking-related consequences.

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Highlights

1. Examines the longitudinal relationships among PBS, alcohol use and consequences
2. Manner of Drinking PBS predicted a reduction in alcohol use and consequences
3. Serious Harm Reduction PBS predicted a reduction in negative consequences
4. Stopping/Limiting Drinking PBS did not predict subsequent drinking or consequences

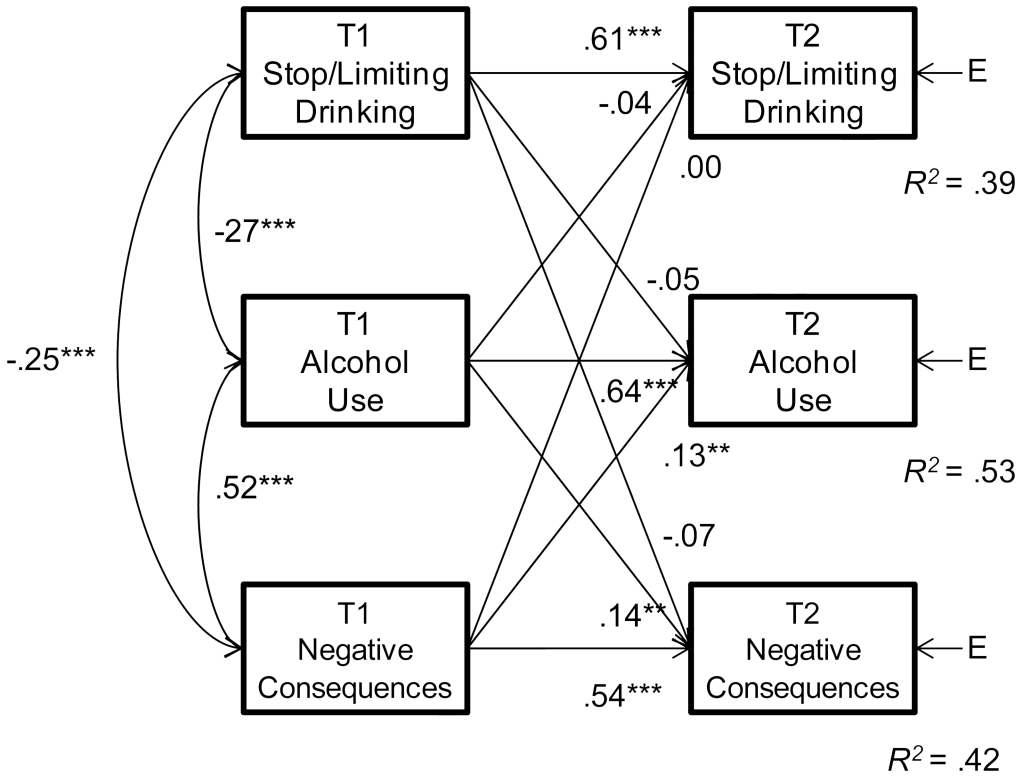

Figure 1.
Cross-lagged model of stop/limiting drinking, alcohol use, and negative consequences. Standardized coefficients are presented. E = error. R^2 = total variance explained on the outcome. For diagrammatic clarity, error correlations are not shown. *$p < .05$. **$p < .01$. ***$p < .001$.

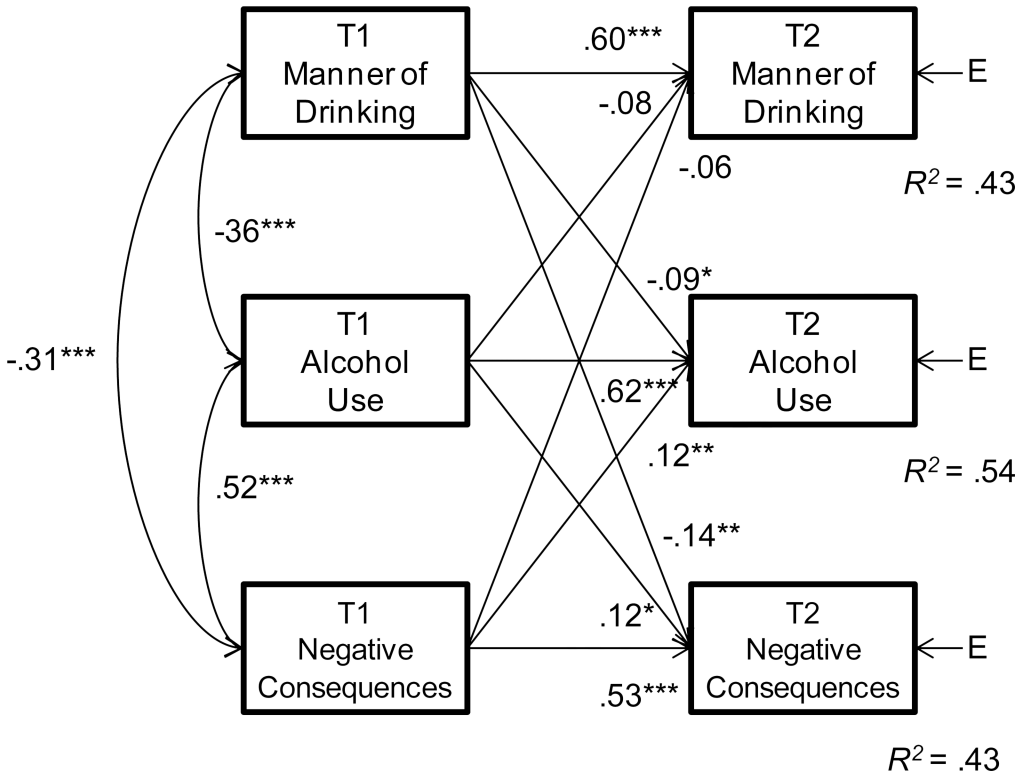

Figure 2.

Cross-lagged model of manner of drinking, alcohol use, and negative consequences. Standardized coefficients are presented. E = error. R^2 = total variance explained on the outcome. For diagrammatic clarity, error correlations are not shown. *$p < .05$. **$p < .01$. ***$p < .001$.

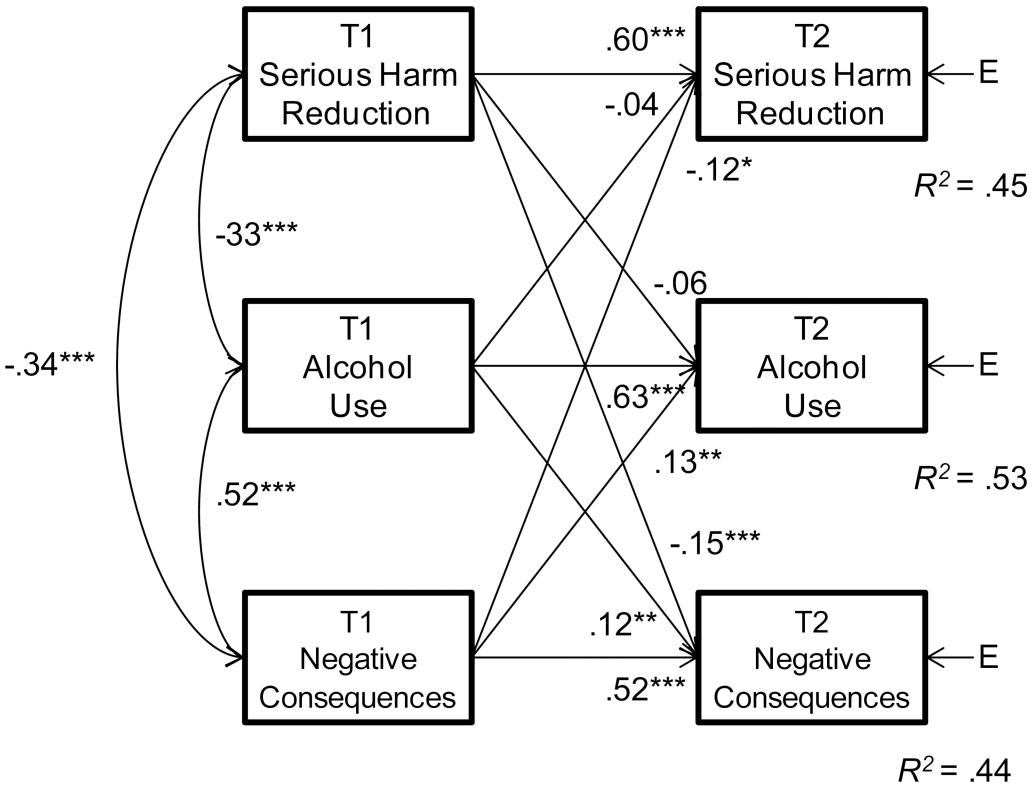

Figure 3.

Cross-lagged model of serious harm reduction, alcohol use, and negative consequences. Standardized coefficients are presented. E = error. R^2 = total variance explained on the outcome. For diagrammatic clarity, error correlations are not shown. *$p < .05$. **$p < .01$. ***$p < .001$.

Table 1

Means, Standard Deviations, and Correlation Matrix of Variables

	Variable	*Mean*	*SD*	1	2	3	4	5	6	7	8	9	10
1.	T1 Stop/Limiting Drinking	18.56	5.52										
2.	T1 Manner of Drinking	13.87	3.34	.46									
3.	T1 Serious Harm Reduction	12.77	2.34	.39	.42								
4.	T1 Alcohol Use	10.82	8.25	−.27	−.36	−.33							
5.	T1 Negative Consequences	5.88	5.41	−.24	−.31	−.34	.52						
6.	T2 Stop/Limiting	18.96	5.68	.62	.28	.26	−.21	−.17					
7.	T2 Manner of Drinking	14.14	3.43	.33	.65	.31	−.33	−.29	.44				
8.	T2 Serious Harm Reduction	12.54	2.51	.27	.35	.65	−.30	−.34	.31	.34			
9.	T2 Alcohol Use	10.28	8.59	−.25	−.35	−.31	.72	.48	−.21	−.39	−.33		
10.	T2 Negative Consequences	5.74	6.14	−.24	−.34	−.36	.44	.63	−.15	−.27	−.33	.59	

Correlation between T2 Stop/Limiting Drinking and T2 Negative Consequences is significant at $p < .01$.

All other correlations are significant at $p < .001$.

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